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CONTENTS

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FULL PAPERS

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K. Altun, U. Babayev/Int. J. Systematic Innovation, 7(6), 1-11(2023)

A novel approach to augment technology roadmapping through systematic innovation intelligence: a case of UAV technologies

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Abstract

Technology roadmapping has been employed for years as an important tool for managing technology and innovation. The latest discussions in technology roadmapping go beyond the T-plan, which is the most popular roadmapping process based on a few workshops of experts. Developing data-driven approaches to modernize this roadmapping process is an active area of research. In parallel with these efforts, we explore a new unified approach in this study by integrating an innovation intelligence process into roadmapping. This systematic innovation intelligence process incorporates relevant patent and publication data, and its methodology is based on topic modeling and type-2 fuzzy sets. Through this unified approach, we provide an augmented technology roadmapping schema that involves technology trendiness infographics. This study illustrates how this approach is executed by providing a case study on unmanned aerial vehicle (UAV) technologies.

Keywords: Innovation intelligence, technology roadmapping, UAV technologies.

1. Introduction

It is becoming apparent that technology management is no longer just a preference, but rather a necessity. The strategic plans of players at any scale incorporate acquisition and exploitation strategies for emerging and available technologies. These strategic management activities are frequently guided by a systematic approach commonly known as “technology roadmaps”.

Technology roadmapping is a long-term planning tool that links technology to businesses, according to Petrick and Echols (2004). The pioneering work on technology roadmapping was undertaken by Willyard and McClees (1987) at Motorola.

There are different types of technology roadmaps shaped by their purpose of use, according to Milshina and Vishnevsky (2019), and this is because of the absence of a standard process for their elaboration. Furthermore, a recent study by Park et al. (2020) revealed the development of seven distinctive “schools of thought”, which may result in multiple approaches to technology roadmapping (Zhang et al., 2021).

Eight different graphical formats have been identified for technology roadmaps; multiple layers, bars, tables, graphs, pictorial representations, flow charts, single-layer, and text (Jin et al., 2015). The most common version is a roadmap including multiple layers and a network of element relations on a yearly-based timeline. of The European Industrial Research Management Association (EIRMA) Working Group #52 has introduced a generic framework for technology roadmap (EIRMA, 1997). Figure 1 provides an illustrative view of this roadmap.

In practice, effective workshops and systematic implementation procedures are required to obtain a useful technology roadmap. It is true that this process may progress in different ways depending on the topic being worked on and other factors related to the implementers. However, a generic process, frequently highlighted in the literature is the “T-plan” process by Phaal et al. (2004) at the Cambridge University Institute for Manufacturing.

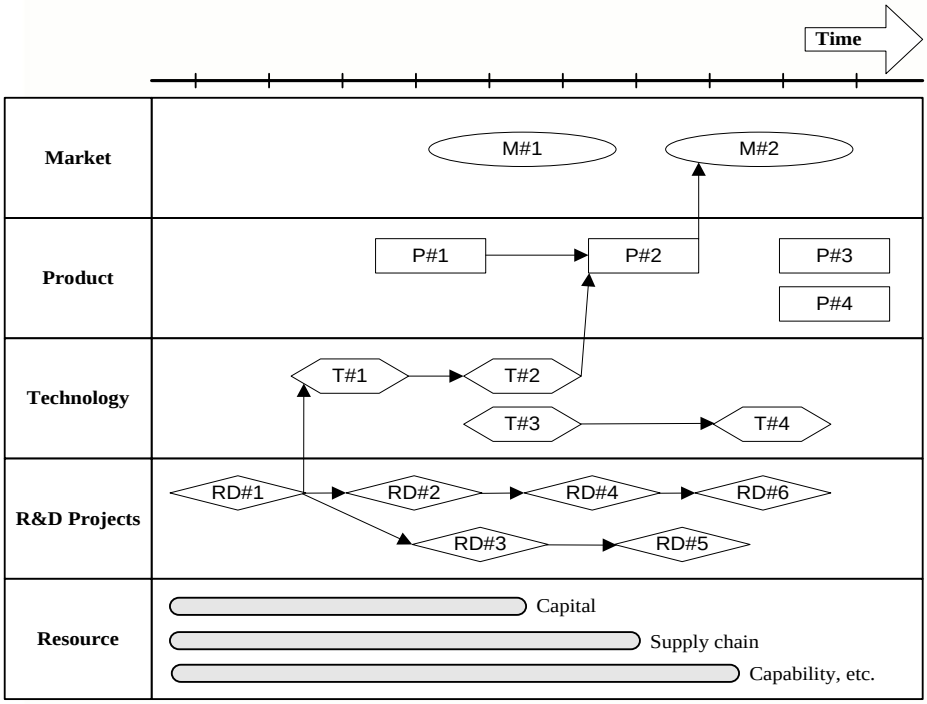


Fig. 1. An illustration of a typical product-technology roadmap.

The T-plan process is also known as the "fast-start" workshop technique. It is a procedure specialized in product-technology roadmapping. Its more general variant, addressing strategic issues as well, is called the "S-plan". Groups of cross-functional stakeholders conduct serial workshops for technology roadmapping. Although the number of the workshops depends on the layers of the planned roadmap, there are generally four serial workshops to address market, product, technology, and charting, respectively. Further details on running a fast-start workshop can be found in Phaal et al (2013).

A group of experts in the area of interest (which might involve 8-12 experts) drive these workshops in practice. The main challenge is finding these experts, particularly at the corporate level. A significant amount of work has been carried out in this area, and an up-to-date overview of themes and methods used for technology roadmapping is presented in de Oliveira Valerio et al. (2020). A concise list of successful implementations and application areas of technology roadmapping is provided in Zhang et al. (2021). A bibliometric literature review clustering the emerging research streams of technology roadmapping can also be found in Vinayavekhin et al. (2021). Quantitative tools and techniques have been integrated into roadmapping workshops to quantify the process, and different technology management activities and decision modeling approaches have also been incorporated. In recent years, according to de Oliveira Valerio et al. (2020), there has been an increased interest in exploring data-driven approaches to modernize technology roadmapping.

High technology is favoring planning in the recent trend of technology roadmapping. Recent studies in the literature aim to develop new perspectives through data-driven approaches. Data-driven market and technology intelligence can contribute to discovering technological opportunities. Scientific publications and patents have been the major data sources of these data-driven approaches. Advances in data analytics handling these patent and publication data can enhance these expert-centric workshops as well. Correspondingly, in a recent study by Son et al. (2020), technology roadmapping in the big data era has been discussed, and fuzzy cognitive maps and text mining have been employed. In another study by Son and Lee (2019), type-1 fuzzy set theory has been employed to analyze the element relations in technology roadmapping. Barip and Altun (2022) have also provided a type-2 fuzzy systems-based approach to analyze the element relations. The reader is directed to the overviews of de Oliveira Valerio et al. (2020) and Winkowski (2020) for further reading.

Patents and scientific publications have been the main data sources for monitoring technology development and evaluating the competitive environment (Trappey et al., 2011). As discussed by Wang and Chen (2019), mapping the relationship between scientific and

technological knowledge can facilitate the discovery of technological innovation opportunities. Recent trends confirm that incorporating the experience of the technology intelligence literature (which is highly data-driven and uses advanced data analytics and algorithms to analyze patent and publication data) into the technology roadmapping has a complementary effect. There is still a great deal of work to be done in this area. In this respect, this study proposes a novel approach to augment technology roadmapping by integrating an "innovation intelligence" process, which is also considered to have a complementary effect.

This innovation intelligence process incorporates relevant patent and publication data, and its methodology is based on topic modeling and type-2 fuzzy sets. The augmented technology roadmapping proposed in this study enables assessment of the innovation potentials resulting from this integration and visualizes this assessment through infographics. This is where the novelty of this work lies. The study illustrates how this augmented technology roadmapping is executed by providing a case study on Unmanned Aerial Vehicle (UAV) technologies.

The remainder of this study is organized as follows: Section 2 introduces the methodology, an illustrative implementation addressing UAV technologies is presented in Section 3, and concluding remarks are provided in the last section.

2. Methodology

This study presents an augmented technology roadmapping approach aimed at improving the roadmapping process through data-driven innovation intelligence. This approach is based on a methodology involving four main phases, which are described in the following subsections with further details:

(1) Keyword generation for the main topic
(2) Topic modeling to determine the elements
(3) Assessing the trendiness of the elements by using the quick innovation intelligence process
(4) Network visualization.

2.1 Keyword generation for the main topic

To retrieve related data from the publication and patent database, a concise list of keywords is needed. It is common for different terms to be used to describe the same topic. For example, "autonomous driving" and "autonomous vehicle" may both be used. To obtain a list of the most relevant keywords for any given topic, keyword suggestion tools of search engine optimization (SEO) can be used, resulting in reliable keyword lists.

2.2 Topic modeling to determine the elements

Topic modeling is an unsupervised machine learning method used to extract meaningful information from large amounts of text sources. It automatically clusters similar expressions into phrases that best characterize the document set. In topic modeling, abstract topics are generated by clustering words that frequently appear together in the text, and related texts are assigned to one or more clusters based on the words they contain. Comprehensive reviews on topic modeling can be found in Vayansky and Kumar (2020) and Kherwa and Bansal (2018). There are many topic modeling methods in the literature, and determining which method best suits the case under consideration is not an easy task. Vayansky and Kumar (2020) also provide a very practical decision tree on this matter. Among the topic modeling methods, the most widely used one is the "LDA - Latent Dirichlet Allocation". The use of LDA is recommended for cases where the number of words in the documents being studied is more than 50 and complex topic relations are not expected. This study proposes the use of the LDA method (see Jelodar et al., 2019).

Having completed the keyword generation phase, we can now obtain the relevant patent and publication data. By processing this data set using topic modeling techniques (e.g., LDA - Latent Dirichlet Allocation), we can determine the elements of the product and technology layers. This phase is crucial when experts are unable to list the elements based on their knowledge and experience. It allows for more reliable keyword lists to be defined for each element of the product and technology layers.

2.3 Assessing trendiness of the elements

In this phase, the corresponding patent and publication data are retrieved from the databases such as WoS - Web of Science for the publications and WIPO IP Portal for the patents. An innovation intelligence process based on interval type-2 fuzzy system computes the trendiness of each element by processing these obtained patent and publication data. This trendiness evaluation process is based on a methodology proposed by Dereli and Altun (2013), and an overview of this framework is provided in Figure 2.

This framework uses patent data retrieved from online patent office databases and publication data retrieved from the Web of Science/Knowledge (WoS/K).

The keywords generated in previous phases connect the patents and their related publications. The hotness of the growth rate of technologies is the main input parameter of this framework. Type-2 fuzzy sets are used to handle the uncertainty of this fuzzy term "hotness" in this framework. The k-means clustering developed by MacQueen (1967) finds centroids of the clusters: low, medium, and high. These centroids and the values limiting these clusters are needed to define triangular membership functions. A fuzzy rule base maps the relationship between patent and publication data, and the inference process incorporating the Karnik-Mendel algorithm (Mendel and Wu, 2010) determines the trendiness degrees. For further details, see Dereli and Altun (2013).

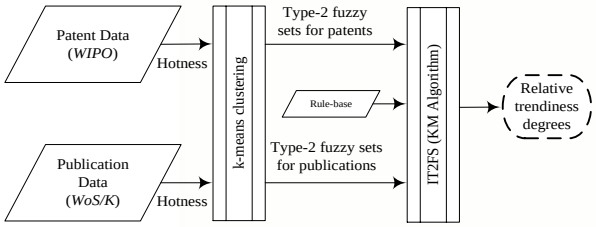


Fig. 2. The framework fusing the patent and publication data.

2.4 Network visualization through bubbles

The ultimate goal of this approach is to obtain an augmented technology roadmap, as illustrated in Figure 3, to assist decision-makers through network visualization. This augmented technology roadmap includes bubble diagrams, where each bubble represents a node of the elements' network. These bubbles are based on patent and publication data corresponding to these elements, and their radius of is proportional to the relative volumes of the patent and publication data. Their colors, on the other hand, are based on the trendiness degrees computed in the previous phase.

3. A case of UAV technologies

3.1 Keyword generation for UAV technologies

To retrieve related data on UAV technologies, a keyword list was created using an SEO keyword research tool called "Semrush". This type of tool checks keywords that have the most traffic in website rankings on Google and finds the most relevant keywords for the niche. When the keyword "unmanned aerial vehicle" is searched in this tool, relevant keywords are obtained. The following query uses these keywords to retrieve relevant data.

"Unmanned Aerial Vehicle" related keywords:

TS = "unmanned aerial vehicle" OR "unmanned airborne vehicle" OR "aerial drone system" OR "unmanned aircraft system" OR "uav aircraft" OR "uas vehicle"

3.2 Topic modeling to determine the elements

Having completed the previous phase, topic modeling is conducted to identify the elements of product and technology layers. The query "unmanned aerial vehicle" created in the first phase can be used to retrieve the dataset for topic modeling. However, technology roadmapping for UAV technologies has been addressed in the literature. One recent study in the literature is that of Son et al. (2020), where they conducted topic modeling (using LDA) for UAV technologies by considering 3,236 textual documents. In this phase, this study employs the results of Son et al. (2020). The following queries are used to retrieve relevant data.

Elements of the "product" layer and their queries:

P1-Internet service: TS = "broadband" OR "mobile" OR "cloud" OR "server" OR "wireless" OR "density" OR "database"

P2-Entertainment: TS = "heritage" OR "program" OR "entertainment" OR "recording" OR "highlight" OR "gathering" OR "library" OR "briefing" OR "soccer" OR "tourism" OR "storage" OR "voyage" OR "racing" OR "motion" OR "climbing"

P3-Warfare and weapons: TS = "agent" OR "capture" OR "captain" OR "gear" OR "veteran" OR "cruise" OR "war" OR "kill" OR "power" OR "military" OR "repression" OR "force" OR "fuel" OR "imprisonment" OR "murder" OR "secret" OR "squadron" OR "artillery"

P4-Disaster and safety: TS = "police" OR "storm" OR "evacuation" OR "die" OR "coast" OR "surge" OR "travel" OR "hurricane" OR "flood" OR "hazard" OR "cold" OR "instability" OR "violate" OR "vulnerability" OR "warrant" OR "prevention" OR "hazard" OR "criminal"

P5-Agricultural support: TS = "farming" OR "zoning" OR "mark" OR "crop" OR "imagery" OR "deforestation" OR "forest" OR "screen" OR "verification" OR "pollution" OR "chemical" OR "livestock" OR "tracking" OR "seed" OR "conservation"

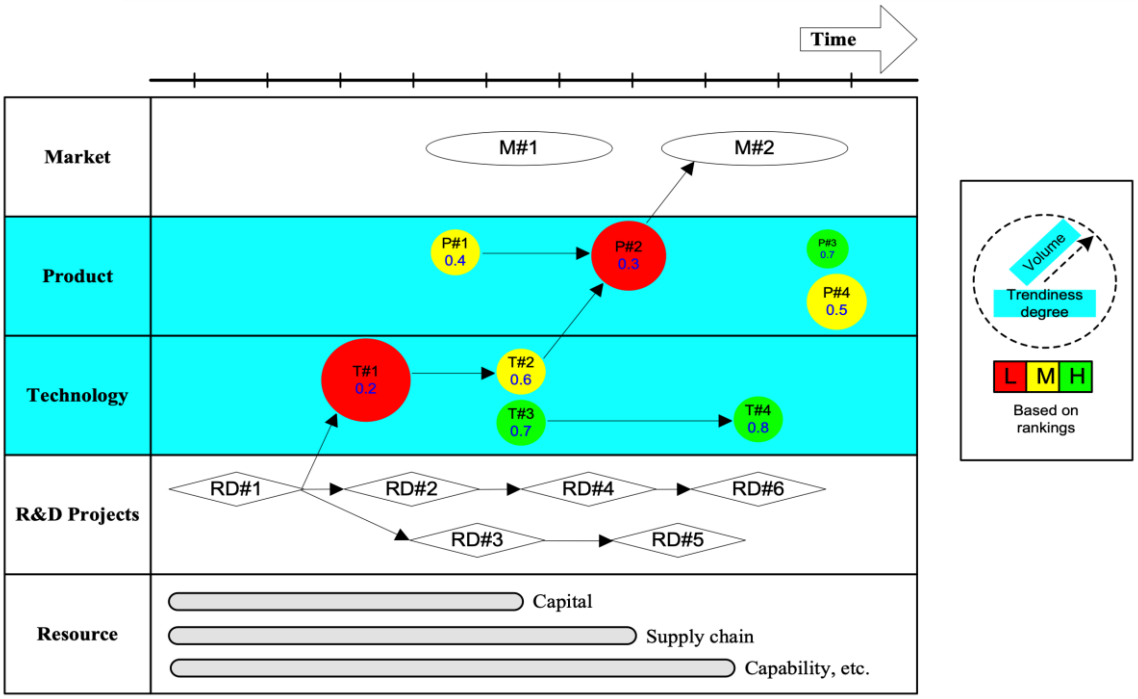


Fig. 3. Augmented technology roadmap through patent and publication data.

P6-Logistics: TS = "transport" OR "packaging" OR "docking" OR "delivery" OR "workplace" OR "shipping" OR "shopping" OR "precision" OR "neighborhood" OR "membership" OR "door" OR "subsidy" OR "unemployment"

Elements of the "technology" layer and their queries:

T1-Software technology: TS = "hunting" OR "observation" OR "biometric" OR "monitoring" OR "precedent" OR "treatment" OR "improve" OR "risk" OR "development" OR "assessment" OR "analytic" OR "framework" OR "storage" OR "warning" OR "response" OR "prevention"

T2-Detection avoidance: TS = "obstacle" OR "control" OR "landing" OR "sonar" OR "carrier" OR "collision" OR "avoidance" OR "robotics" OR "travel" OR "platform" OR "shadow" OR "cruise" OR "awareness" OR "scan" OR "image" OR "drop" OR "altitude" OR "velocity"

T3-Navigation technology: TS = "pilot" OR "radar" OR "processing" OR "monitoring" OR "access" OR "miss" OR "return" OR "reliability" OR "driving" OR "navigation" OR "telecommunication" OR "traffic" OR "gps" OR "control"

T4-Platform and power technology: TS = "imprisonment" OR "censorship" OR "injustice" OR "tyranny" OR "repression" OR "plutocracy" OR "genocide" OR "cruelty" OR "prosecutor" OR "campaigning" OR "coup" OR "impunity" OR "punishment" OR "reconnaissance"

3.3 Assessing trendiness of the elements

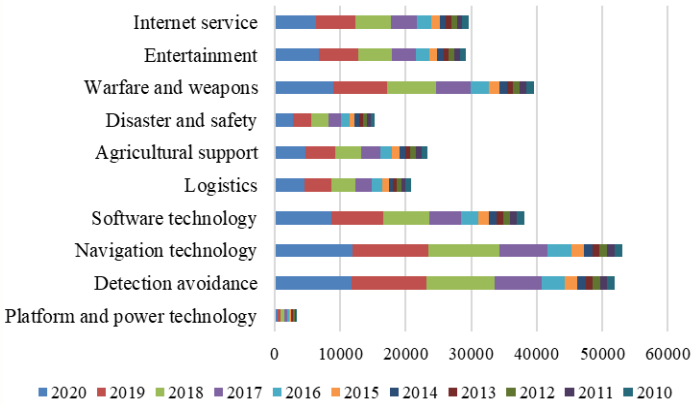
In this phase, data on the number of publications and patents from the last ten years are retrieved from the databases of WoS/K and WIPO IP Portal, respectively (see Table 1 and Table 2). The framework illustrated in Figure 2 is then executed to obtain the relative trendiness degree of each element considered.

According to this framework, hotness values are calculated and then clustered using the k-means clustering algorithm. Subsequently, fuzzy membership functions are determined for patents and publications, resulting in tags of "low", "medium", and "high" (see Table 3).

This framework uses the Karnik-Mendel (KM) algorithm (Mendel and Wu, 2010) for fuzzy inference. The input parameters of this fuzzy inference system are the average hotness values calculated for each roadmap element. A fuzzy rule base is used to map the relationship between patents and publications (see Dereli and Altun, 2013).

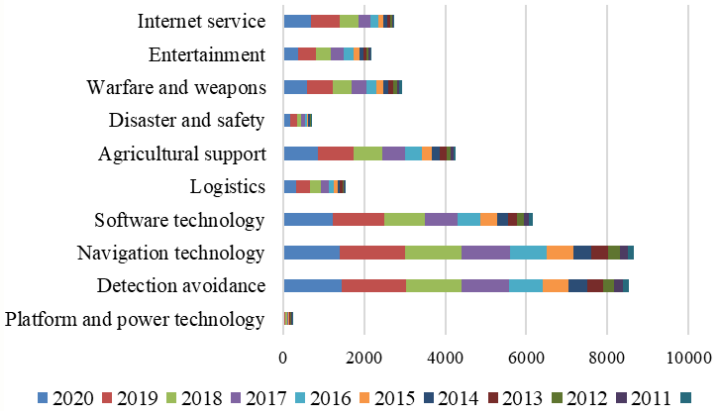
The framework uses these average hotness values and their firing intervals to infer the trendiness degree of each element by executing the following inference procedure:

Table 1. Patent data for the identified elements (retrieved from WIPO IP Portal)



	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Platform and power technology	443	479	507	465	353	221	224	142	194	192
Detection avoidance	11718	11494	10423	7064	3567	1898	1327	1045	1135	1075
Navigation technology	11850	11661	10843	7225	3674	1922	1365	1070	1143	1094
Software technology	8652	7860	7091	4870	2671	1552	1212	1001	1050	1018
Logistics	4549	4142	3567	2572	1568	968	705	599	659	670
Agricultural support	4709	4543	3973	2894	1823	1134	885	751	854	814
Disaster and safety	2808	2814	2570	1967	1241	810	671	557	569	574
Warfare and weapons	8941	8157	7586	5224	2809	1569	1150	968	1039	986
Entertainment	6751	6024	5128	3682	2030	1229	920	794	854	819
Internet service	6243	6022	5427	3970	2259	1287	955	773	864	843

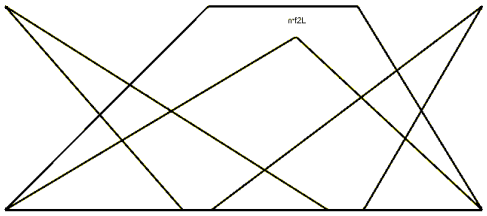
Table 2. Publication data for the identified elements (retrieved from WoS/K)



	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Platform and power technology	24	34	36	23	10	14	15	18	26	14
Detection avoidance	1439	1602	1361	1177	838	620	459	394	280	205
Navigation technology	1395	1622	1387	1191	916	654	449	404	293	194
Software technology	1234	1252	1023	801	561	416	271	212	161	124
Logistics	324	335	264	201	137	84	61	54	31	19
Agricultural support	863	871	711	567	415	247	202	148	114	62
Disaster and safety	186	151	111	86	53	38	28	17	15	7
Warfare and weapons	589	627	478	368	239	161	133	133	84	59
Entertainment	381	434	364	320	231	159	91	75	61	41
Internet service	679	724	450	292	195	132	103	77	44	25

Table 3. Fuzzy membership functions for the patent and publication data

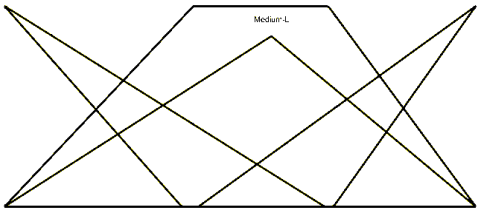
Fuzzy MFs for the *patent* data



Limits of the MFs
Low-U: [0 0 0.6768 1]
Low-L: [0 0 0.3725 1]
Medium-U: [0 0.4262 0.7387 1 1]
Medium-L: [0 0.6098 1 0.85]
High-U: [0.4326 1 1 1]
High-L: [0.7514 1 1 1]

Input values (avrg hotness)
Platform and power technology: 0,4185
Detection avoidance: 0,6257
Navigation technology: 0,6246
Software technology: 0,5995
Logistics: 0,5749
Agricultural support: 0,5523
Disaster and safety: 0,5260
Warfare and weapons: 0,6040
Entertainment: 0,5976
Internet service: 0,5812

Fuzzy MFs for the *publication* data



Limits of the MFs
Low-U: [0 0 0.6796 1]
Low-L: [0 0 0.3761 1]
Medium-U: [0 0.401 0.6868 1 1]
Medium-L: [0 0.5662 1 0.85]
High-U: [0.4114 1 1 1]
High-L: [0.698 1 1 1]

Input values (avrg hotness)
Platform and power technology: 0,3848
Detection avoidance: 0,5090
Navigation technology: 0,5010
Software technology: 0,5580
Logistics: 0,5914
Agricultural support: 0,5626
Disaster and safety: 0,6298
Warfare and weapons: 0,5646
Entertainment: 0,5326
Internet service: 0,6544

Rule (n): If x_1 is $\tilde{X}_1^n$ and x_2 is $\tilde{X}_2^n$ then y is Y^n, $n=1,2,\ldots,N$,

where $\tilde{X}_1^n$ are the MFs which are generated from patent data and $\tilde{X}_2^n$ are the MFs which are generated from publication data. x_1 and x_2 are the average hotness values of the elements, respectively. Y^n values are intervals ($=[\underline{y}^n, \overline{y}^n]$) representing the trendiness degree.

Compute the membership of x_1 on each $\tilde{X}_1^n$, $\left[\mu_{\underline{X}_1^n}(x_1), \mu_{\overline{X}_1^n}(x_1)\right]$, $n=1,2,\ldots,N$.

Compute the membership of x_2 on each $\tilde{X}_2^n$, $\left[\mu_{\underline{X}_2^n}(x_2), \mu_{\overline{X}_2^n}(x_2)\right]$, $n=1,2,\ldots,N$.

Compute the firing interval of the nth rule, $F^n(x_1,x_2)$, through the following equation:

$$F^n(x_1,x_2)=\left[\mu_{\underline{X}_1^n}(x_1)\times\mu_{\underline{X}_2^n}(x_2), \mu_{\overline{X}_1^n}(x_1)\times\mu_{\overline{X}_2^n}(x_2)\right]\equiv\left[\underline{f}^n, \overline{f}^n\right],\quad n=1,2,\ldots,N.$$

These type-2 fuzzy sets transform into their type-1 counterparts in the type-reduction process. This framework prefers to use the center of sets ($Y_{\cos}$) type reducer expressed as the following equation:

$$Y_{\cos}(x)=\bigcup_{\substack{f^n\in F^n(x)\\ y^n\in Y^n}}\frac{\sum_{n=1}^{N} f^n y^n}{\sum_{n=1}^{N} f^n}=[y_l, y_r]$$

where y_l and y_r are the endpoints of the interval set. These points are expressed in the following equations, respectively.

$$y_l=\frac{\sum_{n=1}^{L}\overline{f}^n\underline{y}^n+\sum_{n=L+1}^{N}\underline{f}^n\underline{y}^n}{\sum_{n=1}^{L}\overline{f}^n+\sum_{n=L+1}^{N}\underline{f}^n}$$

$$y_r=\frac{\sum_{n=1}^{R}\underline{f}^n\overline{y}^n+\sum_{n=R+1}^{N}\overline{f}^n\overline{y}^n}{\sum_{n=1}^{R}\underline{f}^n+\sum_{n=R+1}^{N}\overline{f}^n}$$

where switch points L and R are specified by $\underline{y}^L\le y_l\le\underline{y}^{L+1}$ and $\overline{y}^R\le y_r\le\overline{y}^{R+1}$, respectively.

The KM algorithm (see Mendel and Wu, 2010) is executed for computing y_l and y_r. The following equation provides the defuzzified outputs corresponding to the trendiness degrees:

$$y=\frac{y_l+y_r}{2}$$

After execution of this fuzzy inference process, the trendiness degrees of each corresponding roadmap element are quantified (see Table 4 for the quantified trendiness degrees).

Table 4. Relative trendiness degrees of the elements and volume of the patents

	Bubble Color (Red, Yellow, Green)			Bubble Size (Small, Moderate, Big)		
	Relative trendiness degrees	Ranking	Bubble color	Number of the last three years' patent (Volume)	Standardize the volume to [1, 4] interval	Bubble size
Platform and power technology	0.426	9	Red	1429	1.00	Small
Detection avoidance	0.5118	5	Yellow	33635	3.93	Big
Navigation technology	0.5099	7	Red	34354	4.00	Big
Software technology	0.5159	4	Yellow	23603	3.02	Big
Logistics	0.5178	3	Green	12258	1.98	Small
Agricultural support	0.5072	8	Red	13225	2.07	Moderate
Disaster and safety	0.5159	4	Yellow	8192	1.61	Small
Warfare and weapons	0.5181	2	Green	24684	3.11	Big
Entertainment	0.5105	6	Yellow	17903	2.50	Moderate
Internet service	0.5337	1	Green	17692	2.48	Moderate

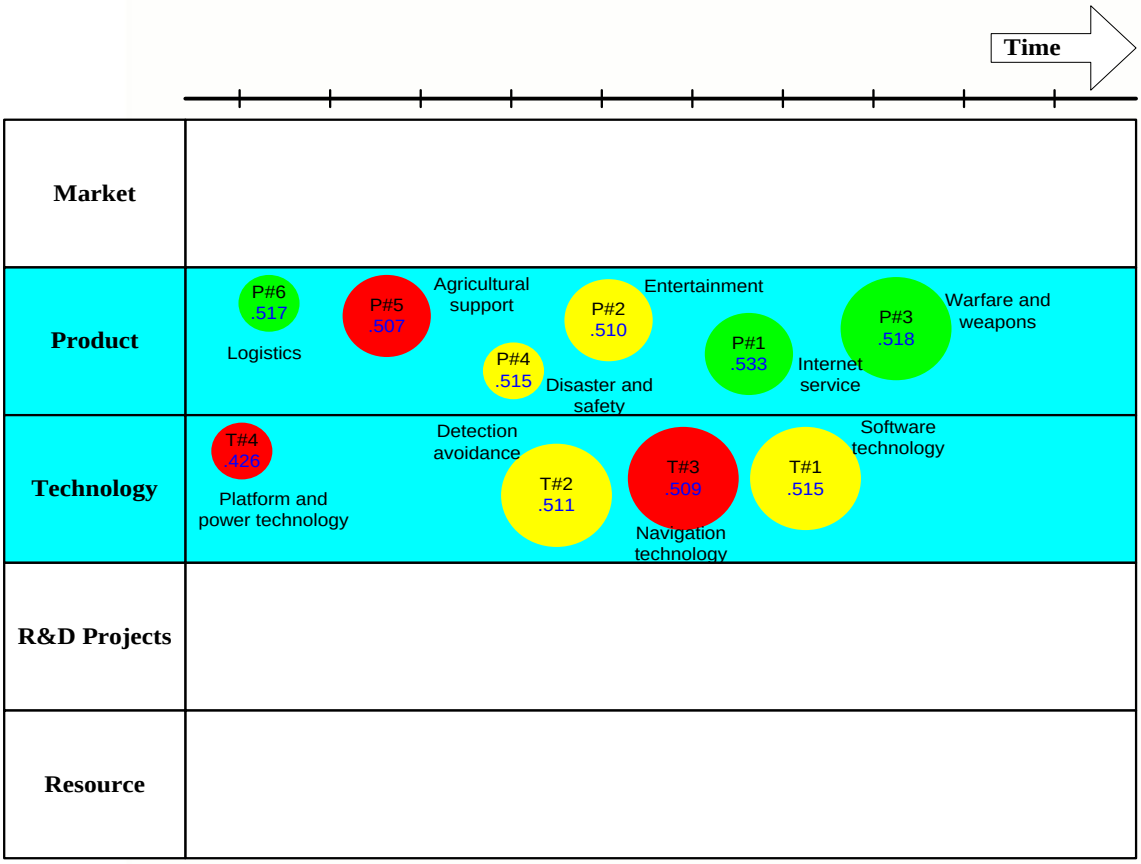


Fig. 4. An illustration of the augmented technology roadmap for UAV technologies (Product and Technology layer)

3.4 Network visualization through bubbles

After computing the trendiness degrees, a ranking is performed to classify the elements into three groups (colored with red, yellow, and green, in descending order, so that the trendiest elements have a green bubble in the technology roadmap). While the color of the bubbles is based on the trendiness evaluations, the size of the bubbles is based on the volume of patent data. To specify the radius/size of the element bubbles, the numbers of the last three years' patent data are considered. After retrieving this patent data, it is standardized to [1, 4] intervals. Corresponding elements are then classified into three bubble-size groups as small, moderate, and big according to their standardized volume values ([1, 1.99] – small, [2, 2.99] – moderate, [3, 4] – big).

Figure 4 depicts the augmented technology roadmap for unmanned aerial vehicle technologies, which is based on patent and publication data. The ultimate goal of these phases is to enhance the technology roadmap by utilizing these bubbles, where the color depends on the trendiness degree and the size depends on the volume.

4. Concluding remarks

This study presents an augmented technology roadmapping process that incorporates an innovation intelligence process driven by patent and publication data. This process involves four main phases: keyword generation, topic modeling, trendiness determination using type-2 fuzzy sets, and visualization of element relations through bubbles.

This process can help users understand the element relations that affect the strategic decisions. The case of unmanned aerial vehicle technologies is used to demonstrate the execution of this process. This study provides a new perspective on technology roadmapping, and future research can use these data-driven elements and layers for network analysis to support decision-making based on this augmented technology roadmap.

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Instance segmentation based precise object detection in UAV Images using Mask R-CNN

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Abstract

Object detection plays a vital role in remote-sensing datasets which trains the image or things and helps in classifying the images into their classes. Instance segmentation is the avant-garde technique used for object detection in Deep Learning. There are many instance segmentation models which can produce significant results. Object detection, segmentation, and RGB analysis in images taken from Unmanned Aerial Vehicles (UAV) are difficult with the desired level of performance. Instance segmentation is a powerful method that extracts each object and its location with the predicted label for pixels in the input image. In this paper, a study has been carried out on the implementation of Mask R-CNN for instance segmentation with different optimization algorithms to obtain a more accurate result for UAV images. The training has been carried out with Mask R-CNN for object detection using ResNet50 and ResNet101 as the backbone. After extensive experiments, it has been observed that the optimization algorithm plays a vital role in the overall computational process and can improve the accuracy level with a reduction in the training/validation loss. The experiment has been conducted on publicly available UAV datasets. The paper further presents the results in terms of different performance parameters

Keywords: Deep learning, Instance Segmentation, Mask R-CNN, UAV Images, Optimization algorithm.

1. Introduction

Deep learning is part of machine learning (ML), which includes many patterns and libraries to implement advanced learning patterns. The results of the deep learning algorithms in computer vision and image processing applications are different models available which develop different image segmentation approaches in the future (He K, Gkioxari G, Dollar P, Girshick R, et al., 2020). The main segmentation process is to reduce the complexity of the image, which is

one of the techniques applied in deep learning. Built-in hierarchical architecture of a deep learning algorithm called Artificial Neural Network (ANN) explores and ensures those who can learn results independently from data. The image segmentation model can be applied in different applications like medical images, UAV images, self-driving cars images, satellite image and fire detection images etc. (Begum, S. R., Datta, S. Y. & Manoj, M. S. V. et al., 2021). The object detection, tracking, and recognition module used images from shading and creates deep learning through image segmentation. This module needs to segment the pixels of the object to the front. Instance segmentation is done through these processes including both object Detection and Segmentation.

The models generated through deep learning for computer vision can achieve meaningful breakthroughs in various fields (Fengbao Yang Yingjie Liu and Peng Hu., 2017) (Lucas Prado Osco, José Marcato Junior, et al.,2021) UAV images are usually within a range of tens to hundreds of meters, bringing large scenes to imagestaken. In the UAV image, most of the things are prone tobe misclassified due to their unclear position and relativelysmaller size compared to that in general terrestrial images. Object recognition in aerial images makes it difficult to annotateobjects and boxes. However, the images are easy to see, but there are many, not just small ones, these investigations are oneof the key discoveries that undermine today's discipline. ThePipeline of the R-CNN model that attempts to solve the disclosureproblem i.e., object detection for UAV images and variousdeep learning techniques can also be used to increase theexposure in various real-time applications like weed control,traffic counting, agriculture, robotics, autonomous vehicle, etc.The object detection issues limit the expressiveness of Future Pyramid Networks (FPNs). In other words, self-markingfrom the pyramid layer is still not enough to effectively detectsmall objects. To solve this issue, the Mask R-CNN modelextracts the features from different layers (Padmalaya Nayak

and Ravalisri Vasam et al., 2019). To achieve the best efficiency, Mask R-CNN uses a simplenetwork structure in the entire network. It is a highly simple andfully convolution network selected on the mask head. The aimis to minimize the processing cost while maintaining theinstance segmentation accuracy (Cong Lin and Shijie Zhang et al.,2021). The key points of this work are as follows:

1. Implementation of Mask R-CNN Model with different optimization algorithms for UAV images.
2. Training and validation of the Mask R-CNN model withabackbone of ResNet50 and ResNet101 enumerate environment.
3. Fine-tuning of the R-CNN network's parameters to improve the accuracy.

The paper is formulated as follows: Section II gives the views on the work related to object detection and Mask R-CNN model implementation with ResNet50and ResNet101 backbone. Section III tests and validates the model with UAV image datasets. Results and discussion of the experiment are represented in Section IV. Finally, section V presents the conclusion of experiment and the future research work.

2. Materials and Methods

2.1 Related works

Deep learning models are modern techniques that areused for object detection (Pathak, Ajeet & Pandey, Manjusha & Rautaray, Siddharth. et al.,2018). It supports the advanced technique used for analysis, which is captured by UAV, and compares the results with different convolution layers for object detection (Chenfan Sun, Wei Zhan, et al., 2020). The FPN is used to extract the feature from Convolutional Networks by detecting the more common features with specific classes and it produces more accuracy for real-time images i.e. drone images (Vaddi, Subrahmanyam & Kim, Dongyoun et al., 2021).To explain the data transfer to the next layers, various types of activation functions and their importance in deep learning (Sharma and Siddharth et al., 2020). Theoretical concepts and characters are used for ReLU activation neural network's function and the results shown are obtained throughthe lens of spline theory (R. Parhi and R. D. Nowak et al., 2020). Existing work (Olgac, A & Karlik, Bekir et al., 2011) compares the back-propagation algorithms of neural networks and the process of different activation indeep learning. Proposed (Konstantin Eckle, Johannes Schmidt Hieber (2019) (Zhang, Yiqing, et al., 2020). The inequality in data binding and risk of fitting neural networks through statistical representations and the results shows that deep networks perform better in terms of feature extraction. In the Mask R-CNN structure, the scale-invariant fully convolution network ignoreslocal data differences between fields of interest of different sizes. Large-scale images do not focus on the size of the image compared to small-scale images in semantic information. So, the network model does not work while comparing the pixels at the object edge and it can misclassify (Renu Khandelwal, 2019). The CNN-based model can be applied in emerging remote sensing applications. It will give a high-accuracy output (Chen and Leiyu et al.,2021). To explore the Convolutional neural network (CNN) architecture for segmentation, classification, and image detection, the functionality of layers will give significant results. (Muhammad Asif Saleem and Norhalina Senanet al., 2022).

2.2 Methods

Drone-based image dataset is downloaded from the public domain (https://github.com/VisDrone/VisDrone-Dataset). The downloaded dataset consists of 2500 UAV acquired images. after proceeding to the data annotation process once the annotation was completed. The following input are setup to the Mask R-CNN model for training with ResNet50 and ResNet101 backbone. The mask R-CNN model is fine-tuned with certain parameters. i.e optimization algorithm and it is passed on the testing process ends with final results.

Pipeline of mask R-CNN model Fig.1. consists of the following

- Data preparation
- Image Annotations
- Select the Base model
- Backbone Selection
- Activation Function Selection
- Optimizer algorithm
- Train the model
- Test the model

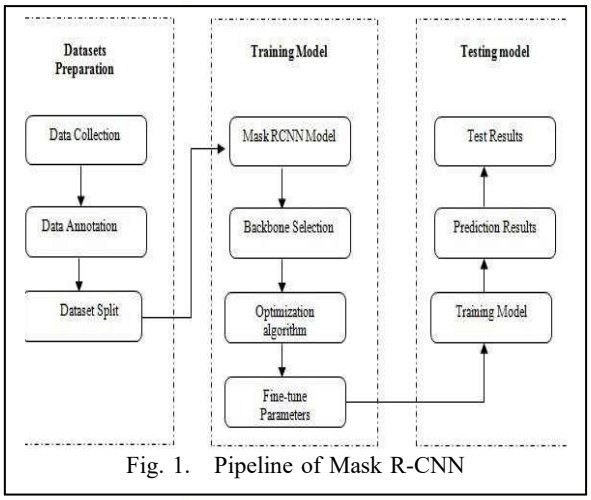


Fig. 1. Pipeline of Mask R-CNN

2.3 Datasets preparation

The datasets consist of 2500 UAV-acquired images. The test dataset consists of 2000 images, taken by various drone cameras, covering a wide range, including location, environment, and objects.

2.4 Datasets Specifications

COCO dataset can be used in huge volumes of datasets for object detection and instance segmentation with more than 85 classes like car, person, and bye cycle, etc., It includes all images with more than 85 objects. Initially were applied the pre-train process to extract features in the COCO dataset with all categories. Objects are labeled (Car) and instance segmentation has been done.

2.5 Image Annotation

The images are collected and have to be annotated. Afterthe annotation, a mask indicates the corresponding objects for the model to identify and train. This process has to be done through the Labelme annotation software tool used to annotate

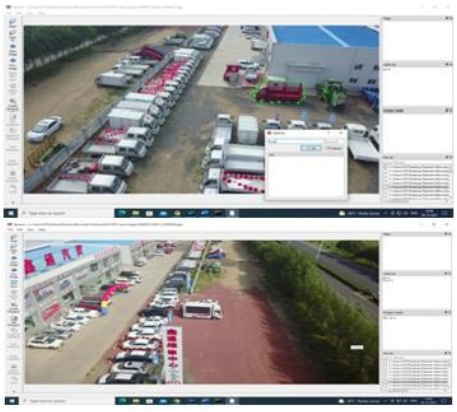


Fig. 2. Annotation of images

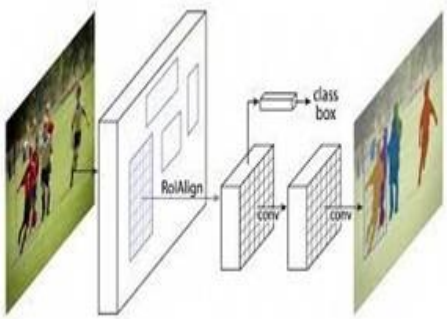
theimages Fig.2. There is a free tool and provides an option whichcreates polygons and a mask for an object. One image contains more than one desired object in a variety of classes. Once the annotation process has completed, it may generate a jsonfile to store a mask which coordinate and class name may be given for all the annotated images.

2.6 Model Training

If the annotation process is successfully completed, combine the entire json file into one json file for the given input to the model and the training process. Use Python programming for the translation process. The dataset along with the entire json file have to be uploaded to the NVIDIA GPU V100 environment. The model was trained which supports instance segmentation (S. L. Ullo et *al*., 2021). The mask R-CNN model is trained with actual LR 0.001 with 500 epochs and 2 imagesper GPU. The original weight is "COCO" such as the updated instance model weight (Jaikumar, Punitha, and Vandaele et al., 2021).

2.7 Mask Region-Based Convolutional Neural Network

Fig. 3. Mask R-CNN Architecture (Kaiming He et al., 2016)



Mask R-CNN is a Convolutional Neural Network (CNN), which is the most advanced in image segmentation and instance segmentation. Mask R-CNN Model is located at thetop of Faster R-CNN, Region-Based Convolutional Neural Network Concepts. Mask R-CNN is a deep learning model which includes both object detection and instance segmentation. Mask R-CNN may identify objects at the pixel level. The objective is to identify objects in real-time images using models implemented are mask R-CNN. Mask R-CNN is a two-step process. Region Proposal Network (RPN) is created andidentifies the objects in an input image which is called step 1. In the second step, these inputs are used to predict a class of objects and build a boundary box around a detected object. The boundary box is refined and masked to the pixel level for input in the first step. Both functions have been executed and connected to the backbone.

The main advantage of Mask R- CNN Fig.3 includes pixel-wise adjustment, which is lost in a piece of the Faster R-CNN model (K. He, G. Gkioxari, P. Dollár, etc.,2017).

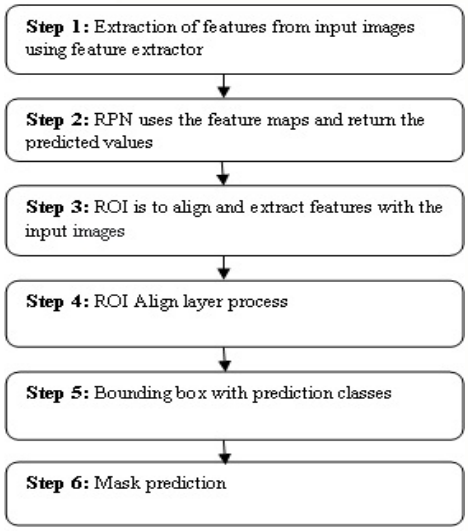


Fig. 4. Steps for detecting objects in Mask R-CNN

The main advantage of mask R-CNN is Instance Segmentation. Mask R-CNN is built on Faster R-CNN as shown in Fig.4. It is image pixel-wise segmentation (Kaiming He et al. 2016).

2.8 ResNet50 Backbone

Developing (Dalal AL-Alimi et al., 2020) the ResNet50 (Residual Neural Network) models are based on deep architectures that have shown good convergence behaviors and compelling accuracy. The ResNet50 (Residual Neural Network) has been used to resolve the vanishing gradient problem compare to other activation functions i.e. sigmoid and tangent activation functions. The network usually has a very deep gradient signal, which quickly approaches zero, making the decline unbearably slow. During gradient descent, moves the last layer back to the first layer. This process is multiplied by the matrix weights at any level, so the gradient can exponentially decrease to zero. ResNet," shortcut" or" skip connection" solves Fig.5 the escalation problem directly in the upper level and adds a link to the next level. ResNet blocks placed on top of each other can form a very high network. ResNet blocks with "shortcuts" are also one of the easiest blocks to learn identity functions.It is understood that one may stack on additional ResNet blocks with little risk of harming training set performance the ResNet learning process has been represented and defined in the following equation (1)

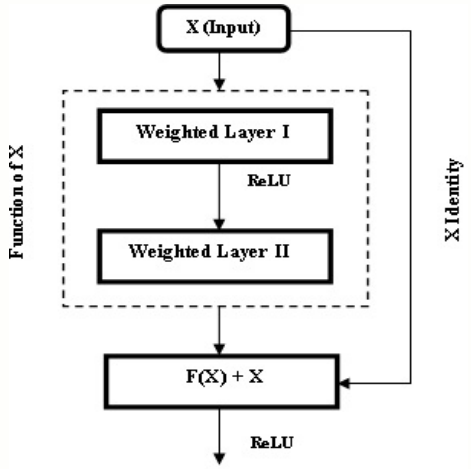


Fig. 5. Skip Connection

$$Output Y_{(}i+1) = f(X) * W \quad (1)$$

When outputting Y(i+1), input X, Wi are the parameters of the convolutional learning layer, and f(X)*Wi is assigned to the residual that we have learned. The identity block is the standard block used in ResNet, and this corresponds to the case where the activation input has the same function as the activation output. ResNet architecture intends to pass the gradient values through the skip connection to the upper layers in the model exits from the last layer to the first layer. The ResNet50 contains five convolutional layers: c1x, c2x, c3x, c4x, and c5x with 1 polling layer and average pooling layers.

The user loaded the image to the convolution layer with 64 filters and a kernel size of 7*7*3 along with a max pooling layer with stride 2. The Max pooling layer executes on the feature map and reduces the image size to the maximum image size. Noise value may be added into the main path ResNet layer in which they perform the convolutions layer size and kernel size 7*7*3 while changing the dimension set 64,128,256,512 every 2convolutions layer skip connection occurs; the input and output remain unchanged. When dimensions change, automatically convolution layer of the block has been added to skip the connection process. The ResNet layer reached i.e. Average polling is completed the feature map gives the output after obtaining the feature map and then passed to ANN.

This process is called forwarded propagation. Loss value is calculated at the output layer which is calculated by exiting weighted value to update the proposed model. It will improve the performance and accuracy value.

3. Implementation

The Experiment was successfully executed and each input image is adjusted to 800 x 1024 using the

zero padding input images Fig.6. Zero padding helps match the size and size of each input environment. The initial size was 2 images per GPU each image had an ROI of 200 which was investigated on a 2 GPU dataset with 300 iterations and 500 epochs. The RPN is supplied to the two networks. One creates a detection limit and a boundary regressor box for each object found, and the other gets a mask to detect the same object.

The output of instance segmentation is calculated with mAP scores. It is measured through the classification of objects. The accuracy is calculating the confusion matrix to the whole dataset first to get the TP-True Positive, FP-False Positive, TN- True Negative, FN - False Negative values. Some other models are noticed and almost all the available solutions are out there for the calculation of the confusion matrix, the only outputs are the TP, FP, and FN values. Instances of the segment generate a collection of local masks that map each object found in the image. The method of estimating the quality of an instance of segmentation is very similar to object detection, except that IoU can calculate masks instead of bounding boxes.

3.1 Calculate the loss value

The loss value of Mask R-CNN includes damage caused by RPN and damage caused by classification, positioning, and segmentation

$$ML(RPN) = RPN - CL + RPN - BBL \quad (2)$$

Where Mask Loss, RPN-LL is Class Loss and RPN-BBL Boundary Box loss

$$ML(RPN) = RPN - CL + RPN - BBL \quad (3)$$

$$Loss = L - RPN + L - Mask\ R - CNN \quad (4)$$

So, the optimizer is to minimize the loss value

4. Results and Discussions

The performance of the proposed method was analyzed using mAP and IOU values. By predicting bounding boxes in the input image to determine whether the above boxes and the actual boxes overlap. The result can be calculated by dividing the overlap integral by the total area of each bounding box, otherwise, the intersection value may be divided by the union Intersection over Union (IoU). The exact results may be the prediction i.e., the bounding box will have an IoU. The representation ofaccurate prediction of a bounding box, IoU value is greater than 0.5.

- Precision is measured by the accuracy of predictions
- The recall is measured by positives findings

The mathematical representation of the following Precision, Recall, and F1 Score

$$Precision = TP/(TP + FP) \quad (5)$$

$$Recall = TP/(TP + FN) \quad (6)$$

$$F1 = 2\,(Precision.\ recall)/(Precision + Recall) \quad (7)$$

Equation (5) refers to the percentage of predicted bounding boxes at position (IoU Greater than 0.5) to the link abovefrom all bounding boxes ending in the image Equation (6) is the percentage of the correct end boundary box (IoU less than 0.5)from all objects in the image. If you want to improve accuracyby using more images to make predictions, the recall will be better, but when false positives start to occur, the accuracy willbe reduced or unstable. The average or average accuracy ofall images (APs) is called average accuracy or mAP.

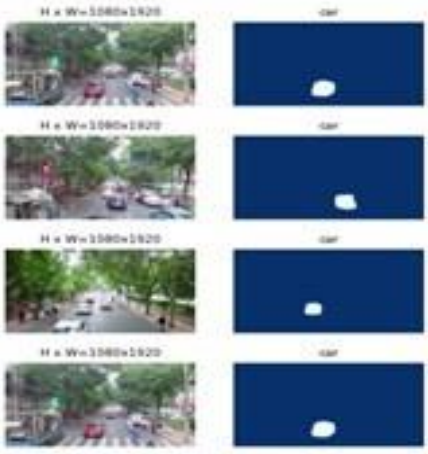


Fig. 6. Input images and Boundary box around images

The mask R-CNN model is to fine-tune with a few parameters in the configuration part i.e., threshold value. It also used different optimization algorithms like SGD and Adam. Initially, the SGD optimizer algorithm is working better and improving the accuracy while minimizing the loss ratio (Mahmoud, Amira, and Mohamed, Sayed et al., 2020) compared to the Adam optimizer. In the above experiments, the dataset of 100, 250, 500, 1000, and 1500 images were used in Fig.7 and Fig.8. The tests are according to the validation dataset of 50, 100, and 250. From the experiment, an average value has been calculated. The dataset trained for 500 epochs as loss is decreased by using the SGD optimizer algorithm and results are stable at the point. The results are compared to the existing model.

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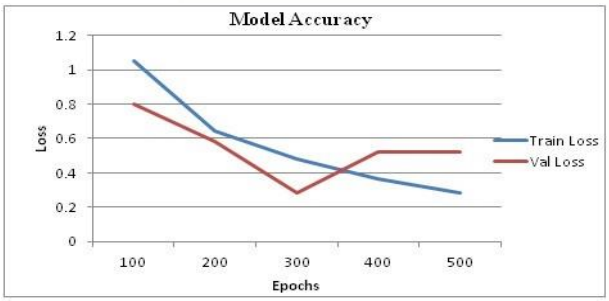

Fig. 7. Accuracy obtained for 1000 images-SGD Optimizer

Fig. 8. Result of Mask R-CNN-SGD Optimizer

along with pixels accuracy which can further implemented the results shows that AP Scores 88-92 results for 1000 images. The analysis of the obtained results during training, testing and actual validation has proved the role of optimizer in deciding the accuracy of the instance segmentation and object detection in UAV images. Implementation can be further improved by real-time UAV images and videos with huge dataset size, as observed there is better accuracy while increasing the dataset size which also helps to increase the accuracy, number of class and its counting values.

For the datasets with 1000 images, the results are in Fig. 9 and Fig. 10 for bounding box scores slightly decreases and mask segmentation value are reduced due to Adam optimizer being used, with ROI values of 200 which needs to be increased. The model trained with different learning rates and weights is collected from the "COCO dataset" model. It will support the new updated weight values with fewer epochs. While increasing the 1000 to 1500 images dataset is trained with an optimizer algorithm with other parameters. The proposed model can be trained well and improved the results. The proposed model improves the accuracy with a minimum computation process.

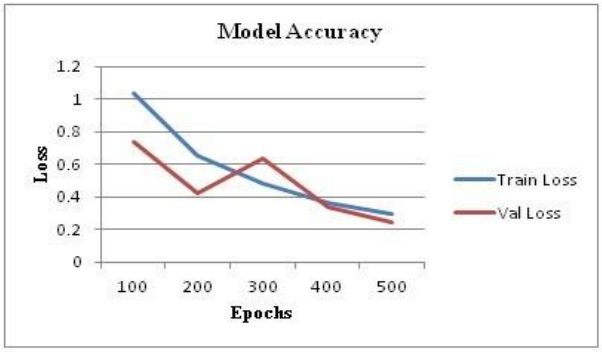

Fig. 9. Accuracy obtained for 1000 images-Adam Optimizer

Fig. 10. Result of Mask R-CNN-Adam Optimizer

5. Conclusion and future work

Mask RCNN is better, for instance, segmentation by identifying each pixel of every object in the input image with a bounding box. Mask R-CNN model with backbone ResNet50 and ResNet101 applied for UAV image dataset. The training was executed into ROI values along with SGD and Adam optimizer algorithms with different dataset sizes. The results show the mask created all over the car along with pixel accuracy which can be further implemented the results shows that AP Scores 88-92 results for 1000 images. The analysis of the obtained results during training, testing, and actual validation has proved the role of the optimizer in deciding the accuracy of the instance segmentation and object detection in UAV images. Implementation can be further improved by real-time UAV images and videos with huge dataset size, as observed there is better accuracy while increasing the dataset size which also helps to increase the accuracy, number of class and its counting values.

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Systematic review: disruptive innovation in non-branded retail markets

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Abstract

The coronavirus pandemic has significantly impacted the retail industry, with changes in consumer shopping patterns and a shift towards online and home delivery services. While branded retailers have adapted to the e-commerce solutions and seen a rise in sales, non-branded retailers have faced disruptions in their supply chain and local market participation. The study found that consumer choices shifted towards healthcare products rather than brand loyalty, resulting in a scarcity of branded products and encouraging the purchase of local unbranded goods. The garment industry supply chain was heavily impacted, and some employees and daily laborers lost their jobs. Retailers are now preparing for post-pandemic conditions, including changes in employee and operations. The paper presents a systematic review of the disruptions created by local retailers and their innovative strategies in the post-pandemic era, providing insights into the consequences and challenges the retail industry faces. Additionally, the study highlights the need for retailers to monitor their liquidity and adjust their short-term cash estimates to survive in an unstable market with reoccurring lockdowns. Finally, the paper discusses the opportunities for more informed retailers to improve their market position by addressing sustainable and ethical concerns that have become increasingly relevant due to the pandemic.

Keywords: Covid-19; Retail Market; Unbranded Retails; Market Disruption;

1. Introduction

The retail industry has been evolving rapidly with the advent of technology and innovative business models. Disruptive innovation has played a significant role in this evolution, transforming the traditional retail markets and creating new opportunities for non-branded retailers (Li & Li, Disruptive innovation in the retail industry: A systematic literature review, 2021). In this systematic review, we aim to explore and study the challenges and impact of disruptive innovation in non-branded retail markets, with a specific focus on India and globally. As defined by Christensen (1997), disruptive innovation is a process by which a product or service initially takes root in simple applications at the bottom of a market and then relentlessly moves upmarket, eventually displacing established competitors (Christensen, 1997). In the retail industry, disruptive innovation has resulted in the emergence of non-branded retailers, who offer products and services at lower prices, often without the overhead costs of branded retailers. Non-branded retailers are prevalent in emerging markets like India, where they constitute a significant portion of the retail industry. Despite the growing importance of non-branded retailers and disruptive innovation in the retail industry, there is a lack of comprehensive research on the challenges and impact of disruptive innovation in non-branded retail markets. This paper aims to address this research gap by systematically reviewing existing literature on the subject.

COVID-19 generated an unprecedented demand and supply shock in agricultural and food production. Some supply networks meant to be efficient could not address the shock completely. COVID-19 and limited supply chain flexibility caused market volatility for several agricultural food goods, including grains, dairy, meat, and eggs. Covid-19 has impacted customers' buying decisions – customers have spent more on health and hygiene items, adapted to the scarcity of items, and preferred home delivery over shopping at stores (Swinnen & McDermott, 2020). This problem impacts brand and category choices, purchasing behavior, and spending. The customers show behavior like stockpiling goods; therefore, supermarkets and grocery

shops experience a jump in visits. Because customers prefer home-cooked meals, restaurant visits have dropped almost everywhere—the difficulty acquiring food and shopping necessities (Nguyen & Nguyen, 2021). Customers had trouble acquiring hand sanitizers and hand-washing materials.

Price-conscious customers increasingly seek to identify promising companies and high-quality personal care items. Indian consumers' desire for online shopping is projected to expand from 46% in the present scenario to 64% over the next six to nine months (Chakraborty, 2020). For even non-essential services and commodities businesses, a social media crisis has come to pass for Covid-19. The relationship customers have with the companies influences their purchasing decisions. The COVID-19 epidemic has wholly altered our lives. Many people, businesses, and certain mindsets are different today (Gupta & Purohit, 2020). Supply chains have been evaluated. Retailers are closing down. The world is looking at products and businesses from a fresh perspective (Singh & Kumar, 2020). The paper's future sections discuss the systematic review of non-branded local retailers and the disruption in their businesses due to pandemics.

In this paper, we first introduce the concept of disruptive innovation and its relevance in the retail industry. Next, we provide a comprehensive overview of non-branded retail markets and their significance in India and globally. We then review existing literature on disruptive innovation in non-branded retail markets and analyze the challenges non-branded retailers face. Finally, we identify opportunities for non-branded retailers to adapt to disruptive innovation and remain competitive. This systematic review will provide insights into disruptive innovation's challenges, gaps, and impact in non-branded retail markets, explicitly focusing on India and globally. The findings of this paper will be helpful for non-branded retailers, policymakers, and researchers to understand the implications of disruptive innovation and identify opportunities for growth and development.

2. Background

The retail industry has undergone significant changes in recent years due to the impact of disruptive innovation. Disruptive innovation has transformed traditional retail markets and created new opportunities for non-branded retailers. Non-branded retailers do not have a well-known brand name and rely on other factors, such as price and quality, to attract customers (Zhang & Li, 2021). The rise of e-commerce, mobile devices, and other technological advancements has enabled non-branded retailers to compete with established brands and reach new customers. This research paper aims to conduct a systematic review of the literature on disruptive innovation in non-branded retail markets (Lee & Kim, 2021). The review will examine the impact of disruptive innovation on non-branded retailers, the strategies they have used to adapt to changing market conditions, and the challenges they face in competing with established brands. The paper will also explore the role of technology in enabling disruptive innovation in non-branded retail markets and the implications for future research and practice.

When COVID-19 arrived, it shook up the worldwide supply and demand equation. Examined and demonstrated that time, disruption propagation size, and facility availability influence retail performance. The retail market was worried about survivability and resiliency following the cataclysmic event of the COVID-19 epidemic. About 43% of retail establishments were more likely to suffer from COVID-19 outbreaks (Lee & Kim, 2021). Hence, they are more prone to being closed. Due to travel restrictions, a health quarantine program, and a production shutdown, merchants are encountering issues maintaining operational continuity (Aday & Aday, 2020). Understanding the direction and consumer behaviors helps with the distribution chain during COVID-19.

Any crisis includes a detailed and thoughtful review of an activity sector. Given these circumstances, Romania's COVID-19 pandemic has emphasized the importance of funding in the healthcare sector. The country's medical system requires significant investments in building, equipment, and staff. The preparation of the educational system must be made more flexible. Its ability to work with the Internet should be enhanced for small and medium-sized enterprises (SMEs) (Creţan & Light, 2020). The agro-food market depends on imports, and these import-related conditions might jeopardize the population's food supply. While climatic circumstances affect agricultural productivity, irrigation system funding is modest (Stanciu, Radu, & Sapira, 2020). The researcher's (Vijai & Nivetha, 2020) statistics values are more significant than table values of gender are not correlated with purchasing behavior, spending money on just essential things, Brand Preference is negative, buying more fruits and vegetables, changing food habits, decreased expenditure, saving the income, and altered lifestyle. The author's statistics show that gender preference is not connected with preferring online payments. The value is smaller than the table value of occupation not being connected with an

altered food habit—decreased spending, resulting in a 5% reduction. The author's hypothesis was accepted as having no gender or spending significance offline or online.

The review will be based on a comprehensive search of academic databases, including Google Scholar, JSTOR, and EBSCOhost. The search will be limited to articles published between 2020 and 2023 to ensure that the review reflects the most recent research. The review will systematically identify relevant articles, assess their quality, and synthesize their findings. The paper will conclude with a discussion of the implications of the review for researchers, practitioners, and policymakers in the retail industry.

3. Non-Branded Market Disruption

Before COVID-19, massive, dynamic, and critical food, labor, and resources movements in the urban and rural markets and significant flows across rural regions. Market forces, as currently employed, were just not a substitute for these. We need other strategies if the pandemic, recurrence, or intensification of the disease or other sickness or climate shock crises occurs. The following are two significant takeaways. First, food supply chains must be protected and prevent obstruction (Liverpool-Tasie, Reardon, & Belton, 2020). They include the main roads, wholesale marketplaces, wet retail marketplaces, interstate, and international borders. Assisting truckers and traders, whose efforts are critical in African food supply chains, is essential. Second, investments in personal cleanliness and ways to decrease illness transmission are compatible (Aromolaran & Muyanga, 2020) . Strengthening market and logistical infrastructure is vital to helping small and medium-sized enterprises in all food areas. If the SMEs face significant cash flow, transport, or labor issues, people will not eat. Free and targeted loans and subsidies might assist small- and medium-sized enterprises (SMEs) in paying rent, energy, fuel costs, and wages for employees and provide cars for truckers, warehouse owners, and wholesalers. Assistance and loans can assist businesses in improving buildings and equipment to guarantee a sanitary environment for employees and consumers. Targeted incentives might promote this improvement (Amabibi, 2020). Covid-19 has inflicted significant economic and social damage on most countries globally, and the challenges in the service industries are severe.

Recent years have seen academics and practitioners use the notion of sustainability to study crises in national economies and local settings (Aydinli, Lamey, Millet, & ter Braak, 2020). The Covid-19 problem has raised complex, significant worldwide concerns for service businesses and showcased fresh viewpoints on these companies' links with sustainability. Normalcy will be restored; however, the restoration's period and scope are entirely undetermined. Within this broader post-COVID-19 recovery scenario, the service industry enterprises and their consumers may return to where they left off (Ntounis, N, Mumford, & Loroño-Leturiondo, 2020). Government and business sustainability efforts may be held up as resources for economic recovery are consumed.

Conversely, the COVID-19 problem has opened a window on some interconnections between the service sectors and sustainability. It has foreshadowed key environmental improvements crucial to transitioning to a more sustainable future. It's hard to predict how many organizations within the service sectors or their consumers would care about such cues and show genuine enthusiasm for new solutions (Jones & Comfort, 2020).

Both general and specific lessons might be learned from examining the market. A significant part of understanding the contract-packer price is first. The market data shows that using contracts where carcass value is used in pricing will reduce risks for packers and farmers. Secondly, teamwork is valuable to vets, animal nutritionists, universities, and the industry (Cowley, 2020). The livestock business collaborated during COVID-19 to determine how to hold pigs' weight and densities on the farm to minimize animal injury (Lusk, 2020). One way to view resilience-enhancing strategies or innovations is via the lens of prior significant disruptions. We do not know the chance of another incidence of this sort (Hayes, Schulz, Hart, & Jacobs, 2021).

The Eswatini garment business has suffered considerable losses due to the COVID-19 lockout. Indirect supply has determined the disparity in the influence that COVID-19 has on the sector (Pasquali & Godfrey, 2020). Indirect suppliers, who get pricing pressure from design firms, feel the pain of the overall sector's struggle. While merchants like Edcon reduced their purchase sizes, the South African vendors they use honour their commitments (Nadvi, Pasquali, & Godfrey, 2020). The Eswatini situation is distinct from the Bangladeshi catastrophe since European and U.S. leading retailers ultimately cancelled orders over 70% of their total supply and, consequently, shut down factories within weeks of the crisis commencing (Banga, Keane, & Mendez-Parra, M, 2020). The data highlights

the inaccuracy of the idea that the global North has all the answers to handle global difficulties.

Significant supply chain disruptions, accelerated product line reduction, planned promotions, and worries over future availability generated a formula for conflict between grocers and suppliers. How much would retailers pass their costs and risks to suppliers? When Morrisons' CEO asked for the Groceries Supply Code of Practice (GSCOP) standards to be removed, customers became worried since de-listings might be completed more swiftly. The Groceries Code Adjudicator, Christine Tacon, has jumped to publish statements and letters indicating that the GSCOP is flexible enough to handle these unique circumstances. Hence, there was no enforcement of the Code's rules (Parsons & Barling, 2021). Surprising calls to loosen the GSCOP norms are recorded when customers, with effective communication, flexibility, and collaboration, report unusual supplier behavior. Some call the present trade atmosphere a "fresh breeze" (Noble, 2020).

When deciding the 'health versus wealth' problem during a pandemic, an essential factor is whether NPHI policies cause net economic losses for society. This response might be tricky and depends on the situation. Authors (Chen, Dasgupta, Huynh, & Xia, 2020) analyze how the market assesses the deployment of such measures during the Covid-19 epidemic. Whether the USA States adopting a lockdown are Democratic or Republican, the market response to lockdowns is favorable. State adopters of the lockdowns were expected to receive a more favorable reception. Even extended lockdowns are seen favorably by the market when the illnesses are high; yet, a locked-down during county's diseases is poorly accepted. The analysis of financial data indicates that the market has considered NPI successes beneficial, even though the long-term repercussions will almost certainly be harmful. Such limitations are essential for stopping the spread of the virus and ensuring future labor participation.

Based on (Hao, Xiao, & Chon, 2020), China's experience with past disasters and the hotel & restaurant sector retailing the services. The research seeks to help hotels crippled by the flu epidemic live better and prepare for the future. This study is expected to stimulate worldwide hotel corporations to take preventative measures, embrace anti-pandemic methods, and work toward industry renewal. To extend the applicability of this study, the COVID-19 framework might be used for a broader range of health-related events. While China was the first target of the pandemic's after-effects, it acted quickly to protect the economic well-being of its staff and consumers. During a complete and lengthy lockdown, the sector actively cooperated in fighting the epidemic. As a result, businesses made a range of inventive actions to help restore performance. The current effects of COVID-19 are unclear because of the worldwide hotel industry's danger to existence. Systematic but restricted answers to foreign hotel corporations experiencing pandemics will radically alter the Chinese hotel business (Rosemberg, 2020). The findings outlined in this study apply to post-COVID-19 hotel sector situations and ideas and will highlight industry transition and upgrading.

(Samila, Goldfarb, & Silverman, 2020) India mostly has Kirana retail structure where most things are displayed (Amrit). The comparable sales for supermarkets and other kinds of organized retail are expanding. At the same time, sales at Kirana businesses continue to rise in absolute numbers, which are affected drastically by two extremes of too-high sales before lockdowns are announced and almost nothing during the lockdown (Kumar & Khan, 2020). Fresh foods, such as food at businesses in backrooms, are notable in Brazil, Mexico, and Kenya (Smith, 2020). Assuming the findings from Sweden transfer over to emerging nations' various situations, behind-the-counter availability might considerably influence the market structure and development outcomes (Medberg & Grönroos, 2020). With the COVID-19 situation, private shops have had to adapt by providing other store models—expensive possible evidence for the shift in retail sales volume by following social distance measurement. The paper extends the reviews on several identifications about consumer behavior and the supply chain disrupting the retail market.

4. Study Methodology

Systematic study literature was searched from 2020 to 2021 to discover peer-reviewed papers that compared secondary data sources to primary data sources to the accuracy of detecting the disruptions in the retail sector caused by the covid-19 pandemic. In addition, the following research question is addressed during the systematic review process.

4.1. Research Question

RQ1: Covid-19 Disruptions in the retail market.

The research question is addressed by systematically reviewing 25 research articles published in 2020-2021. The articles focus on retail industry disruptions covering food, garments, restaurants, and meat markets.

4.2. Search Process

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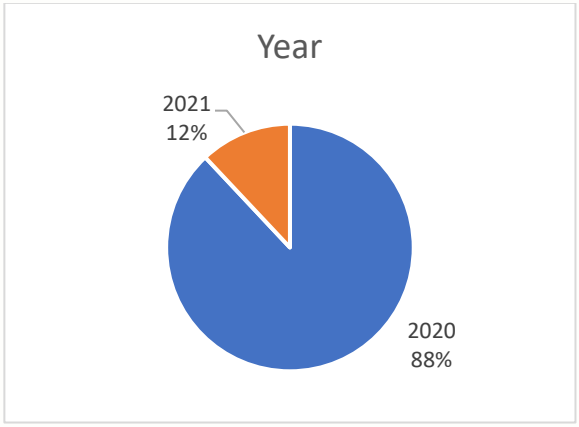
J. Mookerjee, S. Chattopadhyay, etc./Int. J. Systematic Innovation, 7(6), 20-35(2023)

A total of 25 papers qualified; helpful information was found in relevant investigations. The following describes the techniques and validation for secondary data sources and original data collection procedures. In addition, a complete search for "retail sector" in academic databases that include the keywords "retail market," "covid-19 retail impact", and Elsevier's SCOPUS, Science Direct, and Taylor Francis was performed. A search like this has also been performed within the AIS journal basket. This source lists I.S. journals widely accepted as premier IS journals: EJIS, ISJ, ISR, and JAIS, and several journals and conference proceedings.

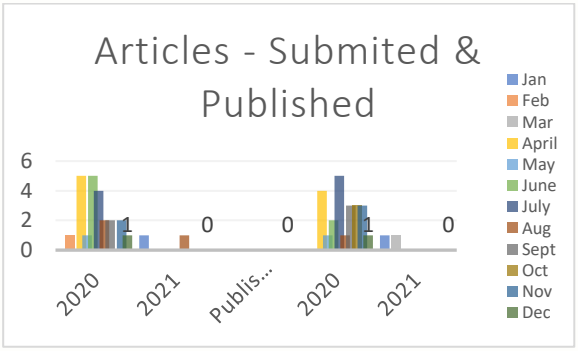
5. Mapping Results

Most stores have many consumer touchpoints, including entering the shop, going through the aisles, and checking out. Stores had to make customers aware of new items before entering the door. As a result, reusable bag usage has significantly increased. There are no bagging policies in establishments where consumers are still permitted to bring their bags. Plastic bags were on sale, replaced by biodegradable and cloth bags. The new social distance behaviors were marked by the placement of informal signage at checkout kiosks. Regular tape was widely used for this purpose. Others indicated where to post the sign, but others did not. The message was utilized for signage: "Please take these actions at Checkout to encourage social distance." At the same time, another sign contained more significant pressure: recommendations to promote the value of social distance. Some retail stores no longer welcome reusable bags to encourage no-contact delivery. Instead, plastic bags would be provided to clients without charge, and personnel would bag all items. This modification was to lessen checkout station congestion produced by self-bagging and minimize customer interactions. With so many changes in the retail market and the environment in the retail stores, customer behavior and responses are also changing. In some cases, customer turnout has decreased, and in some cases, customer demands have also changed due to disruption in the supply chain, and brand loyalty has also been lost. The results below are mapped to detail the impact of covid-19 on the retail market and consumer behavior.

Figure 1 (A) illustrates the distribution of published articles considered for the paper. All the papers were submitted in 2020; one was submitted in 2020 Dec but revised in Jan 2021 and later published by April 2021. Figure 1 (B) shows the monthly submission and publication distribution of 25 papers; April and June are the highest receivers, with five in each.



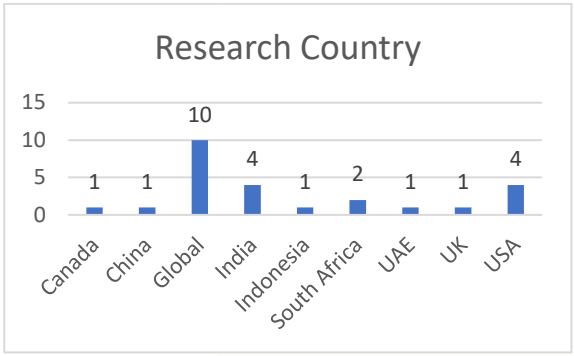
(A)



(B)

Figure 1: Articles collected from 2020-2021

Figures 2 (A) and (B) illustrate the research focus locations covering several countries. The collected articles conducted research centric to countries like India, USA, UK, Canada, China, South Africa, Indonesia, UAE, and most articles focus on global problems faced during the pandemic. The individual concentration in narrowed areas like Chennai in India, West Nusa wet meat market, and Halal market impact Halal Tourism. Figure 2 (A) illustrates the countries of broad consideration for respective research, and Figure 2 (b) illustrates the pinpointed location at the micro level where their detailed research was carried out.



(A)

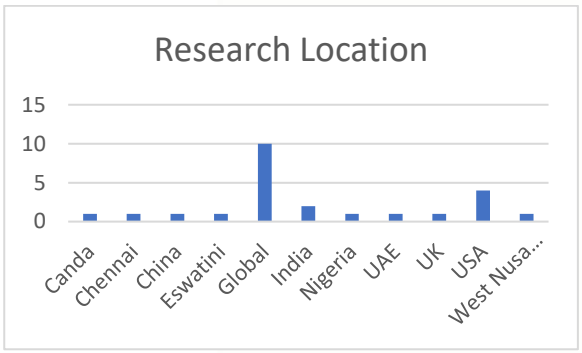


Figure 2: (A - B) Research Country and Locations

Figure 3 gives the distribution of the author's origin. Most of the authors are from the USA and India. For this study, the articles published in open-access mode are considered. The authors are from developed and developing countries, but their research contribution is narrowed to the same country. In most cases, global challenges and issues faced by the retail industry during the lockdown and changes in the country's rise and fall of the covid-19 cases.

Figure 3: Author Country

Table 1 represents the author affiliations. The authors belong decent to prestigious institutions with a reputable track record. Table 2 covers the source of publications. Most of them are journals. The other courses are conferences, research-level briefings, and economic and financial magazines like Covid Economics and Mckency. One book source with a few chapters is considered for the review purpose of this paper.

Table 1: Author Affiliations

COUNTRY	UNIVERSITY						
India	Ashoka University, India	Christ Deemed to be University,Bengaluru, India	Indian Institute of Technology,Indore	National Institute of Industrial Engineering	St.Peter's Institute of Higher Education and Research, Tamil Nadu, India	Symbiosis Institute of Management Studies	Symbiosis International (Deemed University),Pune, India.
USA	Babson College,Babson Park,	Iowa State University	McKinsey & Company	Michigan State University	Real Estate Issues	Virginia Tech	W. P. Carey School of Business
UK	British Brands Group, London	Guildhall School of Business and Law	University of Gloucestershire	The University of Manchester,	-	-	-
Europe	Centre for Economic Policy Research	University of Strasbourg	-	-	-	-	-
UAE	Dhofar University, Emiratos Árabes Unidos	-	-	-	-	-	-
China	Henan Agricultural University	Hong Kong Polytechnic University	-	-	-	-	-
Canada	Rotman School of Management, University of Toronto.	-	-	-	-	-	-
Indonesia	Universitas Sebelas Maret	-	-	-	-	-	-

Table 2: Journals, Conferences & Other Sources

JOURNAL	CONFERENCE	RESEARCH BRIEFING	MAGAZINE	BOOK
Applied Economic Perspectives and Policy published	International Conference on Cvod-19 Studies	University of Manchester, Global Development Institute.	Covid Economics	Integrated Risk of Pandemic: Covid-19 Impacts, Resilience and Recommendations, Disaster Resilience and Green Growth,
J Public Affairs.	-	-	Covid Economics	-
Agribusiness	-	-	THE COUNSELORS OF REAL ESTATE®	-
Diabetes & Metabolic Syndrome: Clinical Research & Reviews	-	-	M&A Practice, Retail Practice	-
Journal of Antitrust Enforcement	-	-	-	-
International Journal of Hospitality Management	-	-	-	-
Utopía y Praxis Latinoamericana,	-	-	-	-
Canadian Agricultural Economics	-	-	-	-
JOURNAL OF CRITICAL REVIEWS	-	-	-	-
Agriculture Economics	-	-	-	-
Markets, Globalization & Development Review	-	-	-	-
Palarch's Journal Of Archaeology Of Egypt/Egyptology	-	-	-	-
Int. J Sup. Chain. Mgt	-	-	-	-
International Journal of Current Research and Review	-	-	-	-
Amer. J. Agr. Econ.	-	-	-	-
Environmental Research	-	-	-	-
Journal of Retailing	-	-	-	-
Journal of Enterprise Information Management	-	-	-	-

Figure 4 illustrates the sources and publishers referred to for the paper. Most are from reputable sources like Wiley, ScienceDirect, and Emerald Publications. The other sources are Springer and other university-level publications indexed in Scopus and Web Science databases.

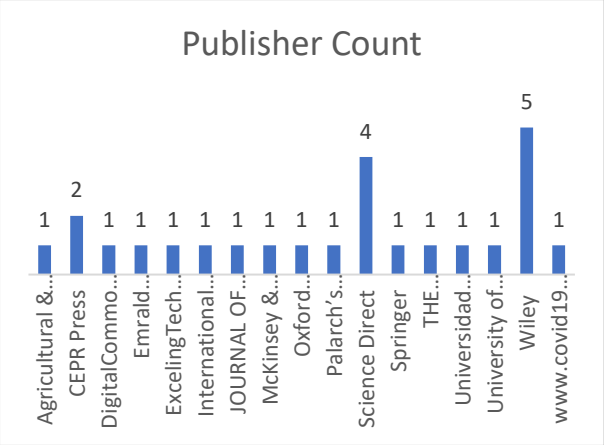
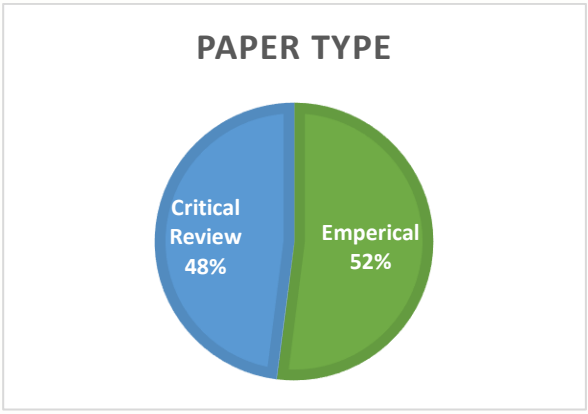


Figure 4: Publishers of Source

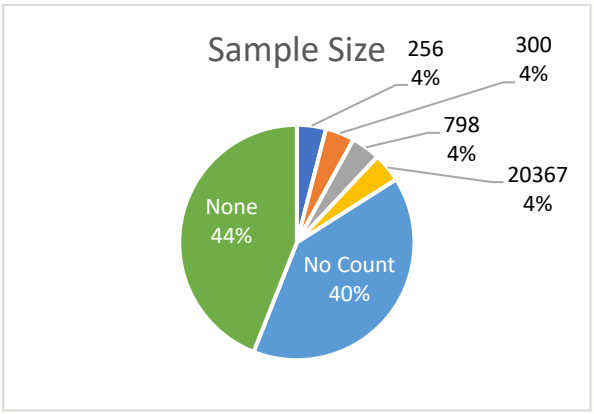
6. Discussion

The coronavirus' first impact is on the retail business. Nations depend on imported items for growth at the local and national levels. Due to the present market conditions, there is an increasing emphasis on shops to value-check essential products. Regardless, governments encourage shops to enhance supplies to meet the increased demand. For this reason, the retail business is unlikely to raise prices. However, it depends significantly on commodities and supplies (Hobbs, 2020). The section discusses the disruptions created in the non-branded retail market.

Figure 5 (A) illustrates the distribution of papers consisting of empirical and critical reviews. The referenced papers that fall un critical review are reviewed and analyzed critically using highly cited sources as desk research. Figure 5 (B) illustrates the sample size; most of the papers have no primary data used, and 40% of the papers have used data, metadata, and other forms of data from trusted sources like WHO, Health Ministry data, Agricultural government statistics, corporate statistics and so on. Four papers have direct primary data source by conducting surveys.



(A)



(B)

Figure 5: (A - B) Type of Paper and the sample sizes

Table 3 discusses the data sources used by the researchers; nearly half of the articles are empirical research, but their data sources are from different sources, including desk research. The other half of the research articles are critical reviews and used data sources from other published articles and highly trusted government documents. There are three papers with no data sources, but they only are based on conceptual analysis.

Table 3: Data Sources of Published Articles

Data Source	
Desk Research, Secondary Data	10
Economic Research Service (ERS) and Agricultural Marketing Service (AMS).	1
None	3
Qualitative Interviews	1
Statista, Desk Research	1
Survey	4

Survey & Desk Research	1
USDA-AMS	1
Various Sources	2
WHO, Ministry of Health	1

Figure 6 illustrates a description of software tools used by the published paper researchers; they are broadly categorized in SPSS for statistical data analysis and Excel for descriptive statical analysis. No software tools are used for critical review and qualitative and content research.

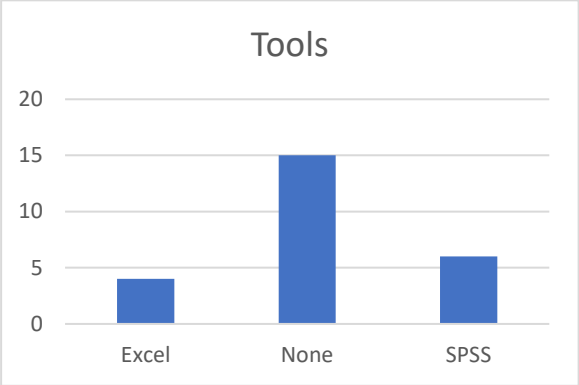


Figure 6: Tools Used for Data Analysis

Table 4 explains the data analysis methods and models used by the researchers to achieve their respective research objectives. Nine papers are critical content reviews about the retail market in different dimensions. Six papers are descriptive statistical analyses using desk research and secondary data.

Table 4: Data Analysis Modelling

Model Methods	
Chi-square test	1
Content Review	9
Descriptive Analysis	2
Descriptive Statistics	6
Descriptive Statistics, KMO, and Bartlett's Test	1
Full Consistency Model (FUCOM) – Best Worst Method (BWM)	1
Log, Mean stringency	1
Regression	2
Systematic Review	1
Threshold Modelling	1

Table 5 lists the variables and parameters used by the researchers in their research; FMCG Retail and Supply chain in the retail industry is used twice along with Meat and Poultry. The rest of the retail parameters are used in every paper. The impact covid on retails has been discussed at a granular level by choosing several dimensions.

Table 5: Variables and Parameters Used by Researchers

Variables / Parameters	
Covid Crises	1
Consumer Package Goods, Director to Consumer	1
Consumption Patterns	1
Customer Reaction to Lockdown at different stages	1
Farm, Traders, Processing, Retail, Food Services, and customers	1
FMCG, Retail	2
Food, Safety	1
Gender, Marital Status, Occupation, Education, Income	1
Halal Tourism	1
Hotel Occupancy	1
Labor	1
Pandemic, Death, Impact on Agro products	1
Pork, Turkey, EGG,	2
Real Estate	1
Retail Brand, Consumer Identity	1
Retail Spending	1
Retail Staff Challenges	1
Retail Policies	1
Sales,	1
Suppliers, Export Value, Employees,	1
Supply Chain	2
Textile Retail	1

The objective of the paper is further reviewed based on the reviews of the referenced articles, and the research question is explained below:

RQ1: Covid-19 Disruptions in the retail market

Twenty-five retail disruption articles studied the disruptions experienced by the retail market of different sectors. Many wet and wholesale marketplaces across Nigeria were shut down under federal and state control. There was much variation among levels of government and localities regarding the policies and levels of execution. Thus, market participants sometimes were "guessing" and puzzled (Liverpool-Tasie, Reardon, & Belton, 2020). The COVID-19 disaster has delivered several environmental benefits while causing widespread economic and social harm. Many individuals, either temporarily or permanently, are no longer employed. The effects are disproportionately detrimental for millions of low-wage employees in less-developed nations' service sectors (Jones & Comfort, 2020). During COVID-19, several shops took a hiatus in their promotions to lower prices. These retail pricing

were surprisingly consistent even through the hog market turmoil. When raw prices dropped, merchants absorbed the increased wholesale cost. The former practice is to ration scarce supplies rather than limit demand by price (Hayes, Schulz, Hart, & Jacobs, 2021). The survey found that consumers spend more money on health and hygiene products in light of the crisis impacting brand choice, shopping behavior, and purchase decisions (Vijai & Nivetha, 2020). Figure 5 and Table 3 illustrate the retail disruptions created during the pandemic lockdown in different countries and sectors.

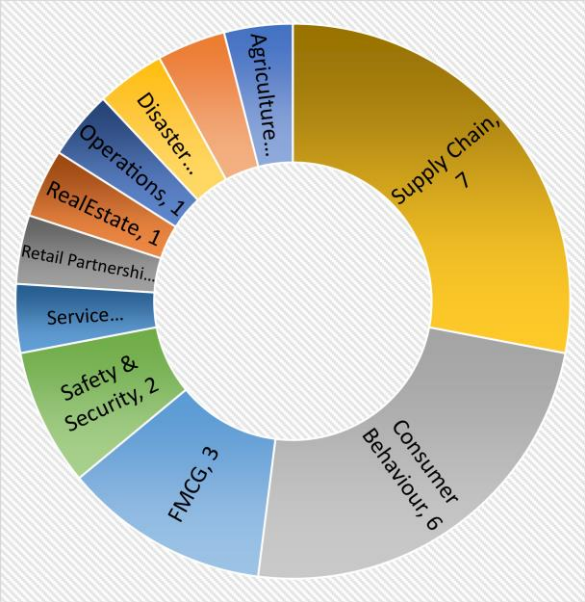


Figure 7: Retail Disruptions During Covid-19 Pandemic Lockdown

The Eswatini garment sector's condition is dire. No private initiatives, like ATUSWA, the sector's largest trade union, will assure the survival of the garment industry and employment for Eswatini employees. Consequently, we demand coordinated public, private, and social forms of governance, including enterprises (both consumers and suppliers), the state, and the largest trade union representing the sector's workers to combat the COVID-19 epidemic (Pasquali & Godfrey, 2020). During uncertain times, consumer behavior changes drastically. They are buying critical necessities. The increased purchase frequency raises the demand for particular commodities. Due to the abrupt shift, the order could not be fulfilled as quickly as it may have been. "Coronavirus" is blamed for causing increased hoarding of necessary items. To ensure survival, customers might turn hostile, and retail locations and distribution sites must install more protection (Kumar & Khan, 2020), (Kumar, Raut, Narwane, & Narkhede, 2020). Branded firms and many others produce critical goods, including foods, home goods, and medications. A fundamental part of the business group's mission is fostering competition and maintaining good ties with suppliers and retailers. COVID-19 Taskforce and safeguards granted by the Foods Supply Code Practiced a competition remedy implemented following a market study of groceries in 2008 (Noble, 2020).

The authors (Chen, Dasgupta, Huynh, & Xia, 2020) monitostates' reactions to staggered Lockdown Events during Covid-19. Retailers in lockdown states have better return performance. Market participants' recent stock price movements signify new opinions based on continuing these lockdowns, including compliance with stay-at-home directives. Effectiveness varies according to the firm's county's infection rate, sector, and states with a Democratic trifecta. During lockdown extension announcements, investors show excitement since the county's infection numbers are elevated. It means that the market assumes interventions are good for business. However, self-service shops to counter-service location shifts might impact focus. Our field experiment found that the reverse of a rise in counter-service buying is a substantial product-market concentration, possibly undermining the effects of the migration to online shopping (Samila, Goldfarb, & Silverman, 2020), (GOLDFARB, 2020).

Table 6: Disruption & Consequences created experiences by Consumers of the non-branded retail Market

DISRUPTIONS & CONSEQUENCES	REFERENCES
Consumer choices during the pandemic towards healthcare products than brands	(Nithya & Chirputkar, 2020)
Consumer brand loyalty disrupted	(Vijai & Nivetha, 2020), (Cambefort, 2020)
Employees & Daily Labors losing jobs	(Jones & Comfort, 2020)
Employee & Operations preparing for post-pandemic conditions	(Sulaiman, Ahmed, & Shabbir, 2020), (Sharma, Luthra, Joshi, & Kumar, 2021)
Garment industry supply chain disruption, selling & purchasing local unbranded	(Pasquali & Godfrey, 2020)
Heavy impact on supply chain product/ produce stuck and is retailed locally	(Sulaiman, Ahmed, & Shabbir, 2020), (Chenarides, Richards, & Rickard, 2021), (Poonia, Goyal, & Madramootoo, 2020), (Ramsey, Goodwin, Hahn, & Holt, 2021), (Poonia, Goyal, &

	Madramootoo, 2020), (Roggeveen , Grewal , & Karsberg, 2021), (Mahajan & Tomar, 2021)
Limited Consumer Participation in Local Market	(Liverpool-Tasie, Reardon, & Belton, 2020), (Kumar, Raut, Narwane, & Narkhede, 2020),8
Scarcity of branded products, encouraging local unbranded goods	(Hayes, Schulz, Hart, & Jacobs, 2021), (Chen, Dasgupta, Huynh, & Xia, 2020), (Hao, Xiao, & Chon, 2020), (Singh, Pawar, Shekam, & Dutt, 2020), (Atmar, Begley, Fuerst, & Rickert, 2020), (Ma , Peng , Soon, & Hassim, 2021)
Supply chain disruption impacting the tourism industry	(Jaelani, Ayu, Rachmi, & Karjoko, 2020)
Unstable retail market, retail shops closing down, thus no rents no new purchases of shops	(Freeman, 2020)

COVID-19 pandemic illness implications were researched in this exploratory project. COVID-19 is designed to help manage anti-pandemic stages, concepts, and techniques. COVID-19 appears to impact four essential components of China's hotel industry: multiple business and channel strategies, product design, investment preferences, and digital and intelligent transformation (Hao, Xiao, & Chon, 2020). To detect and overcome Covid-19 issues, HRM must deal with staff in organized retail. Secondary sources provided data on practical insights and potential remedies to minimize unanticipated disruption generated by the Covid-19 outbreak. These suggestions must be implemented immediately (Sulaiman, Ahmed, & Shabbir, 2020). (Richards & Rickard, 2020) As customers shift to making food purchases through retail, distribution infrastructure, particularly to retail, will remain strained for some time.

The potential long-term repercussions will be seen through input markets, namely labor and structural changes in the sector, including mergers and the increasing use of online shopping (Chenarides, Richards, & Rickard, 2021). Pricing being consistent, local manufacturing expansion and widespread use of cashless payment are outlined in this report. CPG and FMCG models have also been detailed, describing their impact on business. Reacting to customers is crucial (Singh, Pawar, Shekam, & Dutt, 2020). (Poonia, Goyal, & Madramootoo, 2020) The epidemic impacts agriculture and food systems, and industry outlooks aren't good. Induced uncertainty in food security stems from self-isolation, travel limitations, quarantine requirements, and a fear of disease that results in lower food stocks and short supplies. The government's response to the problem resulted in food demand increasing and buying capacity decreasing.

Quite significant price fluctuations are noticed in three meat markets selling different kinds of meat. In April and May 2020. COVID-19-related costs were transited quickly (spiked, then returned to normal) in the pre-pandemic timeframe. This efficient market process shows that U.S. beef supply networks are resilient (Ramsey, Goodwin, Hahn, & Holt, 2021). Long-term studies show that consumption is diminishing. Due to this epidemic, some customers want to decrease their consumption in the long run.

42% of respondents planning to reduce their shopping expenditures discovered that many purchases were unnecessary. This action represents an anti-consumption and anti-consumerist feeling against the existing market and consumerist mindset (Cambefort, 2020). Eventually, we will see how COVID-19-caused changes in human behavior may affect how cities operate. Individuals can determine when specific jobs must be accomplished, affecting traffic and parking needs. We may also witness less congestion at the airports when considering the flexibility to work from anywhere. Managing tenants' schedules may minimize surge demands for things like hot water. Second and third-tier cities are additional potential drivers of urban expansion. Major cities like New York have high case numbers, limited health care, and costly rent. Losing one's employment often leads to people (Nithya & Chirputkar, 2020) remaining in other regions for cheaper living costs (Freeman, 2020). The study reveals that customers would spend less on retail goods even once the Covid-19 issue is over. Consumer spending has been lowered across the ages of 18 and 39, with annual incomes ranging from $0 to $10,000. We also know that consumers will solely concentrate their savings on Health, Hygiene, and Essential products. In current harsh economic times, retail operations must move from traditional selling methods to generating omnichannel customer experiences, considering several characteristics, including zero-contact shopping, curbside shopping, and client demographics. It would be best if you modified your processes to facilitate your expansion of products. Retailers may obtain the highest CX results for their customers across demographics.

People execute supply chains when people from outside of West Nusa Tenggara go on vacation. First, 40% of international visitors choose to "escape from their everyday routines when vacationing with family

and friends." That is the primary cause. Additionally, family, friends, and relatives visiting visitors total 36 per cent. Lastly, mountain-lake-scenery-waterfall- and other visitors attract 26% of the tourists. Fourth, 22% of visitors visit for culture, art, gastronomy, and shows. This is because the visitors want to try to be farmers and fishermen, per the agreement. The data support those four motives (Jaelani, Ayu, Rachmi, & Karjoko, 2020). Consumers intend to cut short-term and mid-term expenditures, especially in non-essential areas. However, the needs and motivations of the individual vary greatly. Please view the in-depth study from McKinsey's poll of consumer attitude during the coronavirus epidemic (Atmar, Begley, Fuerst, & Rickert, 2020). Emerging developments in the FMCG and retail industries point to the disappearance of wholesale distribution and other mediators layers between producers and consumers.

Companies use technology to reach customers directly, becoming closer (Shetty, Nougarahiya, & Mandloi, 2020). The author (Mahajan & Tomar, 2021) studied the food supply disruption caused by the COVID-19-induced economic shutdown in India. A unique dataset from one of the top online food stores is used to study stockouts and pricing. Availability for fruits, vegetables, and edible oils declines by 10%, although this has little influence on the costs. Vegetable and fruit quantities have fallen by 20% at the farm gate. This downfall can be attributed to supply chain disruption. We see a significant decrease in their availability and quantity for farmed commodities or manufactured farther away from the ultimate place of sale. Our findings reveal that food supply networks have suffered from the current pandemic, with ramifications for urban consumers, farmers, and the labor market (Bhatt, Grover, & Sharma, 2020). The outline of possible reservoir hosts that might result in a zoonotic pathogen epidemic. Continue surveillance in the slaughterhouse to avoid the subsequent breakout of disease. This study also covers the main dangers of a pandemic to the food supply chain and market control. Evolving and remerging infectious diseases, such as the severe acute respiratory syndrome (SARS) in 2002, the 2009 swine flu, the 2012 MERS, and the latest COVID-19 show us an opportunity to strengthen governance (Ma , Peng , Soon, & Hassim, 2021).

Using identity congruence in retail improves consumer-brand connection, brand loyalty, and spending willingness. Creative items and inventive merchandising tactics are incorporated into a distinct retail brand identity and communicated to customers. We arrived at five methods for merchants to help customers connect with their company identity by presenting inventive item options. We also focus on five unique merchandising tactics connecting the brand to the customer. Customers will feel congruent with the retail brand if they consider their identity consistent with the retailer (Roggeveen , Grewal , & Karsberg, 2021). A dynamic environment means Retail Supply chains have to tailor their tactics to satisfy diverse customer needs and increase service standards. Working with digital technologies, humanitarian logistics operations, collaborations, information sharing, and operational capabilities reduces supply costs and buffer stock while improving customer satisfaction. Determinants include order fulfilment, digitization, demand forecasting, and other capabilities that allow a firm to thrive if a pandemic occurs. Extreme pressure has been placed on essential sales businesses to deliver value-added services during COVID-19. Retailers have changed from a conventional paradigm to order fulfillment during the pandemic, demand-driven, data-driven, and omnichannel supply chains. Shopping malls are outsourcing their delivery services to help them manage demand amid the flu outbreak. Big Bazaar and several other retail chains are utilizing digital and non-digital means.

Many small businesses also use digital and non-digital platforms (Sharma, Luthra, Joshi, & Kumar, 2021). The coronavirus has a second impact on the retail business. Inventory buyers have already progressed into acquiring products with extended usable lifespans. While other commodities like pasta and rice have a more extended life range, retail has steadily developed with nibbles and savories. Companies in the center east, seeing increasing consumer worries, have moved to internet-based lives to quell issues relating to item scarcity (Yu & Aviso, 2020). Diversion and recreation components are also projected to be cut due to travelers being less willing to pay for pricey tickets and weakening the tourism business. On the other hand, shops, and malls will benefit if people visit them less frequently.

7. Conclusion

Retailers can't escape the economic effects of COVID-19. While the crisis has stabilized, there is a belief that retail activity will intensify due to financially strong businesses acquiring or partnering with weaker competitors. Now is the moment for retailers to start acquiring. It asks to define their function in the future 'normal,' review financial health and subdivide the retail sector. The short-term impact of the COVID-19 pandemic has been felt in the shift of local produce supply chains due to the closure of practically all food service and branded garment businesses. Distribution infrastructure dedicated to retail has remained strained throughout the development of the epidemic, stressing the supply chain and consumer connections with retailers. Potential consequences are seen in input markets, most notably labor, and through structural changes in the sector, such as consolidation and increased online

buying. The fresh food mandate doesn't protect retail markets from these economic events. Instead, import prices will grow due to rising manufacturing costs and shifts in the export industry's structure. This move might impact all retail products, such as vegetables, fruits, locally farmed grains, and dairy and meat distribution. The recommendations to local unbranded retailers are to adapt the industry 4.0 strategies of business executions.

The future scope of the paper is focused on the post-pandemic impact on the retail sector. Non-branded retailers in India, who may lack the resources and infrastructure of more prominent brands, may face unique challenges in adopting these innovations and staying competitive. This is where the field survey of innovation adoptions comes in, as it can provide insights into the current state of innovation adoption by non-branded retailers in India and identify potential barriers and opportunities for further adoption. Overall, the future scope of the paper appears to be focused on understanding how disruptive innovations in the post-pandemic era are impacting the retail sector and how non-branded retailers in India are responding to these changes through innovation adoption.

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A comprehensive review of fake news detection on social media: feature engineering, feature fusion, and future research directions

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Abstract

Social media platforms are mainly used for information sharing, connecting with people, and staying updated about the latest events. However, information present on social media is sometimes incorrect, unverified, or misleading. Such information is often termed fake news. It is deliberately written to deceive the readers. It has the potential to change their perception of the topic or content being discussed. The best medium to share fake news is social media platforms. Large amounts of misleading or fake online information can have serious consequences. It can affect the social, political, economic well-being of individuals, society, and a nation as a whole. Fake News in the form of satire, fabricated and manipulated content, misleading information, and conspiracy theories get more likes and shares on social media and they spread quickly in no time. Thus, fake news detection (FND) and prevention on social media platforms have gained tremendous attention among researchers. Fake news through online platforms poses unique challenges. Firstly, it is written intentionally and is subjective, making it very difficult to authenticate it based on news content. Secondly, social media information is unstructured and multi-modal, both aspects are complex to capture and integrate in fake news detection. Thirdly, fake information spreads very quickly and is mainly circulated through bots, trolls, and humans from varied backgrounds. Identifying such spreaders and victims is a challenging task. This article presents a critical review of the literature on fake news detection. The state-of-the-art methods are discussed, most of the methods depend on news contents, user profiles, and social context features of a post. The importance of feature engineering, feature extraction and feature fusion in FND are highlighted. Various fake news detection datasets are discussed. Finally, future research directions in the fake news detection problem are presented.

Keywords: Fake News Detection, Textual Features, Visual Features, social media, News Contents, Social Context, Machine Learning, Deep Learning.

1. Introduction

In the internet era, social media platforms such as Facebook, Twitter, WhatsApp has become an integral part of people's lives. They help people to stay connected, updated about trending events and are the primary means of sharing news and user opinions, but these platforms have serious side effects as well. These platforms have now become a means of spreading fake and unverified information. Misleading information appearing as textual news (headline and body), photo shopped images, doctored videos remains a concern. The news articles with images, videos are more appealing and attract more attention from readers than the traditional newspapers.

Social media platforms use persuasive technology to keep users engaged and increase their screen time, strong recommendation helps people connect to like-minded people and groups. Social media popularity indicators, "likes" on Facebook, "thumb up" for YouTube videos, et al. contribute in deciding the authenticity of the message. People believe in whatever they see. Research shows that, psychologically, if a post on social media has more likes and comments, it can change other readers' perception towards the quality of the message and views about the topics discussed in the message. In additional social dynamic from popularity, indicators says: "When a post is accompanied by many likes, shares, or comments, it is more likely to receive attention by others, and therefore more likely to be further liked, shared, or commented on" \footnote{How is Fake News Spread? Bots, People like you, Trolls, and Micro targeting [Online].Website https://www.cits.ucsb.edu/fake-news/spread [accessed: 10 January 2022].}

The Internet and social media are easily accessible to everyone. With little verification process, people can create websites, blogs, and social networks platform accounts. Through this, a huge volume of fake content is published and shared every day. Such websites and

accounts are fake their main aim is to circulate hoaxes, propaganda messages mostly related to politics and finance. The majority of fake news sharing happens by humans (real human accounts) knowingly or unknowingly. Since people like novelty and fake news describes events that are unique and never happened. The propagation of fake news happens much faster as compared to real news. Such social interactions in the form of discussions, comments, likes and dislikes, are called social context features of news posts.

Fake news propagation has become a worldwide concern today. It can influence the well-being of nations. The growing fake news problem has prompted The Prime Minister of India Narendra Modi to address the same in the NAM summit\footnote {PM Modi at NAM Summit: terrorism, fake news "deadly virus" [Online].Website

https://indianexpress.com/article/india/pm-modi-at-nam-summit-terrorism-fake-news-deadly-viruses-6394202/ [accessed: 10 February 2022].}.

Detecting fake or misleading content on social media poses a unique challenge. Firstly, fake news is subjective and depends on the topic or event under discussion. Secondly, fake news mimics real news in terms of writing style. Most of the time it is syntactically and semantically correct but untrue. It is deliberately written to mislead readers. Thirdly, multiple modalities are considered while creating fake news. For example, a social media post can be made up of any combination of text, images, audio, video, infographics, et al. Finally, news on social media is constantly updating making it difficult to verify it against the available knowledge base (Agarwal, & Dixit, 2020).

The main contributions of this paper are outlined as follows:

- The Characteristics of fake news on social media platforms are identified and discussed. These characteristics play a major role in deciding whether a post is real or fake.
- Major feature extraction and feature reduction techniques used in literature for textual and visual data are discussed.
- An in-depth review of single modality-based machine learning and advanced deep learning techniques for fake news detection is provided.
- The need for multi-modal fake news detection systems is highlighted. A detailed review of multi-modal-based advanced deep learning with more emphasis on feature fusion is presented.
- The publicly available datasets used in literature for FND problem are presented.
- Future research directions are briefly outlined.

The remainder of this paper is organized as follows. Section II gives a problem definition. Section III presents the definition, components of fake news and discusses various feature engineering techniques with respect to textual, visual, and social context features. Section IV gives a review of prior work on fake news detection. Section V provides details about the currently available datasets for the FND problem. Section VI presents open issues and future research directions. Section VII provides the conclusion of the work.

2. Problem Statement

We consider fake news detection as a binary classification problem i.e., classifying a social media news post as real or fake. A news post on social media consists of text, visual content like images and video, and social context information such as likes, shares, comments, et al. Let P be a collection of such news posts on social media.

$$P = \{(M_1, S_1), (M_2, S_2), (M_3, S_3) \cdots (M_N, S_N)\} \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where M_i →i[th] social media post with text and visual (image or video) information.

S_i →social context information of i[th] post.

N → total number of posts.

Consider a single i[th] post on social media. This post 'i' has textual features T_i generated from text , visual features captured from attached image or video denoted by V_i and social context features denoted by S_i. A conceptual representation of these features is given below.

$$T_i = \{T_i^1, T_i^2, T_i^3 \cdots T_i^r\} \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

$$V_i = \{V_i^1, V_i^2, V_i^3 \cdots V_i^q\} \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

$$S_i = \{S_i^1, S_i^2, S_i^3 \cdots S_i^s\} \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Where r, q, s depends on the deep learning architecture under consideration.

The aim is to design a model which takes a post as input, generates its textual, visual, and social context features, and classifies it to a predefined label as a real post or fake post.

$$\theta: p \Rightarrow \{T_p, V_p, S_p\} \Rightarrow O \ \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

where O is a predefined label, $O \epsilon \{real, fake\}$, θ is the learned model.

3. Feature Engineering in Fake News

Before performing feature engineering and extracting the relevant features, it's important to understand the fake news and its major components.

3.1. Fake news and its components: The widely adopted fake news definition is "Fake news is a news story written with dishonest intentions to mislead the readers and contains verifiable false information" (Shu, K. & Liu, H. (2019). The definition is based on two key features: authenticity and intent. Authenticity talks about the contents of fake news which are verifiable and intentionally tells the deceptive motive of the creator of fake news (Shu, K. & Liu, H. (2019). Fake news has four major components: news contents, social context, creator, dissemination/spreader. Figure 1 explains in detail every component and its features.

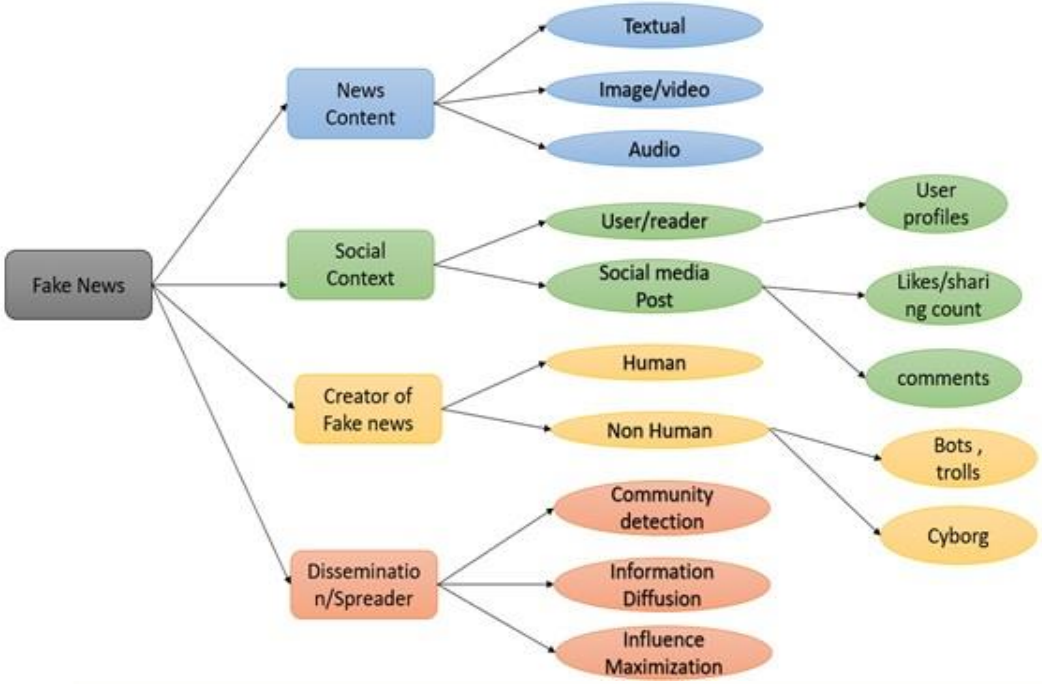

Figure 1. Fake News Characteristics

1. News Content: It refers to the news headline, body of news, and supporting images, videos, or audio. News content is multi-modal in nature i.e., a piece of news can be text only, image/video only or audio only, or a combination of text, images, videos and audio. Every component of the news like URL (Uniform Resource Locator), hashtags, and mentions are important \cite{ref10} and are considered as news content.

2. Social context: It refers to factors that play a major role in the dissemination of news on social media platforms \cite {ref10}. It includes discussion, comments given by users, likes, shares, and retweets on news posts. It provides valuable insights regarding news articles being authentic or hoaxes. It also helps to recognize the distribution pattern of real and fake news stories (Zhang, X. & Ghorbani, A., 2020).

3. Creator of Fake News: Creator of fake news can be humans or non-humans like bots (Zhang, X. & Ghorbani, A., 2020). Humans are malicious users who create fake news for a purpose. Bots are computer programs that mostly help in spreading fake news.

4. Dissemination/spreader: The creator of fake news always decides the people/users who will be influenced by fake news and will maximum participate in its spread. The Spread of fake news along with humans is also done by bots or cyborgs. Fake news dissemination can be done by identifying the target communities, understanding information diffusion, and identifying targets where influence maximization can be achieved.

Valuable information in the form of features can be extracted from the fake news components. These extracted features can be further analyzed and can be used by predictive models. Various techniques to extract

textual, visual, and social context features are discussed below.

3.2. Textual feature extraction Techniques: The information obtained from the news title and news body are textual features. They are classified into four types i.e. semantic, syntax, lexicon, and discourse (Shah, P., 2020).

Syntax features: These are sentence-level features and can be captured using Bag-of-word (BoW)s, n-gram, and Parts-of-speech (POS) tagging and Context-Free Grammar (CFG) analysis[16,17].

Lexical features: It is used to capture the character and word-level information. It gives the statistics of words and letters in the text-gram models [16, 17].

Semantic and psycholinguistic features: Semantic features help to understand the meaning of data and psycholinguistic features helps to capture persuasive and biased language. Google's API (https://www.perspectiveapi.com) and Linguistic Inquiry and Word Count (LIWC) are used to extract these features [16, 17].

Feature selection and feature reduction techniques are used to lower the dimensionality of textual features. Feature selection is a process that selects a subset of relevant features from the original feature set. The feature selection methods are Filter, Wrappers, and Embedded Methods. Chi-square test, Document Frequency (DF), Information Gain (IG), Best Term (BT), Ambiguity Measure (AM), and Distinguishing Feature Selector (DFS) are commonly used filter methods of feature selection. Feature reduction helps to get a new set of features from features at the feature selection stage. Principle Component Analysis (PCA) and Latent Semantic Indexing (LSI) are commonly used feature reduction methods (Haylat, T., 2020).

(Dzisevič, R. & Šešok, D., 2019) captured text features using three different feature extractors and highlighted the one that allows the classifier to give the best accuracy. They used Term Frequency- Inverse Document Frequency (TF-IDF) and its two variations namely TF-IDF with LSA (Latent Semantic Analysis) and TF-IDF with LDA (Linear Discriminant Analysis). (Bharadwaj, P., Shao, Z., & Darren, S., 2019) extracted semantic features using TF-IDF, unigram, bigram, N-gram, and recurrent neural network (RNN). They further highlighted that semantic features can be combined with linguistic clues and metadata to improve detection.

3.3. Visual Image Features Extraction: Due to advancements in technology, many user-friendly sophisticated image editing tools are available in the market. Because of these distinguishing between tampered and real images through the naked eye becomes difficult. Such images are used in immoral ways such as adding it to a misleading or fake news post et al. (Abidin, Majid, Samah, & Hashim, 2019). Mostly used techniques for digital image forgery are copy-move, splicing, morphing, resampling, and compression [15, 16].

Discrete Cosine Transform (DCT) based methods, block feature extraction using Fourier -Mellin transforms (FMT), Discrete Wavelet Transformation (DWT) using pixel matching, Speed up Robust Feature (SURF), Scale-invariant feature transform (SIFT) based methods are used for identifying copy-move forgery. Color Filter Array (CFA), Discrete Octonion cosine transformation (DOCT), and histogram techniques are used to identify image splicing [15, 16]. Many machine learning classifiers in combination with image features are also used for image forgery detection. However, the limitation of this method is that they are suitable for an individual forgery type. When multiple tampering is applied over a single image, the accuracy of algorithms will start decreasing (Singh, B. & Sharma, D., (2021).

Deep learning algorithms can extract important features on their own whereas machine learning algorithms require explicit feature engineering. Deep learning also performs better when there are multiple manipulations in the image and it can learn the forged image features without explicit help from the training dataset (Singh, B. & Sharma, D., 2021). Related research presented then section 5 explains in-depth various deep learning approaches used for image feature extraction.

3.4. Social Context feature extraction: Social context refers to the news propagation on social media. Social Context features include user-news engagements, user and its friend's network information, count of likes and dislikes for a news article. (Hlaing & Kham, 2020) described the process of collecting the social context features. Application programming APIs provided by social media platforms were used to collect user-news engagements such as likes, dislikes, comments, reposts, et al. APIs are also used to collect metadata, user profiles, social network information.

4. Related Research in Fake News Detection

There is vast research currently going on in fake news detection (FND) on social media using Artificial Intelligence-based techniques.

4.1. Single-modality-based Fake News Detection

4.1.1. Deep Learning Approaches: (Girgis, Amer, & Gadallah, 2018) implemented a deep learning model considering online textual news content. They namely used the vanilla, GRU (Gated Recurrent Unit), and LSTM (Long Short Term Memory) model on the LAIR dataset. This model provided better results than the traditional linguistic clues approach. Vanilla was not suitable for practical problems. Compared to GRU, LSTM was inefficient as it is more expensive to calculate network output. The best results were given by GRU as it solved the vanishing gradient problem. They mentioned that CNN combined with GRU can give more accurate results (Girgis, Amer, & Gadallah, 2018). (Ajao, Bhowmik, & Zargari, 2018) propose a system where given a tweet about a news item, the system will determine whether it is true or fake based on the content of the message. They aim to identify the linguistic characteristic linked to the news automatically without prior domain expertise, through the hybrid CNN and LSTM model (Ajao, Bhowmik, & Zargari, 2018). It takes into account only Twitter posts and is not able to track the geo location and origin of fake news. (Bharadwaj, P., Shao, Z., & Darren, S., 2019) extracted semantic features from news posts using TF-IDF, unigram, bigram, N-gram, recurrent neural network (RNN), Naïve Bayes(NB), and random forest are used for further classification. They further highlighted that semantic features can be combined with linguistic clues and metadata to improve detection. (Dong, et al., 2019) used attention forest for detecting opinion and fact-based false information. They used attentive bidirectional GRU for textual feature extraction and a deep neural network for extracting features for side information. To assess news credibility on social media, (Kaliyar, Kumar, et al., 2020) created a deep neural network. Along with news content, user profiles and user groups are taken into account. The news-user engagement and user community information are combined into a 3-D tensor. A tensor factorization method is also employed, yielding a latent design of both news content and social context. Artificial Neural Networks (ANN) and Deep Hybrid Neural Networks (DHNN) were the categorization models used. To enhance the accuracy of fake news identification, the authors plan to integrate temporal information about the dissemination of fake news (Kaliyar, Kumar, et al., 2020).

4.1.2 Ensemble-based approaches: In (Agarwal, & Dixit, 2020), authors presented an ensemble learning approach for addressing the problem of fake news. The ensemble classifier was created using SVM (Support Vector Machines), convoluted neural network (CNN), LSTM, KNN(K-Nearest Neighbour), and NB as basic classifiers. Linguistic features are extracted from the news. Extracted features are correlated with the author of the news article and the credit score is calculated. It was observed that authors with higher credit scores are less likely to form fake news. (Kaliyar, Goswami, & Narang, 2019) developed a multi-class tree-based ensemble classifier using gradient boosting with optimized parameters. TF-IDF, Cosine Similarity, Hand Selected Features, Word Overlap Features, Polarity Features, and Refuting Features are used to extract content and context features from news articles. In the future, the authors plan to apply an optimized deep learning model and a powerful language model like BERT (Kaliyar, Goswami, & Narang, 02019).

4.1.3 Text and social context-based approaches: The majority of current FND algorithms are focused on news content, which is less effective because false news is intentionally created to deceive readers by imitating actual news. Thus, news content should be combined with some supplementary information to enhance detection. (Shu, Wang, & Liu, 2019) used social context information such as user credibility, and publication credibility along with news content. They created TriFN, which considers both publisher-news and user-news relations at the same time for fake news classification. They highlighted that psychology's perspective of the creator and malicious user spreading fake news should be identified for effective fake news intervention and mitigation (Shu, Wang, & Liu, 2018). demonstrated that a correlation exists between user account profiles and fake/real news spread on social media. Users' likelihood of believing fake news has different characteristics than those believing real news. Comparative analysis considering the explicit and implicit user profile features was presented. FakeNewsNet is a data repository of fake news articles created by (Shu, Mahudeswaran, Wang, Lee, & Liu., 2020). It offers two comprehensive data sets, for every new article in the dataset along with news content, spatiotemporal, and social context information is also provided. News content features were taken from fact-checking websites, social context features obtained from Twitter's advanced search API, and spatiotemporal information

extracted from user profiles. They further highlighted that the FakeNewsNet repository can be integrated with front-end software and build an end-to-end system for fake news study.

(Hlaing & Kham, 2020) used social context features along with news content for FND. They collected social context information like reaction counts, comments, and content from Facebook using graph API and legitimate news stories from News API. The semantic similarity match between Facebook posts and legitimate news stories was done using WordNet. The polarity of comments was calculated using VADER. Finally, Adaboost, Decision tree, and Random Forest classifier were used to calculate news authenticity score. Authors highlighted that considering social context features along with news content for FND is a challenging task and a multi-dimensional benchmark dataset is necessary for further research (Hlaing & Kham, 2020).

4.1.4 Single Modal Visual Feature Detection: Deep learning techniques have self-feature extraction capability (Majumder, M.T.H. & Alim Al Islam, A.B.M., 2018) and with the power of GPU (Abidin, Majid, Samah, & Hashim, 2019). they provide better performance than conventional, machine learning approaches that require domain expertise. But the drawback of deep learning is that large datasets are required for training and validation (Abidin, Majid, Samah, & Hashim, 2019). In literature, mostly CNN models are used for image feature extraction. (Majumder, M.T.H. & Alim Al Islam, A.B.M., 2018) proposed the use of a shallow CNN for image forgery detection. (Kaliyar, Goswami, & Narang, 02019) used a pre-trained AlexNet model for copy-move forgery detection in images. (Singh, B. & Sharma, D., 2021). used 16 high-pass filters to amplify the noise in the image, then CNN is used to learn the intrinsic features of the image. The gradient information of the last

Table 1: The Summary of Single Modal Fake News Detection Approaches

Reference no	Textual feature extraction	Social context features	Creator features	Datasets	Classifier	Accuracy	Future scope
8	RNN: Vanilla, LSTM and GRU	No	No	LAIR	-	-	Combine GRU with CNN.
7	LSTM+CNN	No	No	PHEME	-	LSTM:82.29% ,LSTM +dropout: 73.38%, LSTM-CNN:80.38%	Tracking the origin and location of fake news.
12	TF-IDF, N-gram, Glove, RNN.	No	No	*real-or-fake news* dataset from kaggle.com	Naïve Bayes and Random Forest.	Bi-grams with random forest: 95.66%	Combine semantic features with linguistic clues and metadata.
35	Word2Vec, POS tagging	No	Yes	Combines LAIR and dataset from Kaggle.	Ensemble of classifier(SVM , CNN, LSTM, KNN, and NB)	Ensemble classifier: 85%	-
21	Attentive Bidirectional Gated Recurrent Unit(GRU)	Yes	No	Politifact, Facebook Factcheck, and Amazon review dataset	Attentive Forest	AttForest-C: Politifact:80.40% Factcheck:83.30% Amazon:94.80% Attforest2: Politifact:82.80% Factcheck:84.40% Amazon:96.70%	Include more clues like images and videos.
22	TF-IDF features, Cosine Similarity Features, Hand Selected Features, Word Overlap Features, Polarity Features, Refuting Features	No	No	Fake News Corpus(FNC)dataset	Tree-based ensemble classifier	86%	Apply optimized deep learning models and powerful word techniques like BERT

36	Semantic Similarity using WordNet.	Yes	No	Own dataset using Graph API, News API, and referring BuzzFace dataset.	Decision Tree, Adaboost, RandomForest	The accuracy of random Forest is better than the other two classifiers.	Use of hybrid classification methods to improve performance.
26	Clauset-Newman-Moore algorithm	No	Yes	BuzzFeed and Fakeddit	Artificial Neural Network(ANN), Deep Hybrid Neural Network(DeepNet)	ANN:82% DeepNet: 86.40%	Include the temporal information.

convolutional layers was used to localize the target region of manipulation in the image.

More research is needed in image forgery detection for real-world images, multiple tampered images, homogenous images (Abidin, Majid, Samah, & Hashim, 2019), and fake images generated by GAN (Generative Adversarial Network) (Singh, B. & Sharma, D., 2021). For deep learning models, transfer learning and using different learning rates at different layers should be explored to increase accuracy (Girgis, Amer, & Gadallah, 2018).

4.2 Multi-modality-based Fake news detection techniques: Single-mode techniques produce promising results, but the majority of the content on social media platforms nowadays is unstructured. (along with text there can be images, audio, or video). Researchers are now focusing on extracting from such unstructured multi-modal data. Various models are developed which consider both text and image for FND. (Wang, Y., Ma, F., Jin, Z., Yuan, Y., Xun, G., Jha, K., Su, L., & Gao, J. (2018) developed an architecture to extract event invariant features from multi-modal posts using an adversarial technique. They highlighted that existing approaches extract event-specific features from news posts, which is ineffective for detecting fake news for new events. The minimax game is set between a multi-modal feature extractor and an event discriminator. Through this approach event invariants features are learned, which are given to fake news detectors to classify the post as real or fake. (Singhal, Shah, Chakraborty, Kumaraguru, & Satoh. (2019) highlight that current fake news detectors perform sub-task like event discriminators. If the subtask training is not performed it can degrade the performance of the model. They used BERT a language model to capture both context and content features and pre-trained VGG-19 for image features. A simple concatenation approach is used for fusing textual and visual features. The authors highlighted that the study of different modalities in fake news detection and more complex multi-modal fusion techniques must be explored (Singhal, Shah, Chakraborty, Kumaraguru, & Satoh., 2019).

(Khattar, Goud, et al., 2019) used variational autoencoder approach to learn combined multi-modal features representation. LSTM's are used in autoencoders for extracting textual and visual features. The authors plan to extend the model to social context features like tweet propagation and user characteristics (Khattar, Goud, et al., 2019). (Zhang, et al., (2020). developed a BERT-based model with a domain classifier. The domain classifier is responsible for removing event-specific dependencies from multi-modal features. Authors further intend to use the proposed model on similar other datasets, develop a probabilistic FND model, and indicate the relevance of the attached image to text in the post while performing fake news detection (Zhang, et al., 2020). (Tanwar & Sharma, 2020) also used a variational encoder to obtain a shared representation of multi-modal features. Here in the encoder three CNN architectures namely Inception V3, ResNet 50, and VGG-19 are used for image feature extraction. Authors further want to test their model on other publicly available datasets and incorporate additional features like user profile data to enhance accuracy (Tanwar & Sharma, 2020). (Madhusudhan, Mahurkar, & Nagarajan, 2020). used two different multi-modal fusion methods for textual and visual features. In one method textual and visual features are extracted independently and concatenated and in the second approach visual attention is applied. For extracting textual features BERT and SBERT were used and for image features pre-trained ResNet18 was used (Madhusudhan, Mahurkar, & Nagarajan, 2020).

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D. Nikumbh, A. Thakare/Int. J. Systematic Innovation, 7(6), 36-53(2023)

(Giachanou, Zhang, & Rosso, 2020) developed a multi-modal multi-image FND system. The model along with the textual and visual information, uses semantic information as well. The novelty of the work is that multiple images of posts are considered for extracting visual features, temporal information among the images is captured by LSTM (Long Short-Term Memory) and a similarity score is computed among the text and image tags. All three features i.e. text, visual, and semantic are fused either through concatenation or through attention mechanism for making the predictions. (Shah, P., 2020) used an evolutionary computing approach for fake news detection. For a multi-modal news article, the author extracted textual features using sentimental analysis and image features using thresholding and segmentation. A cultural algorithm is used for optimizing the textual and visual features extracted from a news article. She further used an SVM classifier on optimized features (Shah, P., 2020). The author wants to extend the research by considering user-independent features like demographic, sex, age, and reading pattern of readers, social media post dissemination pattern in the model.

Table 2: The Summary of Multi-Modal Online Fake News Detection Approaches

Reference no	Textual feature extraction	Visual feature extraction	Social context features	Creator features	Datasets	Accuracy	Future scope
2	BERT	VGG-19	No	No	Twitter and Weibo	Twitter:83% Weibo:86.50 %	Used developed model on similar fake news dataset. Plan to employ a probabilistic model Give relevance of the attached image to text while performing fake news detection.
1	Word2Vec +bidirectional LSTM	VGG19+ResNet50+InceptionV3	No	No	Twitter	Twitter:76%	Use the developed model on other publicly available dataset. Consider features like user profile to increase accuracy of model.
27	BERT, SBERT	ResNet pretrained in ImageNet.	No	No	Gossipcop Politifact	Gossipcop: Baseline+BERT+Text=89.90% Visual attention+BERT+Text=89.80% Politifact: Baseline+SBERT+Text=89.70 %	-
28	BERT	VGG16+LSTM	NO	NO	Created own dataset and used a part of FakeNews Net dataset.	3-image-vgg16-LSTM+BERT+similarity+fusion(attention)=79.55 %	-

13	Sentimental Analysis	Segmentation using KNN and DWT(Discrete Wavelet Transformation)	No	No	Twitter, Weibo	Twitter: 79.80% Weibo: 89.10%	Consider user independent features and social media post dissemination pattern in model.
3	Bi-directional LSTM's	VGG-19	No	No	Twitter ,Weibo	Twitter: 74.50% Weibo: 82.40%	Extend the model considering tweet propagation and user characteristic.
4	BERT Base	VGG-19	No	No	Twitter ,Weibo	Twitter: 77.77% Weibo: 89.23%	Explore more complex fusion techniques and how different modalities important in fake news detection.
5	Text-CNN	VGG-19	No	No	Twitter ,Weibo	Twitter: 71.50% Weibo: 82.70%	-

4.3 Multimodal Feature Fusion: While building a multimodal fake news detection system, it's very important to focus on fusion techniques. Fusion techniques bring information from different modalities together. Most of the models developed in literature take linear combinations or simple concatenation of modalities whereas complex interaction between the modalities should be explored to develop efficient models.

Figure 2 shows different feature fusion approaches implemented in literature. The early fusion approach is also called data-level fusion. It is applied to raw data or pre-processed data. Here feature extraction of independent modalities is done followed by feature fusion which results in a single feature vector. Early fusion assumes conditional independence between multiple modalities, which is not always true like in the case of video and depth clues (Haylat, T., 2020). The simplest form of early fusion is the concatenation of extracted multimodal features into a single shared representation. Dimension reduction techniques like Independent Component Analysis (ICA), PCA, and canonical correlation can be applied to the extracted features, to make them dimensionally identical, as this will facilitate concatenation operation. Many papers in the literature son multi-modal fake news detection implement early fusion techniques. (Leyva, R. et al., 2019) used an early fusion mechanism to fuse the text, image, and audio features in video memorability prediction systems. The features extracted from different modalities were first subjected to feature reduction using PCA(Principal Component Analysis). Each of these reduced features was stacked and finally given to the regression model to calculate the memorability score.

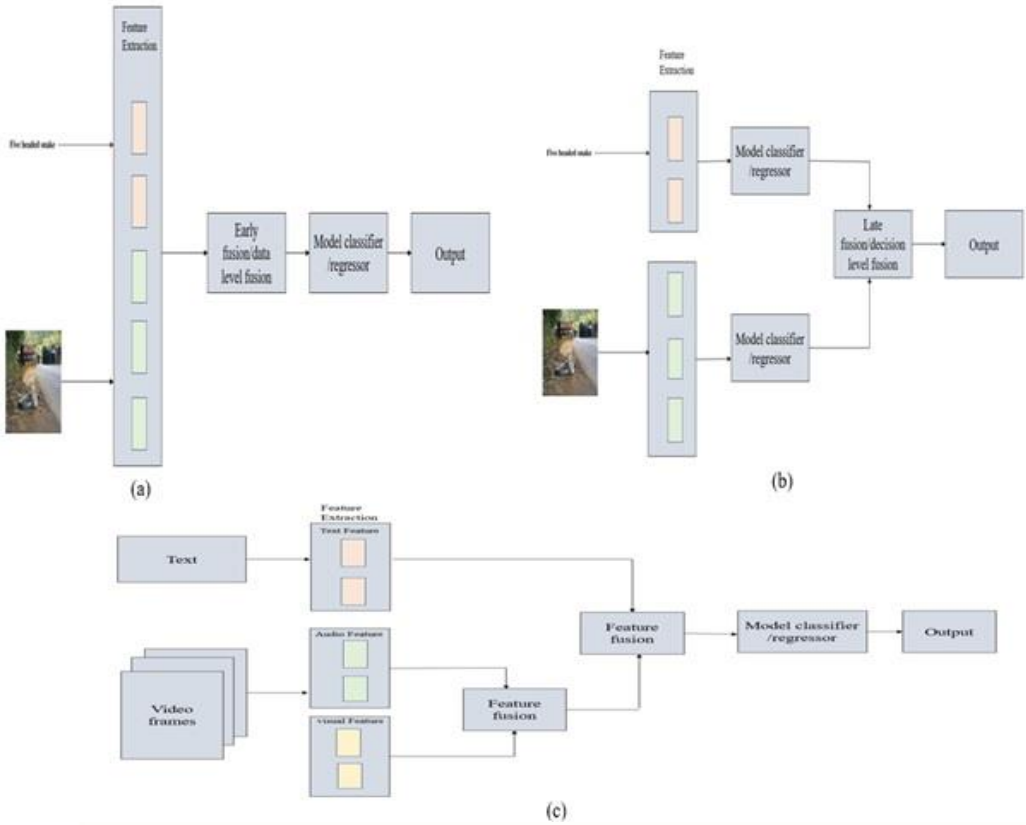

Figure 2. Multimodal feature fusion Techniques. (a) Early fusion approach, (b) Late fusion approach, and (c) Intermediate fusion approach.

The late fusion approach is also called decision-level fusion and is inspired by ensemble classifiers. If the multimodalities are uncorrelated in terms of data dimension, a unit of measure, late fusion approaches give better results. Different rules like the Bayes rule, maximum rule fusion, and average fusion are some of the late fusion techniques (Haylat, T., 2020).

(Kampman, O., Jebalbarezi, E., Bertero, D. & Fung, P., 2018) developed an automatic personality prediction where they investigated different fusion methods for three channels namely audio, text, and video. The first fusion methods are decision-level fusion or late fusion, implemented through the ensemble(voting) method. In this technique, an estimator score was calculated for each personality trait. The estimator score is a weighted sum of the estimator for each trait considering each modality. The advantage of this method is the relevance of modality for a particular personality trait can be identified from the weights (Kampman, O., Jebalbarezi, E., Bertero, D. & Fung, P., 2018). The second fusion method uses limited backpropagation, where only the last two layers of architecture are trainable and the third fusion method uses full backpropagation for the entire architecture (Kampman, O., Jebalbarezi, E., Bertero, D. & Fung, P., 2018).

The intermediate fusion approach is based on a deep neural network. In this approach, a single hidden layer is used to learn the combined representation of different modalities' features. This single hidden layer could be a fully connected, 2D, or 3D convolutional layer. The layer where different modalities fuse is called a fusion layer (Haylat, T., 2020). Figure 2c shows intermediate fusion where the first audio and visual features of the video frame are fused followed by the fusion of text features.

4.3.1 Attention-based fusion techniques: The attention mechanism is inspired by cognitive processes where humans concentrate on particular things and ignore rest. For example, if asked to look for a cat in images, our brains find an object with cat-like features and ignore the rest. The human brain is tuned to the attention. In deep learning, an attention mechanism could be visual attention that concentrates on important regions in an image and text attention that focuses on important words in the text. Neural Machine Translation Systems were the first to implement an Attention mechanism, to

overcome the long-range dependency problem of LSTM's and RNN's.

Attention mechanisms are broadly classified as self-attention and cross-attention. (Vaswani, A., et al., 2017). introduced the concept of the self-attention mechanism through transformer architecture. In the self-attention mechanism while processing an element of a sequence, which other parts of the same sequence are important to process the element is found out. The self-attention mechanism extracts intra-modality information, where query, key, and value belong to the same modality. Cross attention mechanism generates inter-modality information, where for example query can be based on text input and key and value based on image input.

(Duc Tuan & Quang, 2021) addressed the issue of fusing multi-modal features through cross and self-attention mechanisms. Cross attention is used to represent a correlation between text and image and vice versa of a post. Self-attention is used to represent a correlation between different image regions of an image in a post. Further, a scaled dot product attention is used to fuse text and images feature. The formulas for generating query, key, value, and cross attention by (Duc Tuan & Quang, 2021) are as follows:

$$Query(Q) = T_f \times W_Q$$
$$Key(K) = I_f \times W_K$$
$$Value(V) = I_f \times W_V$$

where T_f is text feature vector, I_f is image region feature vector, W_Q, W_K, W_v are weight matrices and $\times$ denotes matrix multiplication operation.

The scaled dot operation is applied on K,V,Q to calculate final attention.

$$attention(text \rightarrow image) = softmax(\frac{Q \times K^T}{\sqrt{d}}) \times V \quad \text{.....(A)}$$

where $\frac{1}{\sqrt{d}}$ is scaling factor

Similarly, for $attention(image \rightarrow text)$ is calculated using the same formula where a query is formed using image feature and key and value are formed using text features.

The Q, K, V for image self-attention are generated as follows:

$$Query(Q) = I_f \times W_Q$$
$$Key(K) = I_f \times W_K$$
$$Value(V) = I_f \times W_V$$

In (Ying, Yu, Wang, Ji, & Qian, 2021b), multi-modal cross attention is implemented by first concatenation of text and visual features. The dimension of visual features is converted to the same dimension as text features. The concatenated feature vector S is then fed to the transformer to generate attention. The following formulas are used in (Ying, Yu, Wang, Ji, & Qian, 2021b) for generating the query, key, and value.

$$S = \begin{bmatrix} T_f \\ I_m \end{bmatrix}$$
$$Query(Q) = S \times W_Q = \begin{pmatrix} T_f W_Q \\ I_m W_Q \end{pmatrix} = \begin{pmatrix} Q_{Tf} \\ Q_{Im} \end{pmatrix}$$
$$Key(K) = S \times W_K = \begin{pmatrix} T_f W_K \\ I_m W_K \end{pmatrix} = \begin{pmatrix} K_{Tf} \\ K_{Im} \end{pmatrix}$$
$$Value(V) = S \times W_V = \begin{pmatrix} T_f W_V \\ I_m W_V \end{pmatrix} = \begin{pmatrix} V_{Tf} \\ V_{Im} \end{pmatrix}$$

The attention is calculated by using SoftMax as mentioned in equation (A).

(Wang, Mao, & Li, 2022) designed a fine-grained fusion model using a scaled dot product mechanism. Several scaled dot product attention blocks are applied to enhance the textual and visual features. The enhanced features are further passed to two more blocks which perform inter-attention. The output is refined features which contain a fusion of textual and visual features. Authors further plan to fuse social context features in addition to textual and visual features. Visual features in frequency domain are to be considered for improvement in the model.

(Ying, Yu, Wang, Ji, & Qian, 2021a) highlighted that existing work suffers from low generalization if a post is related to a very rare or new topic. Hence topic modeling is crucial and should be integrated into fake news detection models. Along with attention (inter and intra modality) to capture post representation they also incorporated a topic memory network to capture global topic features.

(Xue, et al., 2021) designed a unique model which consists of five subnetworks namely text feature extractor, visual feature extractor, tampered visual feature extractor, similarity and fusion modules for FND. The similarity module obtains a semantic representation of text and visual features and cosine similarity is used to measure similarity between them. An attention mechanism is used in the fusion module to assign weights to physical (tampered features) and semantic features. The authors further proposed to perform optimization at the feature fusion level.

(Liao, Q., et al., (2021) designed a model for short fake news detection through multi-task learning. The authors proposed a novel N-Graph method that learns textual and contextual relations in news simultaneously in the representation learning phase. Multi-task

learning module simultaneously performs FND classification and news topic classification, a dynamic weight strategy is incorporated during multi-task learning.

(Kumari, & Ekbal, 2021) introduced a novel feature fusion technique named Multimodal Factorized Bilinear Pooling. The authors further argued that semantic alignment between text and images should be investigated and a better fusion mechanism should be designed. Videos modality should also be considered in FND.

Most of the existing research focuses on implementing supervised learning approaches for FND whereas work on unsupervised and semi-supervised approaches is scarce. (Li, Guo, Wang, & Zheng, 2021). developed an unsupervised FND model using autoencoders. The model considered text, image features, news propagation, and user features on social networks. A splicing method is used to fuse the multimodal features. The author further intends to include more social context features like comments, dissemination patterns of fake news, and other modalities like videos. Also, a detailed classification model should be developed.

(Dong, Victor, & Qian, 2020) used a semi-supervised learning approach for FND. They developed a model with three CNNs: Shared CNN is used to learn low-level features, which are further passed to supervised and unsupervised CNN respectively. For calculating the loss of supervised path cross entropy measure is used and for calculating loss of unsupervised path MSE measure is used. The final loss is optimized using Adam optimizer. The author intends to use the proposed model for various other NLP tasks like sentiment analysis and dependency tasks.

Feature fusion is an important aspect of multimodal fake news detection. Various techniques like attention-based fusion mechanisms should be explored, as they provide the relation between text and supporting images of a post, which is very helpful in detecting misleading posts on social media.

5. Datasets

The publicly available datasets, used in literature for fake news detection(FND) problem are as follows:

5.1 LAIR: It is a publicly available dataset published in 2017 (Wang, W. Y., 2017). It contains short statements related to politics and is extracted from politifact.com. The dataset contains 12,836 samples. For every sample short statement, speaker, context, label, and justification fields are provided. LAIR is a multiclass dataset. Every data sample has one of 6 labels i.e true, false, pants-fire, mostly true, barely true, and half true.

5.2 Fake News Corpus -1(FNC-1): It is a news dataset that maintains news headlines and news body. It consists of 75,385 samples, every sample is labeled with one of the following labels: unrelated, agree, disagree and, discuss\footnote{Stance Detection Dataset for FNC-1 [Online]. Website https://github.com/FakeNewsChallenge/fnc-1 [accessed 12 February 2022].}. This dataset is mostly used for stance detection.

5.3 BuzzFeed: It consists of approximately 2000 news samples which are collected from Facebook during October 2016. These news articles are verified by journalists of BuzzFeed. The labels provided are mostly false, no factual content, mostly true, a mixture of true and false \footnote{Fact-Checking Facebook Politics Pages. github [Online].Website https://github.com/BuzzFeedNews/2016-10-facebook-fact-check [accessed 12 February 2022]}.

5.4 CASIA: It is a dataset of tampered images. The images are tampered with using crop and paste method. It contains 4795 images, 1701 authentic and 3274 forged (Dong, Wang, & Tan, 2013). Casia v2.0 is also available (Zheng, Y., 2019).

5.5 Twitter India Dataset: It is a dataset that contains images circulated on Twitter in India during the period November 2019 to November 2020. It covers events related to politics and religion. It has a total of 110 images out of which 61 images are fake \footnote{Twitter India Dataset Version 3. github [Online]. Website https://github.com/bhuvaneshsingh80/Twitter_India_dataset_Ver_03}.

5.6 Fake News Net: It contains news articles collected from Politifact and gossipcop. For each data sample, it maintains the following information: unique id, publisher URL, the title of the news article and tweeter id's sharing the news \footnote {FakeNewsNet. github [Online]. Website https://github.com/KaiDMML/FakeNewsNet https://github.com/KaiDMML/FakeNewsNet.}.

5.7 Twitter: It is a dataset of tweets provided by MediaEval benchmark used for identifying fake information on Twitter. The dataset contains tweet text, attached images/videos, and social context information of tweets. It contains 7898 fake news tweets and 6026 real news tweets and 514 images (Boididou, Andreadou, Papadopoulos, Dang-Nguyen, et al. (2015).

5.8 Weibo: This dataset contains rumors and fake messages circulated on a Chinese microblogging website called Sina Weibo collected during the period May 2012 to January 2016.These messages are verified by Weibo's official. The real news articles in this dataset are collected from an authentic news source of China and Weibo (Jin, Z., Cao, J., Guo, H., Zhang, Y. & Luo, J. (2017).

6. Open Issues and Research Directions

The detection of Fake news (FND) on social media has many open issues and research directions that require the attention of researchers. We suggest the following research directions:

6.1 Use of Hybrid models in FND mechanism: Most approaches in current literature work independently either on textual news contents, visual contents, or social context information. Hybrid models considering multimodal news contents combined with social context information can be a way forward.

6.2 Multi-Modal Feature Fusion: Studies in the area of multi-modal feature fusion are very limited (Mridha, Keya, Hamid, Monowar, & Rahman, 2021). Fusion approaches help to explore the correlation between text and visual data. This is very important in the case of fake news as text and image data when seen independently can be correct but when seen together might not make any sense.

6.3 Developing Large-Scale Multidimensional Dataset: For supervised learning models to work large-scale benchmark-labeled datasets are required. The lack of such datasets is causing bottlenecks in developing effective FND systems. A publicly available comprehensive large-scale dataset consisting of multimodal news contents, social context information, and dissemination pattern information is needed.

6.4 Unsupervised learning techniques for fake news detection: The availability of limited labeled datasets for FND problem has constrained the usage of supervised learning techniques. Hence, an alternative approach of using unsupervised or semi-supervised algorithms must be explored.

6.5 Fake news monitoring systems: Real-time visualization is an important aspect of monitoring systems. Detailed, multidimensional visualization with the help of modern tools will help to gain insights into online social information. It can help to reveal temporal-based news dissemination patterns, user unusual behavior, and facilitate human supervision.

6.6 Fake news intervention systems: Most of the work in literature fixate on developing accurate FND systems whereas fake news intervention systems are equally important. Monitoring systems can be combined with intervention systems to observe the impact of false information on users, to identify the users who are vulnerable and are easily influenced by false information and mitigation measures, and further monitoring of such users. Designing fake news intervention systems is a potential research area under fake news on social media.

6.7 Explainable AI: Since deep learning techniques involve very deep and complex architectures, it is very important to understand what's happening inside such architectures. Methods and techniques which fall under explainable AI should be considered while developing solutions in the area of fake news detection (Mridha, Keya, Hamid, Monowar, & Rahman, 2021).

7. Conclusion

Fake news or misleading content is a threat to society. Social media platforms that were once designed with good intentions are now being used for spreading false information causing distrust in society. The proliferation of such fake news can have a negative impact on society. Thus, automation of fake news detection has now become an extremely important task. This paper discusses major studies carried out in recent years to address the challenges in fake news detection. The major contributions of this paper are as follows:1)Fake news characteristics are outlined and discussed.2)In-depth knowledge of feature extraction techniques used in literature is provided.3)Exhaustive study of existing single-modal and multi-modal detection techniques.4)

Multi-modal feature fusion techniques used in literature and their importance is highlighted.5)Future research directions that researchers should consider in FND are presented.

This study will strongly help researchers to get better insights in dealing with the fake news detection problem, investigate and extend their work further and help them in building effective fake news detection and prevention tool.

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Product design and development of integrated tea making device

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Abstract

Tea-drinking culture has prevailed for many years, and the traditional tea-making process is exquisite and preparation is cumbersome. In addition to users having relevant tea sets and professional knowledge, the related tea-making device has a wide variety of utensils and is not easy to carry and obtain. Based on satisfying the user's tea-making experience and achieving the purpose of promoting tea-drinking culture, this research focuses on the design and development of a tea-making device and conducts research in two stages. In the first stage, a questionnaire survey was conducted with users who have experience in making tea. Obtained 100 valid questionnaires to understand the user's expectations for the existing tea-making de-vice mainly for the functional requirements such as portability and storage. Continuing this study, the design requirements for product performance improvement were supplemented by the TRIZ forty in-vention evaluation rules to evaluate design solutions that are more in line with this research topic, and related patent searches and analysis were conducted. In the second stage, based on the previous stage, a tea brewing and separating structure with improved functions, simple operation, and a tea set function for separating tea from tea leaves was pro-posed. Finally, based on the results of this research, an integrated tea making device product design is proposed with this new patent structure.

Keywords: tea set, TRIZ, product design, structural design,

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一體化泡茶裝置產品設計與開發

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摘要

飲茶文化獨特且豐富，隨時間推演發展已超越了純粹喝茶解渴的範疇，人們逐漸趨向追求品茗藝術境界。為品一壺茶，使用者需具備茶具使用之相關知識，並且相關泡茶裝置器皿種類繁多亦不易隨身攜帶與取得。本研究以泡茶裝置之設計開發為主要研究範圍，分兩階段進行研究。第一階段以具有泡茶經驗者為對象，進行問卷調查法。取得 100 份有效問卷，瞭解到使用者對於現有泡茶裝置之期望主要在於便攜性與收納性。接續本研究以產品機能改善之設計需求，輔以 TRIZ 四十項發明評估法則，設計提出符合本研究之議題方案，並進行相關專利檢索與分析。第二階段對於前階段進行提案，提出具有機能改善、簡易操作且擁有新式結構用以分離茶水與茶葉的茶具功能之茶水沖泡分離旋轉結構。最終透過研究歷程，以本研究成果之新型專利結構，提出一體化泡茶裝置產品設計。

*關鍵詞：*泡茶裝置，萃智，產品設計，新型結構設計

1. 前言

當前茶製品之商機與衍生產業發展蓬勃，據台灣連鎖暨加盟協會的 2017 年之統計，國人一年消費手搖茶數量達十億二千萬杯，其數量不容小覷(萬年生，2017)。然而隨著現在人的生活節奏不斷加快，對於消費者來說，泡一壺茶步驟繁瑣，場地受限並且器具繁雜，同時需具備飲茶流程的知識等條件，與現代人的生活節奏與型態較不符合。故為滿足現代人需求，許多商家推出的茶包、冷泡茶、掛耳茶包都會省略掉很多傳統泡茶的步驟，此外因為成本考慮，業者在製作過程中添加茶精等，除了會影響健康，顧客亦無法真正獲得茶本質的原味。綜上所述，本研究想營造的是具有機能意義和文化內涵的茶飲產品設計。期望使消費者在短時間內，運用產品，提供化繁為簡，體驗快速但仍完整的泡茶精確流程，使人人都可飲用一杯好茶。營造一個人在需要放鬆的有限時間內所需要的茶館氛圍，提供喝茶本該具有的儀式感。

本研究開發「一體化泡茶裝置產品設計」，以提出具有機能改善、簡易操作且具備新式結構用以分離茶水與茶葉的茶具功能之茶水沖泡分離旋轉結構之簡易構造及機構設計，以達到比市售泡茶裝置結構設計更簡單、操作便利、且易於移動攜帶之效果，以確實強化泡茶裝置器之收納性與易攜帶的設計特點。

2. 文獻與技術探討

本文探討有關泡茶裝置於中華民國的相關專利，以及使用者與泡茶工序之體驗設計。

2.1 專利檢索

檢索現有關於泡茶裝置之技術專利，經統計在台灣專利檢索共計有發明專利公告號 I675636「泡茶器」等 3 件專利，新型專利公告號 323491「泡茶器之改良結構」等 15 件專利，以及新式樣/設計專利公告號 D164044「泡茶器」等 3 件專利，如下表 1~表 3 所示。經分析，上述相關專利均不同於本研究所採用之操作方式與手段，本文所開發之「一體化泡茶裝置產品設計」為一應用於泡茶裝置的創新技術。

表 1. 國內發明泡茶裝置之專利檢索

項目	公告號	專利名稱
1	I675636	泡茶器
2	I481368	泡茶機
3	I290030	多方向控制流量之沖泡結構

表 2. 國內新型泡茶裝置之專利檢索

項目	公告號	專利名稱
1	M578557	茶渣去除過濾器及其泡茶杯結構
2	M551038	泡茶用蓋碗及其碗體結構
3	M546762	泡茶器
4	M544864	真空保溫茶水分離水瓶
5	M530113	泡茶器
6	M513640	泡茶杯
7	M501810	泡茶杯
8	M499154	泡茶杯
9	M499155	泡茶杯
10	M496977	沖泡機
11	M463546	自動泡茶器
12	331113	泡茶器之濾渣裝置
13	326662	飲料沖泡器
14	326664	泡茶杯裝置
15	323491	泡茶器之改良結構

表 3. 國內新式樣/設計泡茶裝置之專利檢索

項目	公告號	專利名稱
1	288748	泡茶器(一)聯合(二)
2	276046	泡茶器(一)聯合一
3	252721	泡茶器(一)

透過以上專利檢索分析與文獻研究成果，可得相關產品多數聚焦於泡茶工具使用的便利性(如表 1 內 3 項發明專利、表 3 內 3 項新式樣/設計專利等)，茶渣與茶水分離之結構(如表 2 之項目除第 10 項外，共計 14 項)等實用特性，可見該類型產品在市場的具發展性。

2.2 使用者與泡茶工序之體驗設計

「體驗行銷不僅讓顧客有所感受，更讓顧客採取行動。」總體而言，「體驗行銷」並非一直談品質，重視的是顧客的經驗、體會(Norris, 1941) ，以及情緒感受的消費(Holbrook, 2000)。使用者經驗或用戶體驗廣泛用於產品設計與開發。Schmitt（2003）觀察消費者經由參與企業所提供的體驗行銷事件，指出感受某些刺激進而誘發其動機，產生認同或消費行為，同時促進產品價值。Babin et al.（1994）更進一步指出體驗知覺將引發體驗價值。藉由體驗價值對

滿足消費者滿意度視為一項重要工作(Oh et al., 2007)，其有助於產品銷售與推廣。Bernd H. Schmitt 提出體驗的類型分為 5 類，分別是：感官式體驗、情感式體驗、思考式體驗、行動式體驗及關聯式體驗。執行體驗行銷需從消費者的情境和需求出發，而非產品本身，藉由用心體驗生活、激發創意，從中找出能使消費者感到驚奇的事物（王育英、梁曉鶯譯，2000）。

本研究目的之一，在提供與滿足使用者體驗完整泡茶工序。泡茶程序可分為 8 步驟。首先，應準備好泡茶所需的乾淨器具：茶壺，茶杯，茶盤以及茶葉。其次為溫杯，用開水將所有的壺、杯沖燙一遍，既為清潔，又可溫熱壺杯，有利於促發茶香。然後是賞茶將茶置於茶荷內，品賞乾茶的色香味。隨後是投茶，潤茶與沖泡。取出將茶荷內的茶葉投入杯壺，注入少量開水浸潤茶葉，連續上下三次，使水上下翻騰易出味出香。倒數第二步斟茶，用壺泡好茶後，可斟入小杯內飲用，一般斟茶只斟七分滿。最後便是聞香品茶（奉茶），聞香在潤茶後或茶湯泡好後進行，由遠而近，反復幾次（許玉蓮， 2013）。

綜合上述如何透過本研究之設計，提供沖、洗、泡、品的機能用一種化繁為簡的快速方式，使消費者通過使用體驗完整感受泡茶流程。同時藉由此體驗提產品價值，視為本研究創作方向要點之一。本研究選定以感官體驗中的視覺體驗與情感式體驗做為討論範疇，強調泡茶儀式感以及流程與體驗，茶文化知識的洗禮和茶葉故事的傳播。運用一體化的茶葉裝置設計，本裝置結構設計提供沖、洗、泡、品的機能用一種化繁為簡的快速方式，使消費者通過使用體驗完整感受泡茶流程。

3. 研究方法

本研究透過問卷調查結合 TRIZ 的 40 發明法則與體驗設計之精神，提出一體化泡茶裝置產品設計與開發。研究首先進行問卷調查了解使用者經驗，並利用專利檢索找出泡茶器與其相關結構設計之專利，對產品做專利分析，從中分析出可創新設計的可能性，再由透過 TRIZ 找出新的創新設計，導入體驗設計的「行動式體驗概念」來使產品除了實用性亦兼具體驗互動之操作回饋。研究流程圖，如圖 1 所示。

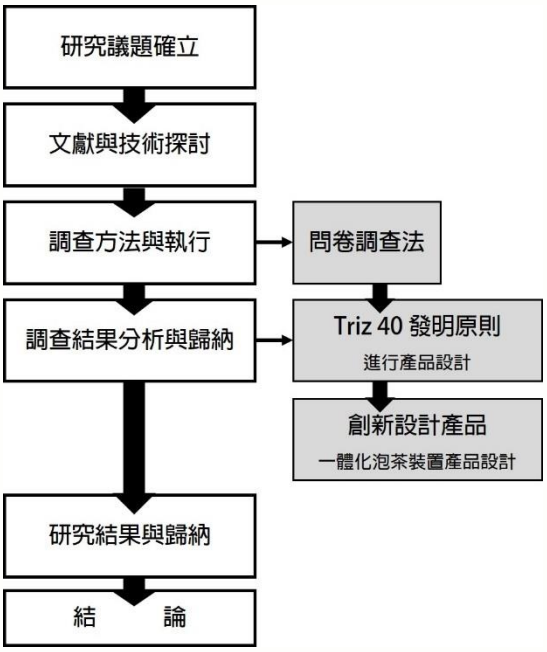

圖 1 研究流程圖

3.1 問卷調查

本研究調查成果方面，首先在問卷調查部分，首先在問卷調查部分，本研究使用實地施測訪談問卷，研究者擬定好問卷大綱，了解民眾對於泡茶裝置看法與造型等方面進行市場調查分析。實地施測問卷，以具有泡茶經驗者為對象，進行問卷調查法，調查樣本共為 100 人。調查結果顯示，受訪者依據其使用經驗提出機能面的意見回饋。使用機能方面：本研究彙整調查資料，依據受訪者在使用與選購泡茶裝置之經驗，92.8%使用者對於現有泡茶裝置有不易攜帶、材質脆弱、收納不易等困擾。其次，就造型風格取向，極簡主義與原型風格更被大眾所偏愛。換言之，強化便攜性與收納性為主等機能需求，為受訪者所期待之產品機能，以簡約方式呈現為受訪者所喜愛之風格。多數使用者在機能收納方面的困擾，統計數據及造型風格詳如下表 4 表 5：

表 4. 機能困擾與解決方案

機能困擾	人數（%）	解決方案
不易攜帶	56	簡易操作
材質脆弱	46	新式材質與結構
收納不易	42	機能改善
無困擾	6	

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S. F. Yu, Y. G. Chen, etc./Int. J. Systematic Innovation, 7(6), 54-60(2023)

表 5. 造型風格取向

風格	人數（%）
極簡主義風格	61
產品語意學風格	45
科技感風格	32
原型風格	65

3.2 一體化泡茶裝置產品設計

本項一體化泡茶裝置產品設計概念係應用TRIZ40 項發明原理，該發明原則，可應用為思考解決方案時提供方向以及線索，如下圖 2(鄧志堅、黃裕峰，2011；Gazem, N., & Rahman, A.A., 2014) 。說明如下：

No.	法則內容	No.	法則內容
1	分割	21	躍過
2	分離	22	變有害為有益
3	局部性質	23	反饋
4	不對稱	24	中介物
5	合併	25	自我服務
6	多功能	26	複製
7	套裝	27	低成本、耐用的物體 不耐用物體代替昂貴
8	質量補償	28	機械繫統的替代
9	預加反作用	29	氣動與液壓結構
10	預先作用	30	柔性殼體或薄膜
11	預補償	31	多孔材料
12	等勢性	32	改變顏色
13	相反	33	同質性
14	曲面化	34	拋棄與修複
15	動態	35	參數變化
16	未達到或超過的作用	36	狀態變化
17	維數變化	37	熱膨脹
18	機械振動	38	強氧化
19	周期性作用	39	惰性介質
20	連續有效作用	40	複合材料

圖 2. TRIZ 技法之 40 創新法則
(資料來源：本研究參考鄧志堅、黃裕峰(2011)及Gazem, N., & Rahman,A.A., (2014)整理)

本研究設計主要以便攜性與收納性為主等機能需求創新作為泡茶裝置的改良，基於上述本設計開發之目標為可實現泡茶工序所需要的壺具與杯具之整合裝置、兼具便攜性與收納性之多功能、以及滿足過濾茶水之設計提案。依據 TRIZ 之 40 項發明法則尋求可行方向，選用上表 6 TRIZ 技法之 40 創新法則的編號 6 多功能、編號 7 套裝、編號 31 多孔材料等法則，進行設計發想且提出「一體化泡茶裝置產品設計」，說明如下述:

應用 TRIZ 40 項發明原理中編號 6 多功能(Merging)：此項發明原理主要用作使一物體或系統能執行多種功能，為達到方便攜帶之目的，本設計參考之，設計如第圖 3 所示之茶具功能之茶水沖泡分離旋轉結構，其包含由上而下依序包含杯蓋、泡茶壺、濾網、濾茶層(包含一濾茶層上部及一濾茶層下部)及公道杯等部件。其中，濾茶層設置於公道杯上，而過濾件設置在濾茶層及公道杯之間。該過濾件包含一濾茶層上部及一濾茶層下部，分別設置於濾茶層底部，使得當濾茶層與公道杯相對旋動時，該濾茶層上部及濾茶層下部亦隨之相對連動旋動。其次，本設計考量茶具與杯器皆為盛裝物品功能之共通特點，設計發展採用「茶具即杯器」之結構。

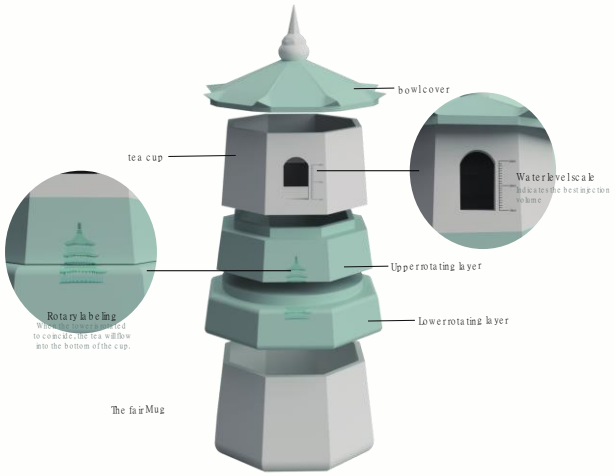

圖 3. 本研究設計裝置

應用 TRIZ 40 項發明原理中編號 7 套裝('Nested doll')：本設計將泡茶流程所需工具包括茶壺與公道杯等器皿。為達強化收納性之考量，把物體放在其他物體之內的發明原理，於分別於杯蓋、泡茶壺、濾網、濾茶層(包含一濾茶層上部及一濾茶層下部)及公道杯等部件造型，設計可互相套合組裝的線條如下圖 4。

圖 4. 本研究設計組合造型

應用 TRIZ 40 項發明原理中編號 31 多孔材料(Porous materials)：在本設計中為使茶水與茶葉得以

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S. F. Yu, Y. G. Chen, etc./Int. J. Systematic Innovation, 7(6), 54-60(2023)

過濾分離，方便使用者飲用。應用此項原理，使物體成為多孔性或加入多孔的元素。其中，如圖 5 所示。

圖 5. 濾茶層結構圖

該第一濾件具有複數個孔洞，該第二濾件具有對應該複數個孔洞的一扇型開口。於泡茶時，係先使複數個孔洞不位於該扇形開口之垂直投影的方向上，而阻斷水流。此時使用者可加入茶葉至泡茶壺，並傾倒 85 度左右的水，使茶葉浸泡在水中。靜置 5 分鐘後，使茶葉與熱水充分融合。接著，旋轉濾茶層，使該複數個孔洞與該扇形開口相對應，讓茶湯流向公道杯，茶葉則停留在上方。此時，從公道杯移除濾茶層，使用者則可享用泡好的茶，其操作流程詳如下圖 6。

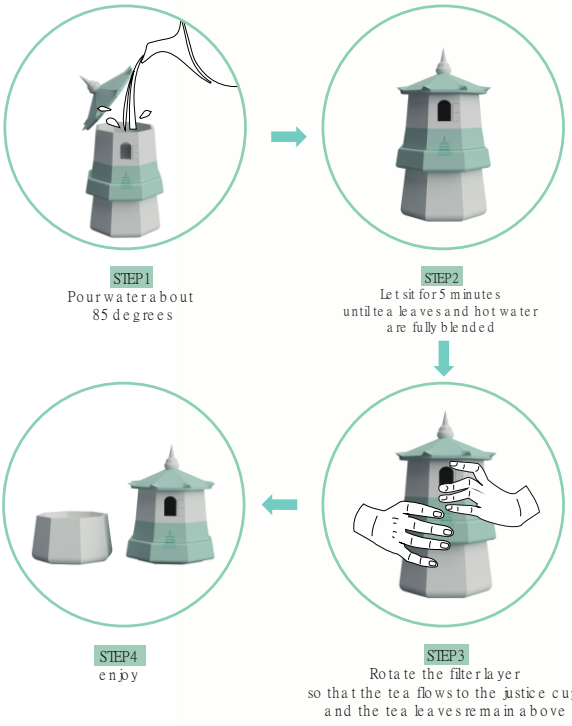

圖 6. 操作流程圖

4. 研究結果與歸納

本創作提供一種簡易操作且具備新式結構用以分離茶水與茶葉的茶具功能之茶水沖泡分離旋轉結構，其包含底容器(公道杯)、頂容器(泡茶壺)及旋轉式連通件。結構簡單，易於使用，設計概念即是「茶具及杯器」。故結合杯蓋、泡茶壺、濾網、手動濾茶層及公道杯，設計出具有沖、泡、品一體化的產品。期望使用者在短時間內，通過運用一體化的泡茶壺結構設計所提供之機能，在需要放鬆的短時間內，快速品到一杯純正的茶。其主要特點在於本設計係有關於一種透過旋轉式通水透氣泡茶器結構改良方式，提出的一體化泡茶裝置產品設計。此泡茶裝置的泡茶壺每次完成茶葉沖泡後，可由泡茶裝置的旋轉操作，以流量大小可控制或變化的形式，簡單將泡茶壺內茶液釋放到公道杯內貯存待用外，泡茶壺內茶液由出水通孔進入通道空間，再從通水孔排放到公道杯的過程中，茶水室內空氣，在茶液注入時，從通水孔排到通道空間，再沿著通氣管的通氣孔交換到泡茶室內的作用，俾使泡茶壺內茶液往公道杯內排放的動作，達到順暢流動的效益，此程序可使使用者體驗泡茶流程之儀式感。

其次，透過造型設計有效整合濾茶層之頂部與杯蓋的底部相契合，濾茶層的底部則與過濾件的頂部、底容器(公道杯)、頂容器(泡茶壺) 彼此相互組合為一個一體化產品，有係增強其收納與攜帶便利性，達到本研究之目的。

5. 結論

對於生活節奏不斷加快的人們而言，快速取得的茶飲飲料，是滿足人們日常口腹之慾的常見選擇。基於此背景下，飲茶文化也在不斷的消失，而如何兼具現代人忙碌生活型態與體現飲茶之道為本研究之目的。故本研究透過研究歷程產出可便利沖泡之旋轉式泡茶壺的專利設計。期望使用者在短時間內，通過此一體化的泡茶壺結構設計所提供的沖、洗、泡、品的機能，在需要放鬆的短時間內，快速品到一杯純正的茶。此外，本研究之「茶具功能之茶水沖泡分離旋轉結構」取新型一項專利，證號新型 M596011 號。並於 2019 年韓國國際發明展獲銀牌肯定。未來期許後續衍生出同系列泡茶用品，使茶葉真正的醇味能被大眾所了解。

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Apply business TRIZ to improve card healing service in new age movement

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Abstract

The New Age Movement has spread from the United States to Taiwan, it not only creates a “Spiritual Industry”, but also brings economic benefits to Taiwan. About this study, the data collection is from practice experience and the study method is Action Research and Business TRIZ, and we also use the concept to be a usual process of card healing. Because of the above problem, we applied Business TRIZ methods to provide 5 suggestions, including taking deep breaths prior to card shuffling, augmenting shuffling procedures and interaction time, inquiring about customers' psychological states and giving direction, engaging in meditative shuffling and concentration, as well as employing appealing visual aids for guidance, then, through the Multi-Criteria Decision Matrix method, the factors of effectiveness, cheapness, time saving and simple similarity are used for weighting and scoring, according to the expected implementation time, and finally two schemes that can be implemented in priority are selected.

Keywords: Business TRIZ, New Age Movement, Card healing, Innovation in service design

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應用商業管理萃思工具改善新時代牌卡療癒服務

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摘要

新時代運動從美國傳播至臺灣後，促進了以「靈性為主題的產業」誕生，並為台灣帶來了經濟效益。研究者使用行動研究法，將工作情境作為研究情境，並把新時代的靈性牌卡療癒之服務流程作為研究對象，將坊間牌卡療癒服務之必要程序進行概念化，並以實際執業經驗為資料來源界定出問題，再藉由商業管理萃思工具對服務流程進行深入識別與產生解決方案，最終得出 5 項改良方案，包含洗牌前先進行深呼吸、增加洗牌程序與互動時間、詢問顧客心理狀況並引導之、冥想洗牌靜心以及用可愛圖形引導，並透過多標準決策分析法以效果、便宜、省時與簡單似因素進行比重評分，配合預計施行時間之長短，最終選出兩項可優先執行之方案。

*關鍵詞：*商業管理萃思，牌卡療癒，新時代運動，創新服務設

1. 前言

當 1960 年代新時代運動(New Age Movement)在西方崛起，宗教與靈性的關係也重新被定義。隨著新時代團體的出現，各種帶有新時代色彩的出版物也印入大眾眼簾，「個人靈性」的概念也隨之擴散，此後「靈性」一詞不再僅限於宗教與神話。新時代運動促進了宗教領域對於「個體」的關注（Luckmann, 1967）。直到 1980 年代前後，原本活躍於西方的新時代運動隨著一些留美知識菁英悄悄進入台灣，不只造就時代書籍的引入，也掀起讀書會與共修會的風潮（中華新時代協會、奧修中心與光的課程等等），更漸漸形成非正式的人際網絡（陳家倫，2015）。

不同於擁護正統的傳統宗教，新時代運動帶起的個人靈性思潮因無中心性特質，容易與各種文化產生混合，創造其獨特的多變性特質，並快速蔓延在各個領域當中，時至今日，或許大眾對新時代運動所知不多，但具有新時代思潮的書籍、課程、活動甚至商品等等，早已遍佈在我們生活周遭，甚至創造獨特的靈性產業，諸如靈性療癒、潛能開發課程、心靈諮詢與靈性商品等等。

研究者作為新時代靈性產業之執業者已十多年，親眼見證其從小眾文化步入商業化之過程，如今，全台各地的中小型靈性工作室、身心靈中心（也有稱心靈中心、靈性中心）與流動的靈性老師數量發展皆頗具規模，而研究者所專精的「牌卡療癒」更是橫跨心靈諮詢與靈性療癒的熱門行業，隨著產業規模的逐步擴張，業界競爭也逐漸激烈，如何規劃出兼具效率與成本管理的服務流程，將成為本研究所關注之重點。

故本研究將以工作情境作為研究情境，以本身執業經驗界定出在服務流程當中反覆出現的問題，再透過商業管理萃思 工具進行矛盾分析，對服務流程進行深入分析，再經由發明原則產生解決方案，並將眾多方案進行綜合評比，最終得出最佳創新解決方案，希望未來能讓同業者作為改進參考。

2. 文獻探討

2.1 台灣新時代運動

關於新時代運動的起源，部分學者相信與「寶瓶時代」不乏關係，所謂寶瓶時代其實是指天文學上的一種歲差現象，即太陽上升位置的改變，從原本的雙魚移至寶瓶，根據占星學的解釋，這樣的天文現象，暗示著心靈將取代物質成為世界的主題，也就是以精神生活為主的新時代即將到來。然而，寶瓶時代雖看似是新時代的先驅，但亦有學者將兩至者區分開。

然而，隨著西方新時代運動持續發展，它也逐漸走出不同於寶瓶時代的特性，包含各種靈性與文化運動，諸如潛能開發運動(Human Potential Movement)、身心靈整體健康運動(Holistic Health Movement)與靈性運動等等，其中每一種運動又擁有不同訴求及內容（Melton, 1990; Newport, 1998; Hane-Melton, 1990;

Newport, 1998; Hane-graaff, 1998: 98-103; 陳家倫，2005）。

直到 1980 年代傳入台灣後，各地開始舉辦新時代相關的讀書會與共修會（陳家倫，2015），時至今日，臺灣新時代運動仍持續引進各種新時代體系，包含各種大師、靈性通訊與靈性療癒系統等，如《光的課程》（Light courses）、靈氣（reiki）、奧修(Osho)、賽斯（Seth）、內在小孩（inner child）、《奇蹟課程》（A Course in Miracles）、《與神對話》（Conversation with God）、克里昂（Kryon）、擴大療癒、靈性彩油（aurasoma）、頌缽療癒等，隨著時代的改變，這些新時代主義思潮，也隨著各種書籍、課程、活動與商品等，逐漸步入我們的生活，並依循著時代的脈絡根植入了消費主義當中，形成了多元又有趣的靈性產業市場。

2.2 台灣新時代靈性產業

西方新時代運動作為一種大型的革命思潮，其廣泛地在全球各地傳播，儘管目前關於亞洲的新時代相關研究仍非常稀少，但我們仍能從不多的研究中，隱約看見一些共通性。

Woo(2018)指出，伴隨 2008 年南韓金融危機爆發，日益激烈的社會競爭和高失業率，讓年輕人產生身心療癒的可持續性需求，因而促進了「療癒產業」的誕生。日本學者 Shimazono(1999)雖未直接指出新時代運動的商業化趨勢，但也同樣指出，在新時代運動自西方傳遞到本國後，開始與民間宗教傳統的巫師和占卜文化相結合，並透過其詞彙與技術重新以現代化的姿態出現在眾人眼前。陳家倫(2015)透過訪談探索台灣新時代運動行動者認知類型時，發現大部深參與者都有過宗教背景，其中廣泛融合型與佛道融合型，兩者皆具有能同時接受多種宗教的特質。這樣的特質完全貼合了新時代運動的去中心化特質，而這樣的特質也促進了其受眾面積的大小。

從以上研究中，我們看見了新時代運動商業化的各種機會與可能，首先，在全球因疫情而緊張的經濟狀況，具有心靈療癒功能的新時代商品（包含思潮、活動、課程與商品等）或許有機會滿足人們的精神需求，再來，原本以為會與當地文化產生衝突的新時代運動，在日本、南韓與台灣學者的觀察中，巧妙與當地宗教文化進行結合與混合，最後，不同於傳統宗教的既有框架，新時代運動更具可變性，這使其更容易創新，也更容易進行商業化。

如今，台灣各地越來越多的靈性工作室、工作坊與靈性商店步入眼簾，同時也造就其獨特的就業市場，這些透過專業技術在靈性領域上協助他人的人，我們又將其稱為靈性工作者，作為此領域的專業者之一，本研究希望能透過商業管理萃思工具針對牌卡療癒之服務流程進行改良。

2.3 商業管理萃思理論

隨著各國學者的參與，原本專為專利發明解決問題的萃思工具，如今已逐漸發展到其他領域。在眾多領域當中，商業管理萃思發展特別受到關注，並對既有管理學思維帶來另一種聲音。近年，萃思在商業領域發生了重大進展，即 Souchkov (2015)發表了商業領域中的萃思應用，並將萃思使用的步驟、方法、工具使用方法與邏輯連結進行系統化說明。

回顧 2016 至 2022 年間，商業管理萃思相關研究也逐步顯露頭角，諸如 Shahin(2016)就以銀行服務作為案例，試圖透過萃思方法找出並解決品質屋(HOQ)中顧客期望(WHAT)與工程技術(HOW)的順序矛盾。而 Lin et al.(2018)則是以問卷形式，針對台灣新竹縣的 71 間 7 -ELEVEN 進行調查，並發現「顧客對提供的產品缺乏信心」和「顧客沒有舒適的用餐環境」最需改進之問題，並透過萃思工具得出 14 個創新理念和與改良方案。在服務設計領域中，Lee et al.(2020)為設計有效的智慧展覽指導服務，故提出 3E 模型之整體服務設計方法，並試圖以萃思理論解決過程中所產生的矛盾。Tang(2020)則透過萃思方法對東北亞社區警務模式提出創新改良方案，藉以優化其商業制度環境。最後，Lee(2022)以筆記型電腦生產過程為實證研究客體，並透過萃思演進趨勢分析工具，提出以客戶需求與戰略性為導向的創新服務設計模型。綜觀以上研究，我們發現商業管理萃思，不僅具備足夠的功能性，亦擁有能夠穿梭於不同領域的高適應性。

3. 研究方法

行動研究(Action Research)是實務工作者的一種特殊研究方法，由勒溫(K. Lewin)首創，其重點在於探究實務工作者自己相關工作的問題。

Elliott (1991)認為行動研究是一種社會情境研究，其研究取向為改善社會情境中行動品質。陳伯璋(1998)將行動研究法視為「研究」和「行動」的結合，透過專家、學者、參與者與組織成員共同合作，將實際問題作為研究主題，屬於相當實際的研究方法。林素卿(2012)認為行動研究法並沒有統一的模式，而是透過活動與活動之間的連結以螺旋式的方式循環。蔡清田(2011)則強調，當研究者欲使用行動研究法前，必須先對情境問題（即研究動機）、問題領域（即研究範圍）、問題焦點（即研究問題）以及此問題之重要性進行說明，並以此確立研究架構與方法。Reason 與 Bradbury (2008)則探討了行動研究在不同場合和領域中的實際

應用，例如教育、社會工作、組織管理等，透過這些案例，我們發現行動研究法能夠幫助實務工作者更好地理解自己工作場域與問題，並進一步探索創新的解決方案。

為了說明本研究所使用行動研究法之必要性，本研究將在表 1 中，針對行動研究法與其他研究方法的優缺點比較。

表 1.研究方法比較表

研究方法	定義	優點	缺點
行動研究法	一種參與式的研究方法，通過實踐改進問題解決過程	1. 實際操作中獲得真實數據 2. 即時改進 3. 研究結果容易回饋到實踐中	1. 可能存在主觀性偏見 2. 時間和資源消耗較大
定量研究法	通過數據和統計分析來研究現象	1. 數據客觀 2. 可以量化結果 3. 更容易推廣到其他相似情況	1. 難以深入了解個案背後的原因 2. 數據可能無法涵蓋所有情況
定性研究法	通過對個案和現象進行深入了解和解釋來研究問題	1. 能夠深入了解現象背後的原因 2. 較容易捕捉特殊情況	1. 數據主觀性較大 2. 難以量化結果 3. 推廣性有限
文獻研究法	通過分析現有文獻資料來研究問題	1. 可以獲得廣泛的信息\ 2. 資源消耗相對較低	1. 可能存在資料不全面的風險 2. 可能無法解決具體問題
實驗研究法	通過設計和實施實驗來驗證假設	1. 能夠確定因果關係 2. 數據客觀 3. 可以進行多次驗證	1. 資源消耗較大 2. 實驗設計可能存在偏見 3. 實驗結果不一定具有普遍性

綜觀其他研究方法之優缺點後，本研究最終考量一下因素，而選擇行動研究法為最適合之研究方法，具體條列如下；

(1) 實踐性

行動研究法強調解決實際問題，與其他理論導向的研究方法相比，它更注重實踐場景，有助於解決新時代靈性產業中面臨的具體挑戰。

(2) 研究者參與

行動研究法允許研究者作為執業者直接參與研究過程，這使得研究更加具有現場感和真實性，有助於獲得深入的見解。

(3) 迭代與改進

行動研究法鼓勵研究者進行多次反思與評估，通過持續改進以達到最佳解決方案。這種過程與其他較為靜態的研究方法相比，具有更高的彈性與適應性。

(4) 創新性解決方案

行動研究法支持研究者提出創新性的解決方案，並將其應用到實際場景中。這與其他傳統研究方法相比，有助於推動業界的創新與發展。

(5) 知識產出與實踐的結合

行動研究法將理論知識與實踐經驗相結合，使得研究成果具有更高的實用性。相比其他偏重理論的研究方法，行動研究法更能產生實際影響。

綜上所述，基於實踐性、研究者參與、迭代與改進、創新性解決方案以及知識產出與實踐的結合等方面的考慮，本研究選擇行動研究法作為最適合的研究方法。

4. 應用商業管理萃思理論解決矛盾的方法

4.1 確認問題範圍

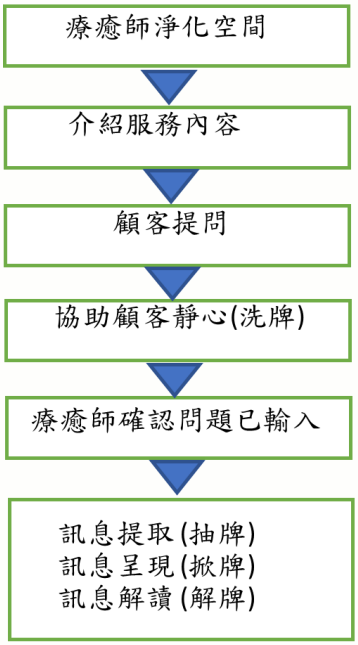

圖 1.牌卡療癒之服務流程圖

透過研究者在情境中的實務經驗，最終總結出以上服務流程，而本研究所欲改良之服務流程為「協助顧客靜心（洗牌）」，其具體原因條列如下：

(1) 帶領顧客靜心是靈性療癒服務中的必要流程，

故應用範圍更加廣泛。

(2) 在實務經驗中，顧客的靜心狀態經常與其滿意度具有強烈連結。

(3) 在過去，引導顧客靜心常需耗費許多時間，故若能透過創意改良方法降低時間成本將有巨大助益。

以下段落，本研究將透過商業管理萃思之功能分析法進行「組件分析」與「相互作用分析」，將服務流程進行分解，以更深入地呈現問題情境樣貌。

表 2.組件分析

服務系統	系統組件	超系統組件
療癒空間	療癒師 牌卡 桌子 蠟燭 音樂	顧客

如表 2 所示，透過組件分析，本研究將「療協助顧客靜心（洗牌）」此流程加以識別（如圖 1 所示）。「療癒空間」即為服務流程之系統，其兼具工作空間與隱私空間雙重身分，故必須與外部環境隔絕，而所有參與此運作過程的「零件」則為組件。

表 3.相互作用分析表

	療癒師	顧客	牌卡	桌子	蠟燭	音樂
療癒師		X		X	X	X
顧客	X		X	X	X	X
牌卡		X		X		
桌子	X	X	X		X	
蠟燭	X	X		X		
音樂		X				

組件之間有些有著作用關係，反之有些則無，依照組件彼此之間是否具有相互作用，最終製成表 3。

經過分析，本研究發現有三項組件關係非正面效用，條列如下：

(1)「療癒師指引顧客步驟」，由於不同牌陣可能對應不同洗牌方法，所以療癒師經常需一個步驟一個步驟地指導顧客，因而造成效用過量。

(2)「牌卡引起顧客焦慮」，當顧客看到桌面上的牌卡時，往往會因過於在意結果（或是對於答案的猜測心理）而產生焦慮感，因而產生效用不足。

(3)「蠟燭使療癒師分心」，因療癒師擔心打翻火燭引起意外，故分心造成負面效用。

在尋找出三項非正面效用關係後，為了找出最需被優先改良的關鍵問題，我們將以-1、+1、0 分別為其進行交互重要性評分， 最終以「牌卡引起顧客過度注意進而產生焦慮感」得分最高（如表 4 所示）。

表 4.問題重要性排名

#	問題	1	2	3	總分
1	牌卡引起顧客過度注意進而產生焦慮感		+1	+1	+2
2	療癒師因擔心蠟燭安全而分心	-1		-1	-2
3	顧客難以專心聆聽指引步驟	-1	+1		0

4.2 尋找矛盾處

不論是心靈諮詢或靈性療癒，由於服務核心都是幫助人們排解壓力，並協助其以正向的心態面對人生，故經常需面對心情不佳的顧客，也正因為如此，為讓服務順利進行，事先提供各種靜心方式助其調整狀態乃必要程序，本研究者就是透過各種洗牌程序配合默念進行協助，然而，由於現代人生活腳步越發快速，閒暇之餘也習慣透過影音媒體獲取娛樂，因此鮮少有獨處面對自我內心的時間，在這樣的社會情境下，也使療癒師的工作更加困難。在實務工作情境下，大部分進行心靈諮詢的顧客表示希望透過此服務滿足兩種需求，其一為解答內心的疑惑，並希望透過得到答案而有勇氣繼續生活。其二，則是希望有地方可抒發心中的負面情緒，並透過療癒師或諮詢師的幫助，深度面對自己的內心的需求。對於希望得到解答(包含自我內心)的顧客來說，在與療癒師或諮詢師進行問題或療癒主題的討論後，往往會變得有些緊張，在這樣的情境下，最終將給予其解答的牌卡，在顧客眼中往往會變得神聖而不可侵犯，因而有時會過度慎重而引起焦慮，而這正好與本階段的目標背道而馳。

為了能解決此問題，本研究提出一改善作法，即在指導顧客靜心之前先介紹牌卡，考慮到顧客可能因為心理上過度神化牌卡，因此可以使其增加熟悉度而平靜下來，然而在增加其放鬆感的同時，由於服務過程可能不只用上一種牌，且有些顧客對於牌卡的了解甚少，故若是每一副牌都必須事先介紹，則將會增加大量的時間成本。

從中我們發現，儘管我們可針對問題要點找出改善做法，但在改善的同時，卻可能又產生一個新的問題，也就是說，在改善服務系統的某一個特性後，該服務系統的另一個特性同時惡化，形成具有矛盾衝突

的問題，故本研究將此矛盾問題應用商業管理矛盾矩陣表找出創新原理來進行改善(如表 5 所示)。

表 5.要改善「牌卡引起顧客過度注意進而產生焦慮感」之矛盾

問題要點	改善作法	改善處	惡化處
牌卡引起顧客過度注意進而產生焦慮感	在指導顧客靜心前先向顧客介紹牌卡，透過增加熟悉度降低焦慮感。	增加顧客放鬆感	時間成本增加

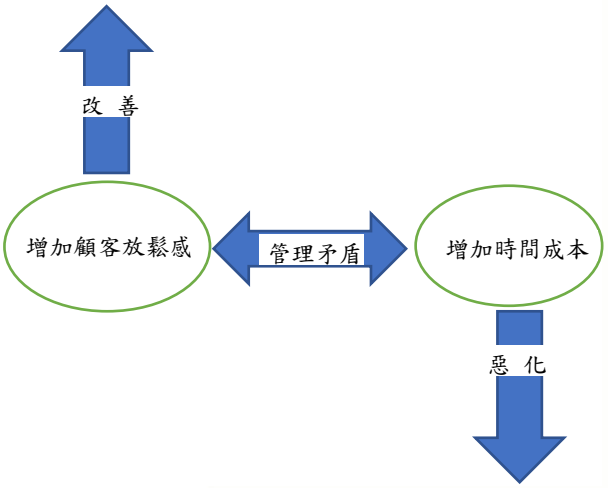

圖 2 改善「牌卡引起顧客過度注意進而產生焦慮感」之矛盾

若將圖 2 改善之矛盾描述格式，以發明性問題以「IF(若)-THEN-(則)-BUT(但)」的方法呈現如表 6 所示。

表 6.「牌卡引起顧客過度注意進而產生焦慮感」之矛盾

	牌卡引起顧客過度注意進而產生焦慮感
IF (若)	事先向顧客介紹牌卡
THEN (則)	增加顧客放鬆感
BUT (但)	增加時間成本

透過找出改善處與惡化處所對應的通用參數，如下：

(1)「增加顧客放鬆感」所對應的參數為「29 顧客壓力」

(2)「增加時間成本」所對應的參數為「4 行動時間」

表 7.矛盾矩陣表找尋發明原理

		2 行動變動性	3 行動成本	4 行動時間 s
28	組織的穩定性	19,5,11,29	5,8,6,26	35,32,25,24
29	顧客的壓力	40,13,14,35	2,39,17,22	**1,31,23,40**
30	顧客的穩定性	35,32,3,13	3,25,16,35	1,2,12,31

表 8.用發明原理產生解決構想

編號	名稱	發明原理敘述	產生解決構想
1	分割	打破過程或行為來產生較小的組成元件	先深呼吸再洗牌
31	孔洞和網路	透過引入孔洞的概念，將系統或子系統變成多孔狀	增加洗牌程序與互動時間
23	回饋	在系統與超系統之間引入回饋	詢問顧客心理狀況並引導之
40	組合(複合)結構	(1)連接兩個相異的流程或活動 (2)以不同屬性的多層組合創造一個複合系統	1.冥想洗牌靜心 2.用可愛圖形引導

整合所有找到的解決構想成為解決方案；

(1) 先深呼吸再洗牌

打破過去「一面洗牌一面深呼吸」之流程，改為先深呼吸一段時間再洗牌。

(2) 增加洗牌程序與互動時間

在引導顧客進行洗牌靜心時，增加更多洗牌程序如切牌、疊牌、洗牌等，此外還可透過雙手輕放在牌卡上，在心中默念自我介紹與所要詢問的問題。

(3) 詢問顧客心理狀況並引導之

由於顧客之情緒壓力深受個人因素主導，故可適時詢問顧客心理狀況，並依照對方的狀態給予引導。

(4) 冥想洗牌靜心

將原本顧客需在睜眼狀態下進行的洗牌活動，改為閉眼冥想之形式進行。

(5) 用可愛圖形引導

除了療癒師口頭引導外，另在桌面上增加具有指示意義的可愛圖案協助顧客靜心洗牌。

在得到五項創意改良方案後，為了能了解這些方案在實務應用上的優先順序，我們將透過多標準決策矩陣(Multi-Criteria Decision Matrix)以效果、便宜、省時與簡單四項評估標準進行分別評分，並依照其重要性程度給予適當的比重分數，最終將其進行綜合評分。

本研究以重要性進行排序，分別以效果、便宜、省時與簡單，由於本次所欲解決之問題對於整體服務品質影響甚大，故我們將以「效果」所佔比例最重為 7，其次，則是因避免額外增加太多經濟成為考量，故

占比第二重的為「便宜」所占比重為 5，然後就是時間成本「省時」(因為療癒服務是以時間長度進行計價)為 4，最後，代表操作性的「簡單」比重為 3 (如表 9 所示)。在進行四項評比之後，透過預計實施時間再進行一次比較(如表 10 所示)，最終以圖 3 將綜合評分結果列為縱軸，預計實施時間為橫軸，並將左上方距離中線越遙遠之方案即最佳方案。

表 9 多標準決策矩陣(Multi-Criteria Decision Matrix)

編號	創意改良方案	便宜	簡單	省時	效果	總分	排名
	重要性	5	3	4	7	19	
1	先深呼吸再洗牌	+1	+1	+0	+0	+8	1
2	增加洗牌程序與互動時間	+1	-1	-1	+1	+5	3
3	詢問顧客心理狀況並引導之	+1	+0	-1	+0	+1	4
4	冥想洗牌靜心	+0	+0	+0	+1	+7	2
5	用可愛圖形引導	-1	+1	+0	+0	-2	5

表 10 創意改良方案預計實施時間

編號'	創意改良方案	實施時間
1	先深呼吸再洗牌	1 個月
2	增加洗牌程序與互動時間	3 個月
3	詢問顧客心理狀況並引導之	1 個月
4	冥想洗牌靜心	2 個月
5	用可愛圖形引導	2 個月

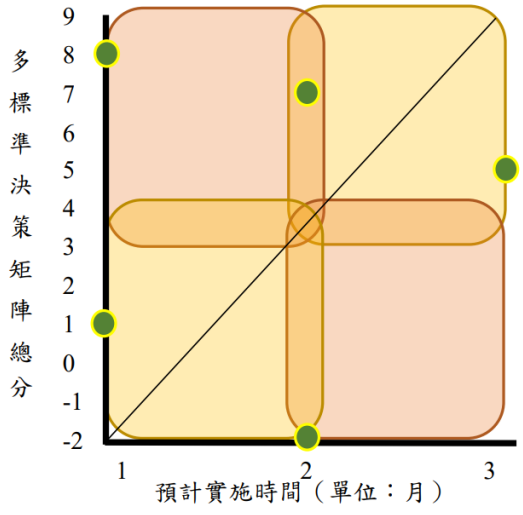

圖 3 創意改良方案條件比較圖

在結合了多標準以及預計施行時間綜合比較後，本研究繪製圖 3，並將整張圖分為四個部分，越是靠左上方的方案，即綜合得分越高且花費時間越小。最終以「先深呼吸再洗牌」及「冥想洗牌靜心」兩方案作為最佳方案。

一、 先深呼吸再洗牌

療癒師若能在進入洗牌程序，先行引導顧客進行深呼吸靜心，則將較好協助顧客進入平靜狀態，有助於降低焦慮感。然而，這同時也有需要注意的部分，首先，必須考慮到服務過程中的時間消耗，依實務經驗，本研究建議將深呼吸時間控制在三分鐘內，因為若時間太長則不利於時間控管，時間太短則效果有限。第二，則是必須營造出一個適合短時間靜心的空間，如避免周遭有過大的聲音，有鑑於目前的工作室是獨棟的，故此問題較容易控制，但若附近有施工等噪音則將增加實施難度，但因此狀況屬於偶發因此先不納入考慮。

二、 冥想洗牌靜心

以冥想的形式引導顧客進行洗牌靜心，此方案在效果上是值得期待的。首先透過閉眼冥想可以降低其他外物對顧客造成干擾，進而降低其焦慮感，第二則是冥想不只有助於為顧客進行情境營造，也能將原本既有之程序，例如當顧客猶豫不決要問甚麼問題時，可透過冥想洗牌的設計，幫助顧客釐清自身問題。

5. 結論與建議

新時代思潮進入台灣後形成了獨特的產業市場，這樣新興市場目前仍很少研究者注意到，本研究透過行動研究方法，將自身工作情境作為研究情境，且以多年實務經驗歸納出服務流程，通過商業管理萃思理論得出 5 項改良方法，並經多標準決策矩陣與實施時間評估，最終將以「洗牌前先進行深呼吸靜心」與「冥想洗牌靜心」作為優先嘗試之改良方案，在日後被使用在實務工作當中，研究者也將持續進行觀察其所帶來的效果。

本研究之研究限制條列如下：

(1)因甚少學者對新時代運動的產業面進行研究，故很難找到相關文獻。

(2)行動研究本身具有一定主觀性，未來希望能用問卷形式了解顧客端的想法。

(3)這些改良方案運用在實務工作中仍需一定調整與時間，本研究由於時間不足故難以一一嘗試。

由於此次研究是針對問題分析為主，儘管最終得到了五項改良方案，但若沒有得到應用，則無法知道其效果如何。因此，本研究期望未來能夠針對這些方

案持續行動研究，以此了解以上方案的實用性，並持續讓服務品質更臻完美。

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林明松碩士自 2017 年畢業於明新科技大學管理研究所，目前正在亞洲大學經營管理學系之新興產業類攻讀博士，現任善智全開股份有限公司董事長、台北市道士工會理事與中國玉清聖境返真靈道院院長，並具有中國二級心理諮詢師資格，研究領域包含新時代五術文化研究與行銷管

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