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Image and Signal Processing Approaches Applying in Developing Business Markets Affects Economic Growth

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Abstract: Emerging business markets gain strength through their establishment. However, as it grows stronger, there tends to be relatively less progress in science and technology. A variety of scientific and technological achievements have been introduced into business markets to address these issues, and in the process, they have undergone several modifications and driven abundant economic developments. This study explores how the application of image and signal processing methods in developing business markets impacts economic growth. This research breaks down the relevant aspects and focuses on highlighting the most significant outcomes. When expanding company marketplaces, two types of hypotheses emerge. This study concentrates on technology - based research: the first is product reduction, and the second is a manual method to check the availability of items. This research addresses both hypotheses. It introduces image processing methodologies and techniques to detect product reduction using the Retina Net algorithm and enhances them to handle numerous challenges brought on by Business Markets factors. To address these issues, this research report cites three primary technical approaches as follows. (1) The return on investment (ROI) method is used for corner selection. (2) The Retina Net algorithm is utilized to locate product reduction and misplaced products. (3) Finally, the Radio-Frequency Identification Technology (RFID) technique employs two fish algorithms to find product details. The proposed Twofish method requires 3548 Mbps, compared to the Advanced Encryption Standard (AES) with 1236 Mbps and blowfish with 2619 Mbps, all based on the values obtained in this study. As a result, the Two - fish method demonstrates superior performance to existing algorithms in terms of throughput, encryption, and decryption time parameters. Moreover, the proposed system, running on the Ubuntu 14.04 operating system, can recognize objects in 122 milliseconds or less. The results are presented as follows: the existing Dynamic Convolution Neural Network (DCNN), YOLOV3 (You Only Look Once Version 3), and Fast - RCNN (fast Region - based Convolutional Neural Networks) have average accuracies of 77%, 86%, and 88%, respectively, whereas the proposed Deep Retina Net achieved an average accuracy of 94%.This study offers actionable insights for policymakers to prioritize investments in AI and RFID infrastructure, fostering economic resilience.

Keywords: Advanced Encryption Standard (AES); business markets; radio-frequency identification technology (RFID); return on investment (ROI); twofish method

1 INTRODUCTION

Business intelligence enables monitoring customer reactions to enhance business efficiency [1]. Emotional recognition of both essential and diverse commodities can be leveraged to find the customer's reaction to make the business very big [2]. The emotion can be recognized by the method of multi-model emotion recognition [3]. Here the process of maintaining the optimization and applying the future direction can be enabled. Here the emotions can make the fusion of the feeling can be allowed based on face recognition. Also, the application of willingness and optimization enables the domain adaption for the corresponding emotion to enable several keys. This marketing-related expression can be encouraged for feature fusion, and the transformation of the future direction can be helped [4]. In the COVID-19 situation, the marketing situation of AI can maintain the decrease in intense emotion. Here the representation of the feeling can be allowed so the AI can be helped [5]. In education, emotion made the customer's quality and satisfaction based on the products decades ago. Here, to make the decision, the signal processing is done based on the face detections [6]. Some business marketing strategies are made to communicate the customer's emotions. Here the recognition of the face by signal processing can be done [7]. Based on the accuracy of the comprehensive aspects of the data collection and the computational methodology, manage the quantitative review and the tutorial style for the MER introductions [8]. Here the emotional states can be analyzed based on the marketing strategies, and emotional states can be evaluated. The signal that enables emotion classification can be found in detecting emotions [9]. This makes the business more effective and employs the focus on the customers. The natural designs of the multi-model have been evaluated. Some text transcription is also used for the different emotions to obtain effective desired feelings for the existing framework.

Business Markets lead to many significant economic developments in the current era. Thus, the development of various financial technologies plays a more critical role in the present than in the transmission era [10]. The Business Markets established in this way are strengthened as Emerging Business Markets. At the same time, it is more powerful, which makes less scientific and technological progress [11]. To overcome these shortcomings, various scientific technologies are introduced in business markets, many changes occur, and the economy in them gives many detailed answers to scientific and technological progress [12]. For this reason, the technology in such emerging business markets is essential. Considering the objective, this research paper explains how Image and Signal Processing Approaches, when used in emerging business markets, impact economic development. This research breaks down the many twists and turns every time this is explained and emphasizes only the best outputs. So, this research is designed with problem analysis for the role of image and signal processing approaches for emerging business markets as the main factor [13]. When emerging business markets are focused on technology-based research in this way, two types of problems used product reduction and manual methods to check the availability of products. When introducing specific business markets based on a certain number of city residents, issues arise in two ways. 1. People live there. 2. Assessment of essential needs of the people there. The above situation is likely to occur due to these two factors. This research addresses both the problems mentioned here [14]. As this solution to be solved depends on technology, every issue available here is a significant factor for the essential need of the people and the economic problem [15]. To solve these problems, this research introduces image processing techniques to find the reduction of products using the Retina Net algorithm and improves them to solve many problems caused by business markets factors. These advanced techniques are suitable for solving problems in merging business markets [16]. This research paper has three primary technical citations: 1st techniques ROI method used for the select corner, 2nd Retina Net algorithm used to find the product reduction and misplaced product. Finally, the 3rd RFID technology adopts two fish algorithms to find the product details. The output of the research paper obtained is used to detect frequently moved and misplaced products concerning the accurate data and to reduce manual checking.

The topics are divided in the following manner in this research paper. The background aim of the topic is shown in part 1, Introduction, literature review is presented in part 2. Processing strategies of emerging business markets in part 3 are divided into four parts, which are Process for Planogram compliance problem, Object identification using Retina Net, Product location and product count, and Signal processing method in a retail store. In the fourth part Result and Discussion is described. Finally, the Conclusion clearly explains how this research comes from a theoretical perspective.

2 LITERATURE REVIEW

In this study, deep learning has been enabled for the interpretability of the unrolling algorithm for the signal and the image processing. For the theoretical investigations, the process of elimination and the scanning of the products has been done. Here the efficient and high-performance network made the processing of the images done. Overall, 57% of retail sales in China are currently affected by digitalization, and the digital capabilities of retail enterprises will become one of the decisive factors for their future success. The new retail business model and digital transformation have achieved comprehensive customer connectivity, and can also help retail enterprises achieve a new business model based on customer big data and new retail platforms. Retail enterprises must seize the opportunity of digital transformation, perceive and outline customer profiles comprehensively through big data, perceive customer needs in a scenario-based manner, and create a digital customer experience. The registered users of domestic mobile banking exceed 1.5 billion, and the transaction scale of mobile banking is 689 million yuan. By the end of the year, mobile banking channels accounted for 57% of customers. These apps have become a new platform for the banking and retail industry, allowing customers to discard their bank cards and avoid queuing at branches, saving time and improving efficiency. They can also experience more diverse, intelligent, and convenient product services to meet the needs of users and upgrade. By 2023, various electronic payments and online transactions can be seen everywhere, and people's consumption habits are changing.

Digital technology is changing all aspects of the retail industry, from supply chain to production, sales, and marketing processes. For example, artificial intelligence technology can improve inventory management and reduce operating costs through data analysis. Intelligent warehouse systems can optimize the storage and sorting of goods, and improve delivery speed from a coordination perspective [17]. Digital transformation not only increases efficiency, but also reduces costs in multiple fields, from logistics to transportation and marketing. In traditional sales models, a large amount of personnel and time are invested in warehouse management, promotion, and marketing. However, with the digitization of processes, retail enterprises can eliminate human factors and errors that occur in various processes, and reduce the number of employees and expenses. In this way, retail enterprises can use their funds and resources for strategic and brand building, improving their core competitiveness. In the digital age, customer experience is a key element in maintaining customer loyalty and increasing sales [18]. Consumers are increasingly concerned about the convenience and personalization of shopping experiences; therefore, retail enterprises need to provide new shopping experiences that meet consumer needs through digital means. Nowadays, most consumers prefer to shop at home, and they need to be able to easily browse and find content that matches the products and services they like or need. Digital transformation can meet the needs of consumers, strengthen the connection between online and physical stores, and provide comprehensive experiences for different customers, thereby enabling retail enterprises to win the trust and support of customers [19]. Digital technology can increase brand exposure and visibility, further consolidating the brand's image. For example, retail companies can leverage digital technologies, including search engine optimization, to increase their brand recognition and recognition in the minds of consumers. In addition, retailers can attract consumers, promote brand stories, and increase loyalty through social media and e-commerce platforms, thereby creating localized or globalized brands. The application of digital technology can also help retail enterprises better manage and monitor all performance and risks, improve the accuracy of risk decision-making and operational efficiency. For example, in the product development phase, digital technology can test the effectiveness of the product, determine requirements and functions, to avoid unnecessary costs and risks. Digital transformation can also improve the network performance of global supply chains, thereby reducing transportation, quality control, and other risks. This will enable retail enterprises to better play a role in the global market and maintain a leading position in the fierce market competition environment [20]. In short, digital transformation has begun to change the retail market, changing the way consumers shop and retailers operate. Although digital technologies face some uncertainties, they provide better opportunities and tools to help retail enterprises better coordinate, expand, and integrate their businesses, and utilize data from all stages of production, sales, marketing, etc. to better manage and optimize brands and businesses.

Digital transformation refers to deepening the application of new generation information technology, stimulating the potential of data element innovation, building new capabilities to enhance the survival and development of the digital age, improving the level of digitization, networking, and intelligence, and achieving transformation, upgrading, and innovative development. China's digital economy has maintained rapid development, ranking second in the world in total for several consecutive years. The scale of the digital economy has increased from 30.20 trillion yuan in 2018 to 56.80 trillion yuan in 2023, with a compound annual growth rate of 13.04%. The scale of China's digital industry is rapidly expanding. From 2018 to 2023, the revenue of the computer, communication, and other electronic equipment manufacturing industry above designated size increased from 12.43 trillion yuan to 16.70 trillion yuan [21]. The revenue of Internet and related service industries above designated size increased from 0.87 trillion yuan to 1.63 trillion yuan. In addition, if you need financial products, you can open your phone and enter the app to check the products introduction in real time and quickly process them online. You no longer need to spend a lot of time going to branches or queuing up, promoting the development of financial services. The second is to establish an innovative strategy for the digital transformation of retail business. In this study, the image and signal processing and the photoacoustic imaging technique have deteriorated the PA image [10]. Here for the image processing, the resolution and the processing of the signal and the image has been done for the biological tissues in the high-quality images [22]. So, this is used for the output of the high-quality image for the perfect processing techniques. Based on computer vision, signal processing is used for deep learning, and the classification of the product in the business and the images from the medical sector is enabled [23]. Also, here the linguistic and communication process enables the classification of the videos and the images proposed. Based on the business analysis, the images and signal processing have been done based on the data collected in the data. Here the machine learning and the company's processing to manage the visual recognition are also done for the business analysis [24]. Support Vector Machine (SVM) is one technique that handles deep learning and evolution methods for recent trends. Based on the outlook, signal processing and deep learning are used for industry analysis. Here the signal processing is done for the analysis. Here in the company, digital signal processing has been enabled for the modern digital age for processing big data and deep learning-related factors. Using the prediction, the high order and the time series-related market enables the big data and the stock market to produce the trend prediction based on the market utilities [25]. Nowadays, the time series is related to the stock market to enable this in the marketing analysis. This study uses performance analysis to process the signals and the technologies. Here the S-curve model enables the technologies, and the technology can be processed.

3 PROCESSING STRATEGIES OF EMERGING BUSINESS MARKETS

Business is one of the essential roles in this world. First, they produce goods and services to satisfy our requirements and wishes. Then, they also recruit households as labourers and provide them with compensation, such as wages, salaries, and benefits. The business people also get profit from their business markets [26]. In this category departmental store is one of the essential matters of life because it has all people's basic needs. Hence, profit depends upon goods' availability and quality. Sometimes, a lack of availability of goods or the improper positioning of products on the shelves of a retail store can result in a loss of sales to a retailer [3]. In this paper, we use one of the image processing techniques of retina Net to detect object which is not available in their places, which also detect which product is in misdirection. It will reduce the manual method of checking product availability, and it is also used to help gain more profit. Our research provides occupancy computation, product location, and product count (Fig. 1).

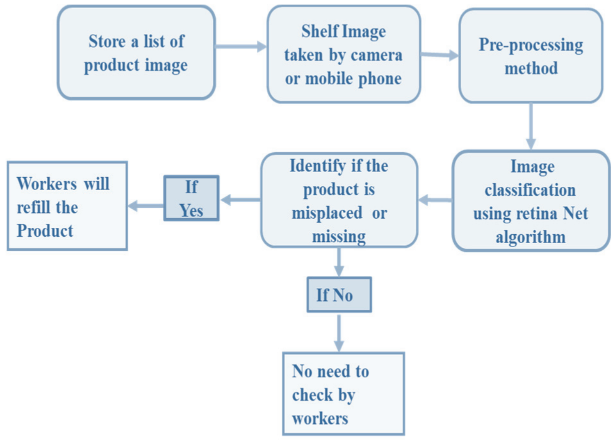

Figure 1 Workflow of image with signal processing using business markets

3.1 Process for Planogram Compliance Problem

The availability of retail items on shelves is shown by the planogram as a convenience to customers. Maximum sales and more profit are the consequences. The procedure is divided into three modules: product location, product count, and occupancy computation. The process starts with image acquisition, and then we use region of interest (ROI) to process corner selection [27]. The ROI method selects the corners of the input image (captured via smart phone or camera) and transfers them through a network. The availability of the product list images is already stored as data in the monitor for reference. ROI's first step is perspective distortion rectification of example images, which are captured by a smart phone or camera. This can avoid misjudgment caused by distortion. Using the touch screen, the user chooses the corners of the shelf picture [28]. By giving bounding boxes with (a, b) coordinates and the dimensions of width and height, you may calculate the ROI in the shelf picture. The shelf picture cropped by ROI used the monitoring process to include the pertinent empty corner image. In addition to extracting the contour, the Sobel operator also produces gradients [29]. The remaining pixels are set to zero since the ROI increase for every pixel is more than or equal to the threshold. The ROI gradient is then used to determine the ROI mean value. Thus, thresholding is preferred. Additionally, our method gives additional importance to pixel values near the ROI's center.

$$W(a, b)=\frac{\sqrt{R^2-\left(a-a_0\right)^2-\left(b-b_0\right)^2}}{R} \tag{1}$$

In Eq. (1), Radius of the circular ROI; a, b: Pixel coordinates.a_0 and b_0: Center coordinates of the ROI. The ROI mean values are kept in a circular buffer during TRR collection. The TRR collection process can correct motion artifacts and reduce misjudgments caused by artifacts. As soon as the circular buffer is filled, RR may be calculated. If no BB is received from the ROI Tracking module for duration longer than T, the circular buffer is emptied. If not, a linear interpolation is carried out between the current value and the last remembered value in the circular buffer. You may calculate the signal frequency using linear interpolation without biassing the results.

3.2 Data Sources

According to the analysis of the Trax BI platform, in the latest evaluation of a series of products by a large chain retailer, a certain brand found that their shelf shares in various stores had dropped from 70% to 40%. The brand retail management team has decided to evaluate their shelf execution in order to discover how shelf execution affects their sales.

Peudocode for ROI method
Input: Supermarket shelf Image-Img, C_{buffer}-Circular buffer
Capture Img
ROI_Img←crop (Img, Boundingbox)
for all pixels in Img do
ROI_{Grad}← S (ROI_Img)
Mean←Mean(ROI_{Grad}, Threshold)
if ($ROI_{Grad} \geq 0$), then
Compute center of the ROIas W(a,b)
interpolate (C_{buffer}, Mean)
end if
add (C_{buffer}, Mean)
end for

Pre-processing methods are employed to rectify perspective distortion in the image. Specifically, we encounter scenarios where they are missing products while computing the occupancy, i.e., the empty front portion in shelf rows and misplaced products (Fig. 2). In order to improve the utilization rate of warehouse space, many enterprises hope to design a suitable shelf layout scheme. Whether from the ventilation lighting, or from the placement of goods, the rationality of the shelf layout has a great influence. However, sometimes, the Planogram compliance of enterprises will encounter some problems, and eventually lead to low utilization of warehouse space.

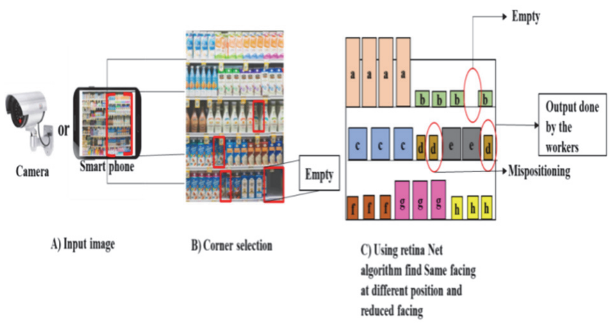

Figure 2 Process flow for Planogram compliance problem

3.3 Object Identification of Retina Net is Shown as Follows

This article uses the Deep Retina Net algorithm to measure advertising processing speed. Compared to traditional single-stage detectors, Retina Net combines the accuracy of two-stage detectors with the speed advantage of single-stage detectors, allowing for fast image processing while maintaining high accuracy. Retina has been designed and developed as a highly versatile, adaptable, and scalable plug-in framework that can seamlessly collaborate with any CNI, operating system, or cloud provider, making it a valuable addition to any existing toolset. Retina supports Linux and Windows data planes, ensuring it meets the various needs of infrastructure and site reliability engineers while maintaining minimal memory and CPU usage on the cluster - even in large-scale situations. Retina's pluggable design philosophy helps us easily expand and adapt to new use cases without relying on any specific CNI, operating system, or data plane.

The Retina Net technique, a one-stage object detection model, is used in the suggested approach. We extract the various rows of the product shelf using this method. Row identification reduces computation error and speeds up computation overall. Our strategy focuses on precise row detection with the Retina Net technique (Garg and Kumar 2015) [30]. With the help of retinal image processing technology, information such as the size, position and shape of the fundus structure can be accurately measured, and the corresponding treatment plan can be formulated according to this information. Our approach is based on the Retina Net architecture, which also employs anchor notions. Pyramids are utilized by SSD and FPN, and it is introduced by RPN. For backbone networks, Retina Net is a single-stage network, while for subnetworks, it is a two-stage network. The single-stage backbone network adopts a pre-built CNN (Convolutional Neural Network) to extract feature maps from the whole picture. The first subnet is used to perform convolutional object classification on these characteristics after the backbone network has removed features from the picture.

The picture has already determined the bounding box. We employed a second network to do regression on the output of the backbone since it is a regression challenge. Small-size objects cannot be detected by the anchor configurations, including anchor size, aspect ratios, and scales. When small object identification is required, the crow search method is used to find little items on the product shelf [14]. However, we look for the best proportions and sizes of anchors on the training set using the Crow Search Algorithm (CSA). The crows are intelligent and have different communication methods, strong senses, and face recognition abilities performed according to the requirements [13]. The behavior of crows is to find food and then hide excess food position called memory, which is taken out when needed, and steal the food from others by tracking another crow. The same technique is applied here, and the grocery products are stored as stocks when the products are sold, which means the product's shelves are empty. That time, the products are refilled using the CSA algorithm. Assume the n number of products in the retail market with their location position as

$$Ak, Itr = (k = 1, 2, \dots, n) \quad (2)$$

$$itr = (1, 2, \dots, Itr\ MAX) \quad (3)$$

where,

$$Ak, Itr = (Ak, Itr(1), Ak, Itr(2), \dots, Ak, Itr(\mathrm{d})) \quad (4)$$

When the product is sold, the product is taken from the stocks/memory. Each process is denoted as an iteration *Itr*, and the maximum iteration is distinguished as Itr_{MAX}. Case 1 - when product '*i*' is sold that time product '*k*' observes it. As a result, product '*k*' locates the position of product '*i*', and the position of product '*k*' changes from its previous position in the stocks as follows.

$$Ak, It\,r+1 = Ak, Itr + Rk \times L(p)k, Itr \times (Pi, Itr - Ak, Itr) \quad (5)$$

Rk represents the uniform distribution between the value of 0 and 1, then *L*(*p*) denotes the length of the product. Case 2 - product '*i*' gets aware that product '*k*' is hiding, so development '*i*' starts moving to another search space location. Hence the equation for the observation is as follows:

$$Ak, Itr+1 = \begin{matrix} \{A_{k,Itr} \times R_k \times L(p)_{k,Itr} \left(P_{i,Itr} - A_{k,Itr}\right), \\ Rk \geq AP_{i,Itr})\text{Random Position, Otherwise} \end{matrix} \quad (6)$$

where the $AP_{k,Itr}$ denotes the awareness probability of a product *i*.

3.4 Crow Algorithm

One of the clever behaviors of crows is to hide excess food in specific hiding places and recall the location of the food when needed. In addition, crows have a greedy habit of following other crows to find their hiding places for food. If a crow finds another crow's hiding place, it will steal the hidden food. The Crow Search Algorithm (CSA) provides an effective way to solve optimization problems by imitating this behavior.

In CSA, the position of the i-th crow is represented by vector $x_{i,iter}\left(i=1, 2, ..., N; iter=1, 2, ..., iter_{\max}\right)$, $x_{i,iter} = x1_{i,iter} x2_{i,iter}, ..., xd_{i,iter}$. $iter_{\max}$ is the maximum number of iterations. *d* is the dimension of the decision variable. Every crow has its best hiding place in memory.

The algorithm steps are as follows:

1) Initialize parameters. Define decision variables, set the number of crows, and the maximum number of iterations $iter_{\max}$, Flight distance (*fl*) and perception probability (*AP*).

2) Initialize the position and memory of the crow. N NN crows are randomly distributed in a $d4 dimensional search space. In the first iteration, it is assumed that the crow hides the food in its initial position.

3) Evaluate the fitness (objective) function. This paper calculates the objective function value for each crow.

4) Update the crow's location. It generates a new position according to Eq. (1).

5) Feasibility of detecting new locations. Feasibility of detecting the new location of each crow. If the new location of the crow is feasible, the crow will update its position. Otherwise, the crow stays in its current position and will not move to a new position.

6) Evaluate the fitness function for the new location. Calculate the fitness function value for each crow's new position.

7) Update memory. If the fitness function value of a crow's new position is better than the fitness function value of its memory position, the crow updates its memory through the new position.

8) Iteration termination condition. Repeat steps 4), 7) until the maximum number of iterations is reached. When the termination condition is met, output the position corresponding to the optimal objective function value.

```
Pseudocode for Crow search Algorithm
Initialise: Ak, Itrϵk=(1-n)
Evaluate product stocks
Memorize products in stocks
set: AP
while itr<ItrMAX
for each kϵ(1-n) do
        choose one product
if (Rk ≥ AP_{i,Itr} )then
Ak, Itr+1= Ak, Itr×Rk×L (p)k,Itr (P i,Itr- Ak,Itr)
then
Ak, Itr+1 as random_position
end if
estimate the best position of the product
update stocks
Ak, Itr+1= Ak,Itr + Rk* L(p) k,Itr *(P i,Itr- Ak,Itr)
end for
end while
return, the best solution
```

To maximise the overlapping area between the bounding box and the anchor, our major objective is to find the ideal anchor settings for scales and three ratios. For reducing the search space, the ratios are set in accordance with the concept of scale, defining additional ratios as reciprocal pairs (e.g., 1:*X* or *X*:1). This enables to get scales and ratios that are appropriate for the size and huge ratios of the items. Now that the anchor sizes have been altered, the detector is trained using these optimal configurations.

3.5 Product Location and Product Count

After the configuration detection, the following process is to detect the product count and its location concerning its parameters. In current retail marketing, there are a lot of similar products with slight differences. Our Retina Net algorithm finds the text, color as well as the extra availability of the template to determine the exact product place and count. The backbone network: The top-down and bottom-up pathways make up the backbone networks. The feature extraction is detected using a bottom-up approach like Res Net. Therefore, regardless of the size of the input picture, it calculates the feature maps at various scales. The spatially coarser feature maps from higher pyramid levels are sampled via the top-down route. With the same spatial dimension, the lateral connections combine the top-down and bottom-up layers. The resolution of the higher-level feature maps is quite low. They are still better at identifying bigger objects and are more semantically robust [31]. Low-level feature maps are utilized to find tiny items since they have high resolution. The image or display device has more pixels, higher image quality, and better clarity. As a result, its lateral linkages do not require additional calculation because of the mix of top-down and bottom-up routes. The semantic and spatial complexity of feature maps is high at every level. Both the accuracy and speed of these characteristics may be improved. Sub-network for object regression and object classification: Utilized in the object categorization sub-network is the feature pyramid network (FPN). A fully convolutional network is attached for object categorization at every level of the feature pyramid network.

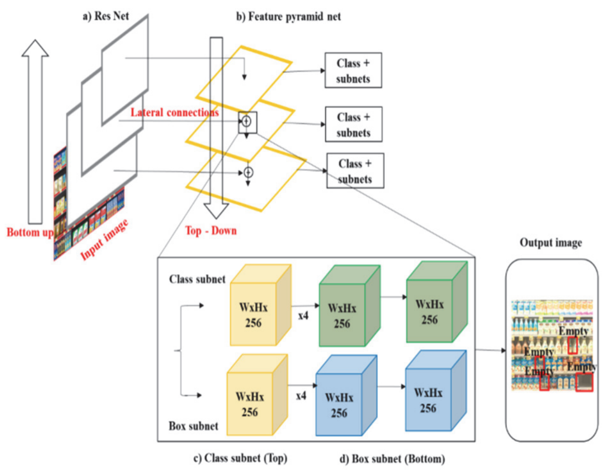

Figure 3 Working on Object detection using Retina Net

In Fig. 3, the object detection subnetwork contains 256 filters and 3 × 3 convolutional layers. Following this coordination, $K \times A$ filters are used to coordinate another 3 × 3 convolutional layer. The size of the output feature map is, therefore, $W \times H \times KA$, where W and H are proportional to the input feature map's width and height. Then, K & A filters each have several object classes and anchor boxes. The Sigmoid layer has finally been applied by researchers to classify objects. Parallel to the classification subnetwork, the regression subnetwork is connected to each feature map of the Feature Pyramid Network. Except for the last 3 × 3 convolutional layer with 4 filters, the regression sub-architecture net is identical to that of the classification sub-net. This results in an output feature map that is $W \times H \times 4A$ in size. In order to localise the class objects, the preceding convolution layer used four filters, such as: Noise filtering. For each anchor box, the regression sub-network generates four integers that indicate the relative offset between the anchor box and the ground truth box, such as the center coordinates, width, and height. Consequently, the $4A$ filters or channels are present in the sub-network regression's output feature map.

```
Pseudocode for Object detection using Retina Net
Input: PL- count of pyramid levels, SL- size interval for the pyramid levels, T-threshold, G-ground truth
For each level jϵ [1-L], do
if S(G) ϵSLj then
Location in G as positive Samples
Location beyond G as negative Samples
end if
set: classification and focal_loss
compute Class score
Classscore= classification * focal_loss
compute cross-entropy loss
if (γ ≥ = 0) then
cross-entropy loss=(1−pt) γ
α-balanced variant of the focal loss
end if
for γϵ [0,5] do
if (α=0.25 and γ=2) then
compute focal loss
FL (p <em> t) = −α < /em> t (1 – p <em> t) γ ln (p < /em> t)
end if
end for
if training do
calculate IoU loss
calculate Computation loss
update weights of the network
end if
if (Classscore>t) then
choose boxes as output
end if
end for
output: Focal loss
```

Every sample image output is weighted according to its error. In the Retina Net algorithm, we used the Focal loss method for addressing the class in balance during object detection. When it is necessary to give extra weights to complicated or easily misclassified samples, such as backgrounds with noisy textures or incomplete objects, it is an upgraded form of Cross-Entropy Loss (CE). If you use focal loss as a loss function, you need to configure α and γ for each category so that the task of tuning is relatively large. In actual business, rather than adjust γ to make the model focus on difficult cases, it is better to construct more similar samples, which will be relatively efficient. Another simple example of down-weighting is background objects. Therefore, focal loss lessens the loss contribution from the cases, which highlights the significance of correctly classifying data [12]. The cross-entropy loss function, which would down-weight simple instances and concentrate training on difficult negatives, is only made more accessible by focal loss. Therefore, researchers suggested that the cross-entropy loss be reduced by (1 pt), with a tuneable focusing parameter set to $\gamma \geq = 0$. The optimal values of the focal loss used by the Retina Net object identification algorithm are α = 0.25 and γ = 2. The focus loss can therefore be described as follows.

$$FL(pt) = -\alphat(1-pt)\gamma \ln(pt) \quad (7)$$

The focal loss is projected for several values of $\gamma \epsilon$ [0, 5]. When the IoU (Intersection over Union) is between [0, 0.4] and the threshold is 0.5, an anchor is chosen to ground-truth object boxes. During training, the anchor is not allocated if the IoU is between [0.4, 0.5]. In accordance with this, the anchors must be installed in at least one object box. When no assignment is made, the offset between the anchor and the allocated object box is used to compute the box regression. Therefore, for each of the anchors and object classes, the classification subnet forecasts the likelihood of an item's presence at each geographic point.

3.6 Signal Processing Method in a Retail Store

The signal processing method is one of the growing technologies in the current modern world. It is used in various industries like communication, signal, speech processing, and RADAR for compressing sensed data and recognizing meaningful patterns from recorded data. In this proposed system, we used Radio-Frequency Identification Technology (RFID) to identify retail store items using radio waves [32]. RFID is a wireless technology that provides precise, real-time inventory monitoring data by transmitting data from an RFID tag to a reader. Retailers can automate their inventory data with RFID technology, increase accuracy by 30%, and cut down on out-of-stock situations by 50%. RFID changes the retail environment in ways including logistical fulfilment, inventory management, and streamlined product information. It consists of two primary components: retail shop readers and tags. In this case, the reader is a machine equipped with one or more antennae for transmitting and receiving RFID signals. These tags employ radio waves to transmit their data to adjacent readers, where they store a serial number or collection of data. Automatic Identification and Data Capture (AIDC) is a category of technologies that includes RFID. We use AIDC tools to identify items, collect data about them, and send that data to a computer system with little human interaction. For retailers that need to track stock accuracy, an RFID system that integrates with your inventory can increase efficiencies significantly. You can use it to improve inventory accuracy and visibility to create better shopping experiences for today's Omni channel shoppers.

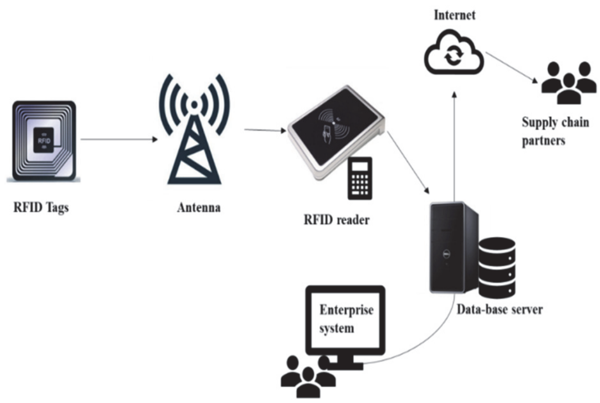

Figure 4 RFID-based tags reading

RFID is used to increase stock accuracy in retail stores. The standard retail inventory process is still in the method of manual and time-consuming. RFID allows us to check individual product scanning, bill receipt reading, and shipments (Fig. 4) instantly and accurately.

3.7 Working of RFID

For text encryption, this RFID technique makes use of the Two Fish algorithm. This paper adopts two fish to perform data encryption processing in terms of throughput, encryption, and decryption time parameters. Two Fish does not limit the output length for applications, but each group of plain texts is 128 bits. The key length can be one of 128, 192, or 256. When the length of the plaintext grouping does not meet the grouping requirements, the user agreed filling algorithm can be used, and the county filling rule can refer to the DES document. When the key length does not meet the requirements, fill in 0 until the first requirement is met, and then stop filling. For example, if the key length is 150 bits when it is not filled, fill in 0 until the key length is 192 instead of 256. The iconic feature of the Pisces algorithm is its use of key related replacement boxes (S-boxes). Half of the key input bits are used to orchestrate the "real" encryption process and serve as Feistel's round key, while the other half is used to modify the S-box used by the algorithm. The key arrangement of the Pisces algorithm is very complex. An antenna, a transceiver, and a transponder make up RFID (tag). The retail store's data is encoded using the tag. Antenna and transceiver integration is required, as well as permanent and portable RFID readers. Only a few readers are placed, and mobile readers may be transported anywhere. Information is saved on an RFID tag and connected to any item in the shop during the initial procedure [33]. The signal is sent by a nearby transponder and is received by an antenna. The product information contained in a transponder is obtained by an RFID reader that is wirelessly connected to the antenna. The data is subsequently sent from the RFID reader to a database, where it is assessed and saved. Here, tags are divided into two categories: active tags and passive tags. With their power supply, active tags have a reading range of up to 100 meters. Companies that need to optimize their logistics or locate assets employ active tags. Unlike active tags, passive tags do not have a power source. These tags receive electromagnetic energy from a scanner that extends about 25 meters. RFID technology can therefore track frequently moved and lost objects in retail stores.

4 RESULT

In this section, we estimate object recognition using two-dimensional digital images of a commercial market. The performance of the proposed method is evaluated using various measures such as precision-recall curve, average precision, and F1 step. This experiment is implemented using the Deep Retina Net framework and performed on an intel core i7 CPU with the Ubuntu 14.04 operating system and 6 GB GeForce GTX 1060 GPU, and 16 GB random access memory. The effectiveness of our proposed Deep Retina Net is verified using various measures, namely, precision, recall, f-measure, *IoU*, and *mAP*. Precision (P) measures the fraction of accurate positive detections, and Recall (R) measures the fraction of correctly identified positives. These are defined as follows.

$$P = \frac{True\,Positive}{True\,Positive + False\,Positive} \tag{8}$$

$$R = \frac{True\,Positive}{True\,Positive + False\,Negative} \tag{9}$$

The $F1$ score combines precision and recall metrics into a single measure for a comprehensive evaluation of the quality of an object detection method, and it is defined as follows.

$$F1\text{-}Measure = \frac{2\left(P \times R\right)}{P + R} \tag{10}$$

Table 1 Results of various detection methods performance analysis

Methods	Detection Performance Measures		
	Precision / %	Recall / %	F-measure / %
DCNN	74.04	78.43	76.17
YOLOV3	76.23	84.93	80.34
Fast-R-CNN	78.16	88.32	82.92
Proposed Deep Retina Net	89.92	92.45	91.16

Tab. 1 shows the performance of the proposed system with various types of object detection/recognition methods with the computation of performance measures. The technique has the highest detection speed due to the simple infrastructure but has a lower precision rate than the Fast RCNN and Proposed Deep Retina Net method.

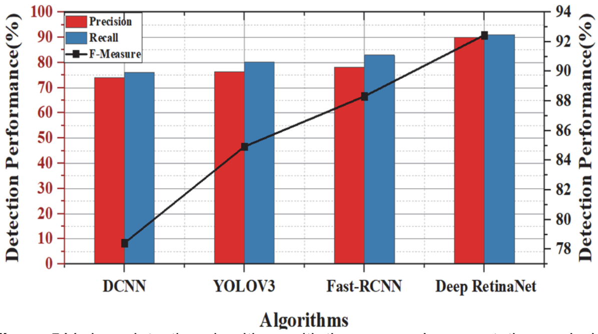

Figure 5 Various detection algorithms with the measure's computation analysis

Fig. 5 illustrates the precision, recall, and $F1$-score percentages of various object detection techniques such as DCNN, YOLOV3 and Fast RCNN on datasets. The area measures the average precision metric under the precision-recall curve. The higher the average accuracy value, the better the proposed system's performance. The Proposed Deep Retina Net approach has a higher recall value than the DCNN, YOLOV3 and Fast RCNN.

$$mAP=\frac{1}{C}\sum_{i=k}^{n}P(I)R(I) \tag{11}$$

The accuracy of the proposed method needs to be estimated. For each condition, *mAP* and input image processing speed is calculated based on penalty factors tracked in Tab. 2. where n represents the total number of frames.

Table 2 *mAP* and Processing speed for the penalty factor result

Penalty factor	*mAP* / %	Processing Speed (ms/Image)
0	78.54	97
10	82.46	84
20	82.94	86
50	83.26	78
100	84.04	66
200	83.24	70
500	82.16	62

Fig. 6 shows the proposed system's *mAP* and processing image speed by varying penalty factors. The *mAP* value tends to be the highest, and the processing speed is also met in the penalty factor range of 100. When the penalty factor is 0, the processing speed of the image is higher at 97 (ms/Image). Similarly, when the penalty factor has increased up to 500, the image processing speed tends to decrease and reach 62 (ms/Image) speed. As previously said, when the penalty factor is taken as 100, that time, the *mAP* of the proposed system reaches the highest value. According to this, the penalty factor is indirectly proportional to the processing speed, and processing speed is indirectly proportional to the *mAP* value.

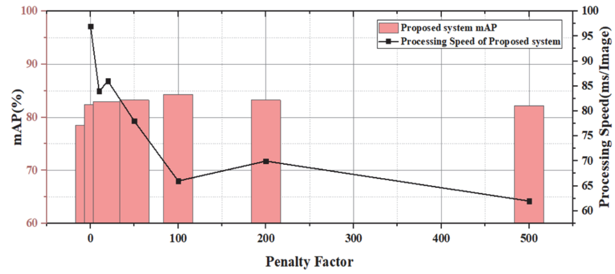

Figure 6 Analysis of *mAP* and processing speed of the proposed method

Generally, deep learning algorithms have strong advantages, such as faster speed of image processing and high accuracy. Digital image processing can detect multi-class objects in *mAP* images with poor foreground by Image denoising and orthogonal transform technology. It is the same as other machine learning methods. All the methods mentioned above can manually adjust parameters, so they are not suitable for mass data analysis. This paper presents the comparative results to do the performance research of the proposed Deep Retina Net in all other CNN-based deep learning algorithms.

Table 3 Result of various *mAP* (%) with respective Processing Speed (ms/Image) detection

Methods	Performance Measures	
	mAP / %	Processing Speed(ms/Image)
DCNN	76.54	55
YOLOV3	79.40	69
Fast-R-CNN	80.14	76
Proposed Deep Retina Net	88.62	45

Fig. 7 shows a *mAP* ad processing speed measures comparison between the proposed and existing object detection algorithms. The proposed improved multi-class object detection method based on Deep Retina Net outperforms existing methods. When the evaluation results are compared with the ground truth data, DCNN is found to have the lowest performance among the four methods. The proposed faster recognition algorithms R-CNN, Fast RCNN, and YOLOv3 outperform DCNN.

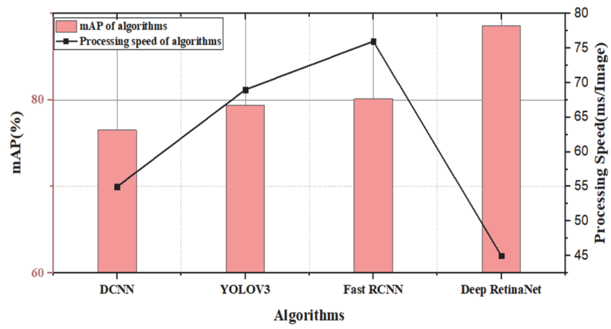

Figure 7 Detection performance comparison of various methods based on *mAP* and processing speed

The proposed faster R-CNN algorithms are the most efficient in terms of detection. They can accurately detect these components, even if they are minimal. Tab. 3 also shows the cumulative computational performance of these four algorithms. The detection accuracy of the faster R-CNN is higher [34]. The Proposed Deep Retina Net has a better object recognition effect in images. The YOLO algorithm cannot be applied to small targets. YOLO does not handle small targets well, because it relies on the camera to obtain pictures, and the target is too small, and the camera is prone to distortion. Although DCNN has good detection performance, its processing speed is the slowest of all convolutional neural methodologies. It also requires a larger sample space from the test, so it cannot meet the computation requirement for future online detection. Experimental results show that the improved Faster R-CNN algorithm is suitable for single-object recognition and multi-class object detection with high accuracy and can be used in a set-collecting robot.

Table 4 Average detection precision of various objects by detection methods

Methods	Average Precision of Detection / %		
	Small Obj	Medium Obj	Larger Obj
DCNN	18.20	36.34	46.32
YOLOV3	12.35	34.3	48.23
Fast-R-CNN	7.34	29.45	36.32
Proposed Deep Retina Net	21.60	38.92	49.21

The objects in the images are categorized into three parts, small, medium, and more significant, based on the proportion of the things in the image. The detection of average precision over the various detection algorithms is stated in Tab. 4.

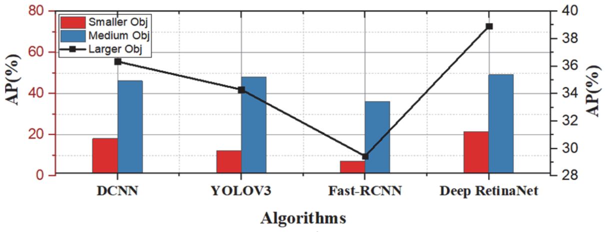

Figure 8 Average precision of various detection Methods

Fig. 8 shows object detection among the small, medium, and higher objects. The comparison of other methods with our proposed system is 3.6% greater in small object detection and 0.9 % greater in medium object detection. Also, our proposed method is 4.6% greater in more extensive object detection. From the result, the standard outputs of a detector applied to a testing image I denote the predicted detections that are indexed by the object of Bounding Box, that are regarded as a True Positive (TP) if the expected category equals the ground truth label c^g and the overlap ratio IOU (Intersection Over Union). The mean AP (*mAP*) averaged over all object categories is adopted as the final measure of performance to compare performance overall object categories.

$$IoU = \frac{Area\left(b \cap b^g\right)}{Area\left(b \cap b^g\right)} \tag{12}$$

The predicted bounding box and the ground truth (bg). Tab. 5 is not smaller than a predefined threshold where the ∩ cup denotes the intersection and union, respectively. We assume the possibility of *IoU* as 0.5 and 0.95 for detection methods.

With the vigorous promotion and implementation of cost structure optimization in other industries, retailers can gain confidence and courage to succeed from the intermediate level, but still need to broaden their horizons. Under the existing business model, adopting algorithm optimized image recognition methods for cost reduction cannot achieve significant cost savings. On the contrary, retailers need to think about cost reduction from the source, completely abandoning the concept of "traditional models" and adopting a cost reduction transformation method from scratch, focusing on the true needs of customers. The proposed detection framework makes large-scale input images available, which is essential to detection accuracy. Fig. 9 depicts the various algorithms' *mAP* (%) values based on the intersection and overlap values. On the *IoU* of 0.5 and 0.95, our proposed system has the best image object detection achieving 72% and 50% *mAP*, respectively.

Table 5 Detection of *mAP* results of various methods

Methods	Detection *mAP*	
	IoU 0.5	*IoU* 0.95
DCNN	0.20	0.36
YOLOV3	0.25	0.43
Fast-R-CNN	0.37	0.59
Proposed Deep Retina Net	0.50	0.72

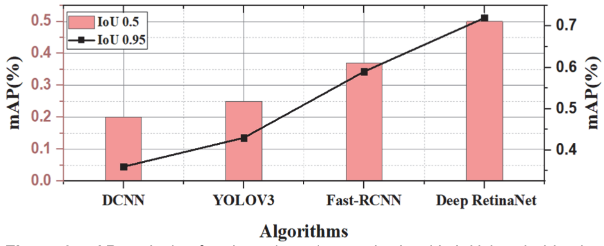

Figure 9 *mAP* analysis of various detection methods with *IoU* threshold value

The use of ensembles of multiple models, incorporating context features and data augmentation improves accuracy. The improvements focused on performance, such as speed and the Deep Retina Net, to achieve a better balance of effectiveness and efficiency, exceeding, and so on [35]. The Proposed Deep Retina Net architecture is a foundation, introducing many features such as nearest interpolation and reducing computation costs. The accuracy and speed of the various detection methods are calculated and observed in Tab. 6.

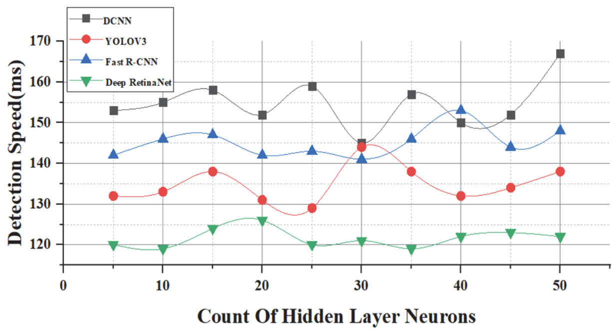

Figure 10 Detection speed of various DCNN, YOLOV3, and Fast-RCNN with Proposed Deep Retina Net Methods with Object Detection Methods

The YOLOV3 is more straightforward but less accurate than the Retina Net. At the same time, the detection accuracy of the proposed Deep Retina Net algorithm has the most significant increase for object detection. The proposed Deep Retina Net has an average accuracy of 94%, and the existing DCNN, YOLOV3, and

Fast-RCNN have an average accuracy of 77%, 86%, and 88%, respectively.

Table 6 Performance Measure Analysis of Existing DCNN, YOLOV3, Fast-RCNN with Proposed Deep Retina Net Methods

Count of hidden layer Neurons	Detection Accuracy and speed of the various methods							
	DCNN		YOLOV3		Fast-R-CNN		Proposed Deep Retina Net	
	Accuracy / %	Speed / ms	Accuracy / %	Speed / ms	Accuracy / %	Speed / ms	Accuracy / %	Speed / ms
5	64	153	75	132	76	142	84	120
10	69	155	77	133	79	146	85	119
15	71	158	81	134	83	147	86	124
20	74	152	84	131	85	142	88	126
25	75	159	86	129	83	143	90	120
30	72	155	84	134	79	141	89	121
35	71	157	81	138	85	146	89	119
40	69	153	79	132	84	153	90	122
45	73	152	84	134	86	144	92	123
50	75	167	86	138	89	148	94	122

Fig. 10 compares the detection time of the four detection algorithms under different counts of hidden layer neurons. From the graph, the proposed algorithm has the best detection speed compared with the other existing methods. The accuracy and detection speed depend on the FPN, ResNet, and image pixel of the proposed Deep Retina Net. In particular, the proposed system detects objects at approximately 122 ms. The existing methods see the things in 146 ms, 137 ms, and 165 ms of Fast-RCNN, YOLOV3, and DCNN, respectively. From this result, the proposed method is 24ms faster than the Fast-RCNN, 15ms shorter than the YOLOV3 and 43 ms quicker than the DCNN method.

Table 7 Comparison results of text encryption algorithms

Algorithms	Encryption Time / ms	Decryption Time / ms	Throughput / Mbps
AES	8.8	7.5	1236
Blowfish	4.3	4.8	2619
Twofish	3.2	4.0	3548

In signal processing, the RFID tag encodes the retail store's data. This RFID uses the Twofish algorithm for text encryption, derived from the Blowfish algorithm. The performance of the Twofish algorithm is estimated based on three measures: encryption time, decryption time, and throughput for analyzing the system's performance. The estimated values are stored in Tab. 7.

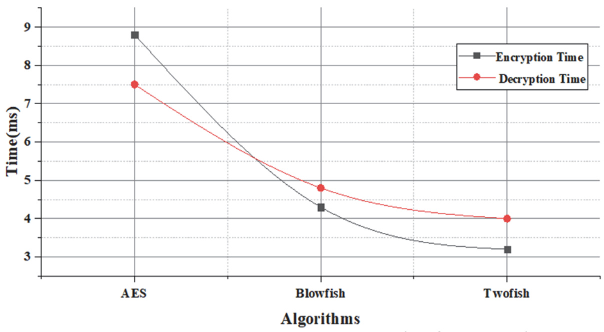

Figure 11 The encryption and decryption time of AES and Blowfish with proposed TwoFish algorithms

The encryption and decryption time of the AES, Blowfish, and Proposed Twofish method is shown in Fig. 11. That offers the efficiency of the processes, and it is measured in milliseconds. The encryption time is defined as the time taken to convert the plaintext into cipher text. The AES algorithm has.

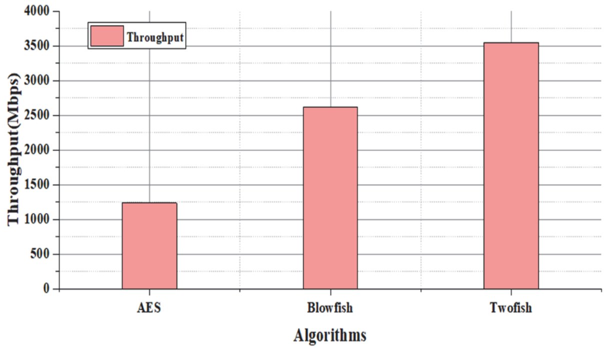

Figure 12 Throughput of AES and Blowfish with proposed TwoFish algorithms

The various methods of throughput are shown in Fig. 12. Generally, the throughput is defined as megabytes of the encryption or decryption of text per millisecond using algorithms. It is denoted in terms of Mbps and shows the system's efficiency. When the throughput is higher, the system performance is also higher. From the observance of Fig. 12, the proposed Twofish algorithm uses 35488 Mbps, and AES has 1236 Mbps. Blowfish has 2619 Mbps. As a result, our proposed two fish have advantages over throughput, encryption, and decryption time metrics, so the performance of the Twofish is better than the existing algorithms.

5 DISCUSSION

According to McKinsey Global Institute (2023), digital transformation is projected to contribute 0.5% to global GDP by 2030, driven by efficiency gains in sectors like retail. The simulation results of the total and net impacts of digital transformation on GDP and labor market in this article indicate the growth of about 13 trillion US dollars compared to today. This will be the incremental value created in addition to the current global output. This simulation includes: the digital transformation will drive the GDP growth to increase by 26%, and the costs associated with the transition to these technologies (such as labor transfer) and their implementation (such as the deployment of digital transformation solutions), as well as the negative externalities of the economic activity baseline (such as the loss of consumption during unemployment). These factors combined, the average annual net contribution from now to 2030 is approximately 1.2% of economic activity growth. If this situation can be realized, the impact on the economy will be enormous. As for steam engines, it is estimated that they increased productivity by 0.3% annually between 1850 and 1910. Research has found that the introduction of robots in the manufacturing industry and information technology account for 0.4% and 0.6% of annual productivity growth, respectively. Recent estimates indicate that the productivity impact of information and communication technology (ICT) and early digital technologies such as broadband was 0.6% per year in 2000. The value-added and substitution of inputs, as well as additional innovative outputs, generate new economic activities and productivity benefits, which researchers tend to use as indicators to measure the impact of digital transformation on the economy. However, in order to gain a more comprehensive understanding of the economic impact, other factors need to be considered. For example, the use of digital transformation tools and technologies can promote global mobility between countries and facilitate more effective cross-border trade. In this regard, countries with closer connections and greater participation in global mobility will clearly benefit more from digital transformation. The income from economic activities can be reinvested and continue to generate growth.

The share of digital transformation in direct transactions such as knowledge and information exchange, as well as retail, is greater than in the past. These data streams have brought substantial growth to globally interconnected and digitally advanced economies. In previous studies, MGI estimates that global data flow will drive approximately 3% of global GDP growth annually in 2024. This discovery suggests that by 2030, digital and data flows may contribute approximately 7% to GDP growth compared to today. We have simulated that the proportion of digital transformation in the contribution of data and data flow may reach up to 20%, and by 2030, compared to today, the impact may be as high as 1.5%.

Digital transformation can promote datal flow in two ways. Firstly, by promoting more effective cross-border trade. About one-third of digital transformation flows are related to cross-border e-commerce, and 30% to 40% of digital commerce may be attributed to digital transformation technologies. Some people estimate that recommendation engines based on digital transformation contribute 30% to 40% of sales among leading e-commerce participants. If we apply the ratio of companies adopting and absorbing digital transformation by 2030 about 50% digital transformation may contribute 5% to 10% of the value created by the digital transformation flow or promote GDP growth of about 0.5% by 2030 compared to today. For example, digital transformation can also promote global trade by improving supply chain efficiency and reducing complexity related to global contracts, classifications, and trade compliance. Based on Montreal's 3CE, a major source of supply chain friction is addressed through the deployment of natural language processing, which automatically identifies and correctly classifies trade goods based on customs commodity classification (for example, the correct classification for manually labeled "baby food" is "homogeneous composite food formulations"). The improvement of transparency and supply chain efficiency can help enterprises obtain better trade financing and reduce bank concerns about compliance risks. Banks can use digital transformation technology to review trade documents, classify and label them correctly, and analyze risks in a less labor-intensive manner. The digital transformation flow has promoted cross-border trade, but digital transformation can make this trade more effective. For example, the global e-commerce platform Wish uses machine learning algorithms to connect billions of businesses and consumers worldwide with target advertisements. This had an explosive impact on the volume of goods imported from China by Sweden in a very short period from 2016 to 2017, this volume increased by 65% in one year. Due to the benefits of digital transformation in improving economic productivity, the output brought about by efficiency improvement and innovation can be transmitted to workers in the form of wages, as well as to entrepreneurs and businesses in the form of profits. The wealth generation brought about by digital transformation may have spillover effects, thereby promoting economic growth. As workers' incomes and expenditures rise, businesses can reinvest profits into strategic activities, fostering economic growth through increased consumption and productive investments. This side effect or overflow may develop over time, and in fact, they have always been the main source of sustained growth in the past.

If these benefits are reinvested into the domestic economy rather than other countries, they will have a significant impact on an economy and its participants. Countries prioritizing domestic consumption possess resource allocation systems that encourage reinvestment into their economies, as well as minimize capital leakage from corporate profits repatriating or outflowing capital flows, which can maximize efficiency. The value chain of digital transformation may grow and drive the information and communication technology sector, making significant economic contributions to the economy. It is important to establish a strong digital transformation value chain to maximize the return of additional output to the economy.

6 CONCLUSION

From the perspective of technical environment, Internet technology is mainly related to the development of retail industry, and the development of Internet technology in the e-commerce environment is directly related to the development of online shopping business. With the advent of the big data and 5G era, the retail industry will undergo changes driven by technology in the future. Big data will bring about changes in the marketing model of the retail industry, and precision marketing will be the trend of the future. The development of industries such as 5G, artificial intelligence, and VR/AR will bring about more changes in the retail industry. The virtual shopping malls and other future retail business models brought about by VR and other technologies will become a reality. The future development direction of the retail industry is based on the rapidly developing information technology and aims to achieve strategic transformation. Business markets focus on specific research into image processing with signal processing and planogram compliance reduction utilizing the Twofish method. The two factors mentioned are sufficient for meeting the population's basic needs and the demands of business markets. Both issues raised here are addressed by this research. Every problem here is a crucial element for the basic needs of the people and the economic issue because this solution depends on technology. The suggested innovative strategies are excellent for resolving issues in commercial markets that are merging the Retina Net algorithm. Based on image processing techniques, it is utilized to determine the difficulty mentioned above and many other problems brought on by business and market-related factors. The Retina Net algorithm is utilized to detect product reduction and lost products by proposed ROI approach. RFID technology is used to find product information by two fish algorithms. Finally, according to the value obtained here proposed Twofish algorithm uses 3548 Mbps, and AES has 1236 Mbps. Blowfish has 2619 Mbps. As a result, our proposed two fish method has advantages over throughput, encryption, and decryption time metrics, so the performance of the two fish is better than the existing algorithms. Also, the proposed system detects objects at approximately 122 ms. The proposed Deep Retina Net has an average accuracy of 94%, and the existing DCNN, YOLOV3, and Fast-RCNN have an average accuracy of 77%, 86%, and 88%, respectively. In the future, this work will develop Image and Signal Processing Approaches, which help to improve Emerging Business Markets and create better Business Markets by IoT and Numerical Methods for economic science and technology advancement. By redesigning goods and services through low-cost business models (e.g., leveraging new technologies for customer self-service or complexity reduction), retailers can achieve future profit goals like other industries. The cost reduction transformation will not happen overnight, but we believe that in the coming years, more retailers will start implementing similar cost change actions in different segmented markets and countries.

The emergence of digital transformation technology has posed significant challenges to the interests of traditional enterprises. For example, the monopoly mode of traditional property developers and the financial industry have had a great impact on the challenges of emerging businesses such as P2P online lending and Internet finance. In addition, the rise and rapid development of Internet emerging enterprises have also intensified the competition among industrial groups to a certain extent. For example, some traditional industries (such as retail and hotels) may be affected by the transformation towards the O2O and sharing economy model. Faced with the challenges and opportunities brought about by digital transformation, traditional enterprises should actively introduce new information technologies to improve production efficiency and innovation capabilities. 1. Strengthen technological application and industrial transformation and upgrading. 2. Develop an integrated online and offline marketing model to enhance brand marketing and user experience. 3. Strengthen cooperation and competition with emerging enterprises to achieve common development and innovation. 4. Explore the expansion of higher value-added industries and achieve the transformation and upgrading of traditional industries. The proposed system's accuracy depends on high-quality image inputs but may face challenges in low-light retail environments. Computational costs for real-time processing also require optimization for scalability. In short, the rapid development and popularization of digital transformation are driving traditional industries to shift towards more functions and directions. In the face of such changes, traditional industries should strengthen their own capabilities, seek more opportunities, and maintain a leading position in innovation and management. Governments should incentivize digital adoption in SMEs through subsidies and training programs to maximize GDP growth.

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