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Fake Product Monitoring System Using Artificial Intelligence

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ABSTRACT

In Today's Generation, The availability of counterfeit (Fake) products is more than the Original Products. The problem of recognizing counterfeit (fake) products is a tedious task cases in today generation and can be dangerous when it comes to medical products. As selling of Fake products in offline or online is easier if the person not checking the product details properly. As Many of the Techniques are used to overcome this problem by using Barcodes and QR scanner and methods like Deep Learning But, the main objective here is to scan the logos, which is the visual representation of the particular product.To suggest a better solution using Artificial Intelligence for Technotard customers who can scan the product with the help of a mobile application to identify, if the product received is fake or original. The major focus will be on the detection of logos may be either purely graphical (only symbols), purely textual (only name of the Association), or textual-graphical (a combination of symbols and text).

Keywords — *Counterfeit products, Artificial Intelligence, logos, Technotard*

1. Introduction

A logo is a visual representation generally used by companies and Association to plump public acknowledgment. It may be textual or graphical or text-graphical. Logos are brand of an Organization and Hence these are protected by Intellectual Property Rights (IPR) protocols. There are many approaches for logo detection whether it is original or fake. Firstly, it came by object classification for the textual and visual cues combinedly and later on it is developed by Deep learning on the basics of product manufacturing and Finally Artificial Intelligence with new trends. Here in this model each having specific method and it is developed by considering with previous model. Then it is based on first and last letters of the logo

The market surveillance authorities require generally that a product must pass through and prove certain regulations and standards before it can be imported and sold in the internal market. This verification can be provided either by a self-declaration by the manufacturer, supported by Appropriate tests, or by certification of an independent third party from the certification industry. The Final Solution is to make the People to identify the fake products.

2. Literature Survey

In paper [1] karaoglu and Sezer, proposes Fake product Detection using Fine grained object Classification. It was the first implementation for fake product detection for both logos and Textual. The author has used Techniques of Computer vision and Natural Language Processing such as Image Recognition, Character Recognition, Trigrams, Bigrams. The Implementation not efficient in the real time application.

In paper [2] Eduard Daoud, Dang Vu, Hung Nguyen and Martin has designed a Web Based recognition by implemented a Deep Learning Approach for identification of Fake Product. The author has implementation the model is based on the certifications of the products which have falsified certification or and quality marks. The author has taken Two steps Building a web application and Deep learning Model. The author used concepts of Classification and Localization for deep learning model and for web application Google tensor flow and web server. The main Steps in deep leaning approach is Feature Extractor and Object Detectors.

In paper [3] Pathak, A., Velasco, C., & Calvert, G. Has taken two Case Study To identify How people are going to identify Fake products. Here, the author has taken 93 participants of age 20-60. The Author has given relative Importance on the First and Last letters in word recognition. The author taken the point that Most fake products retain the Visual Appearance of the original brand logo symbol (ex: colours, design and visual elements) but deceptively uses alternative brand name.

In paper [4] Eduard Daoud, Dang Vu Nguyen Hai, Martin Gaedke and Hung Nguyen proposed a low-cost and user-friendly solution relies on machine learning-based technology which enables end-consumers to identify and verify products without any special equipment. By using image and text recognition, this approach aims to improve fake product detection. It can also combine with over, covert and/or Track and Trace technologies to help combat counterfeiting more efficient and effective.

In paper [5] R. Roy & Patil. S have designed a mobile application system for detecting fake product logos. The author has implemented the model using machine learning algorithm as Naïve Bayes Classifier and Deep Learning algorithm Convolution Neural Network (CNN). The author included Techniques

such as Image Recognition, Conventional Neural Network (CNN), Hamming Distance and Editing Distance. The author mainly focused for the Techno tard people for efficient use. The author used spelling Detection and logo detection.

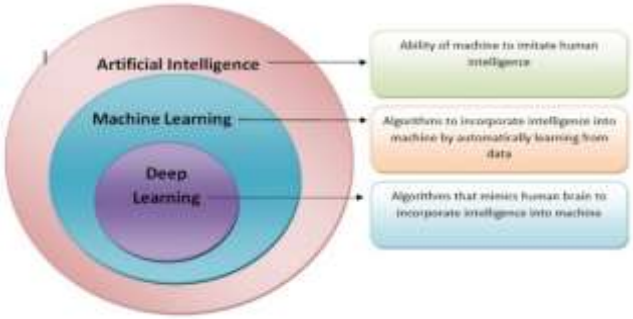
3. Data Collection

The data is collected from 2000 certification marks and logos from the websites (web crawler) of the Testing, Inspection and Certification (TIC) members, e.g. TÜV SÜD AG, Dekra and Bureau Veritas.

4. Artificial Intelligence

The major limitation in defining AI as simply "building machines that are intelligent" is that it doesn't actually explain what AI is and what makes a machine intelligent. AI is an interdisciplinary science with multiple approaches, but advancements in machine learning and deep learning are creating a paradigm shift in virtually every sector of the tech industry.

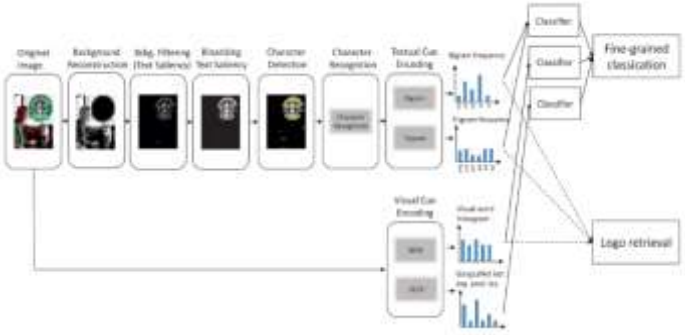
ML refers to an AI system that can self-learn based on the algorithm. Systems that get smarter and smarter over time without human intervention is ML. Deep Learning (DL) is a machine learning (ML) applied to large data sets. Most AI work involves ML because intelligent behaviour requires considerable knowledge.



5. Methodology

Method 1: Fine Object grained classification

Firstly, the image will be constructed background like in below figure and then Text saliency i.e, unique features of image in the context of visual processing. The character recognition which means process which allows computers to recognize written or printed characters such as numbers or letters and to change them into a form that the computer can use. Character Recognizer - ABBYY We first use ABBYY, leading commercial OCR engine, to perform character recognition on the text saliency. ABBYY receives an image as input and outputs recognized characters within that image. And later Character Detection is done by the Text cue encoding i.e, Bigram and Trigram and finally visual detection is done by visual cue encoding These two are classified using object-grained classification and finally result is logo Retrieval.



Method 2: Deep Learning Model:

In this paper the author method has two primary components has been implemented. For the Web server, we build a web application by using Flask. This web application focuses on handling requests from the client (mobile/web browser application), which includes the digital product images with the mark/logo. In the backend, the images will be sent to the second component- our Deep Learning application, which is built with the Google Tensor flow library. This application runs the algorithms to identify the location of the mark/logo in the digital image (localization) and then classifies whether the

mark/logo is valid or not (classification). At the end of this process, the detection result will be sent back to the Web server and then to the end-user. In the above figure, which consists of 2 steps: training model and detecting images.

Feature Extractor: It Aims to extract features from raw data sources (region output of object detector) and return output as a class label

Object Detector: Object detectors, there are two common meta-architectures: Region-based family detectors and Regression/Classification family detectors.

Region-based family detectors: These are further dived into two region proposal and region classification. e.g., R-CNN, Fast R-CNN and Faster R-CNN these different similarities: color, texture, size, fill, etc.

Classification detectors: These are also known as shot detectors which use YOLO and SSD

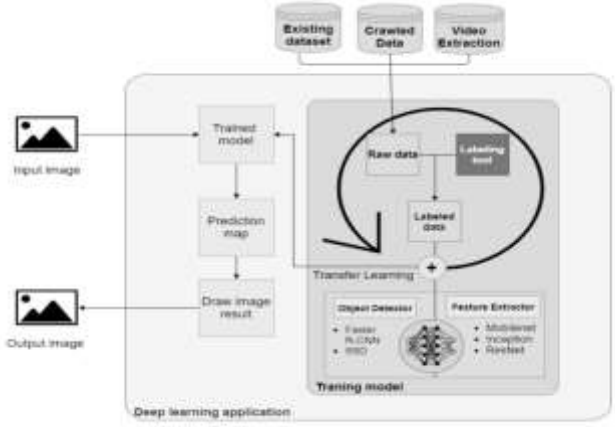


Figure 5. Implementation of Deep Learning application

Method 3: Lexical Processing:

This paper has taken Seven popular brand logos were altered by transposing and substituting the first and last letters of the logotypes. Consumers then classified the logos as counterfeit (vs. original) across two experiments. Here , It is like case study , where in 1st Study the original ,First letter and Last letter were changed and people has to Identify the Original logo In the Second Case Study it has original ,first letter replaced with dissimilar letter, first letter replaced with similar letter, last letter replaced with dissimilar letter, last letter replaced with similar letter, Here Most of the people has guessed the Original logo.

Figure 2. Examples of the fake logos used in Study1

Figure 6. Examples of fake logos used in Study 2

Method 4: Machine learning

This paper focuses on Machine Learning Approach. The paper focuses on implementation which consists of two steps: training models step and detecting logo step In this paper it collect 2000 certification marks and logos from the websites (web crawler) of the Testing, Inspection and Certification (TIC) members, e.g. TÜV SÜD AG, Dekra and Bureau Veritas. We use transfer learning- an optimization that allows rapid progress and boots performance when modelling our detection task. Two pre-trained models are used in our transfer learning are SSD300 - Regression/Classification based family and

Faster R-CNN, Region-based family and Faster RCNN archive high accuracy with low training speed. Detecting small image resolution with detailed features, it is used to verify certification marks. On the other hand, SSD can run fast and smooth (test time of 0.02 second/image and rate of 45 frames/second, tested on VOC 07 Test set) on identifying large objects, such as logo, with high precision. To perform visualizations for end-user, the prediction bounding box and the class label for each certificate mark are drawn on the uploaded

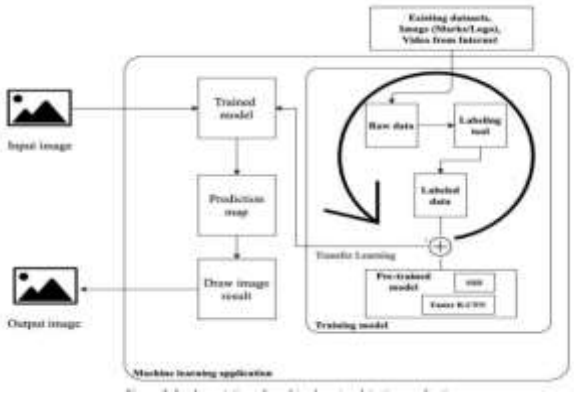


Figure: Machine Learning Model

Method 5: Deep learning with Conventional Neural Network

This paper proposed a system which works under 2 phases.

The first phase is logo detection using spelling detection and colour recognition and the second phase is training the ML model and then detecting fake or original logo with the help of the Feature Extraction method. There are two approaches for spelling detection:

1.Hamming Distance: It is about amongst two strings of equivalent length is the number of locations at which the corresponding symbols are dissimilar

2.Edit Distance: It is about Scheming unlike two strings (e.g., words) are to one another by counting the least number of processes obligatory to convert one string into the other For Logos with images Image Detection, Convolutional Neural Network(CNN) deep learning approach .As we are using CNN which process the pixel data of image and it can achive both graphical and computational tasks.

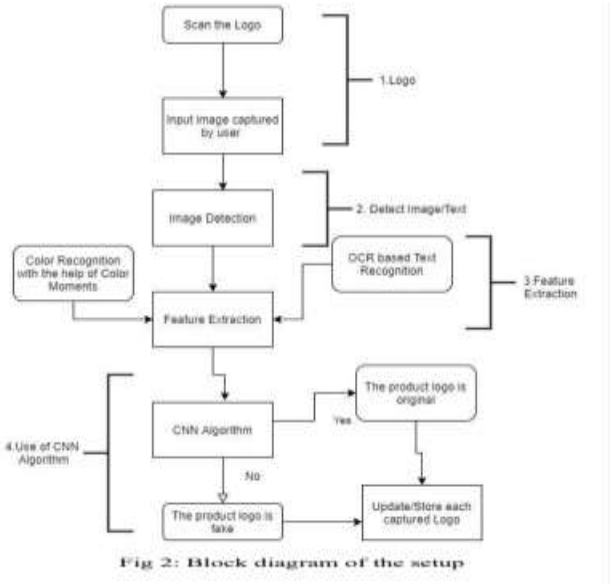


Fig 2: Block diagram of the setup

7. Results and Discussion

Both the methods have been applied and results are compared.

S.NO	Model	Accuracy
1	Fine Grained Object Classification	57.4
2	Deep learning object detection	83.5

3	Lexical Processing	94.12 and 93.67
4	Machine learning	97
5	Machine learning (Naïve Bayes Classifier and Deep Learning algorithm (CNN))	70

8. Conclusion

This Paper has taken the report of (Statista, 2019), the current number of mobile phone users in the world is 4.78 billion, of which 3.5 billion are smartphone users and said users can easily own a smartphone with a built-in digital camera and internet access. Based on the above report Author developed a web application the end-consumers to use their phones as equipment to detect fake products. In server side there are two components a web server and Machine Learning Approach. When user sends an image through website the image will be taken by server and verified by machine learning model. In addition, the server also performs several operations such as storing detection results, data statistic or allowing users to report counterfeit products. The machine learning application is the main contribution of this paper. This solution provides a low-cost implementation, which is appropriate when the market is scaling up. This paper solution archives 97% precision at 3.1 seconds/certificate mark, on 400 tested data. As the result the sophisticated forged marks can be detected, e.g: minor change in colour, missing text.

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