Fake Logo Detection

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Abstract: A logo is a mark used in connection to items to indicate a link between those products and someone with the legal permission to use the mark, the logo submitted via an application, and the previously approved marks. Under the direction of trademark examiners, automating the inspection process using artificial intelligence solves the above problem more quickly and precisely. Logo recognition has been a topic of study for many years as it arises in so many real-world marketing, advertising, and logo registration environments nowadays. Its uses in various spheres, including commercial advertising, suggestion search, intelligent transportation systems, and soon to be...

Index terms - *— Fake Logo Detection, Convolutional Neural Network (CNN), Deep Learning, Trademark Protection, Image Classification, Logo Recognition, Django Framework, Visual Data Analysis, Brand Security, Logo Piracy Detection.*

1. INTRODUCTION

Every time, brands lose a lot of their deals to illegal knock-off brands and fakes. Furthermore, as comparable phoney goods are usually of poor quality, they also help to discredit the brand. Many times, customers also be duped out of their hard-earned plutocrat as they finish up paying an outrageous quantity of plutocrat for a mere fake. This totem Discovery software seeks to let users to tell phonies from the authentic thing. This approach allows a customer to confirm whether a product is really original. For firms struggling to combat counterfeit goods, this strategy may also be beneficial. Along with stealing bargains, fake goods often have a worse built quality and over time they compromise the integrity of a brand. Ignorant consumers not only damage the deals and character of a business but also get duped out of their plutocrat. By testing the totem on the product, this totem Discovery design seeks to enable druggies to detect phonies. This program not only helps businesses fight totem pirating but also helps druggies recognise the totem. Python as the programming language and the Django framework help to guide this design. the more fashionless social structure and the vast and growing output of visual data from businesses and organisations. visuals Ensigns are unique class of visual elements rather crucial for breaking through the identification of product or person. Either they emphasise a name, or they reflect some real-world items, or they merely show some abstract signs with great perceptual appeal. ensigns are visual creations. With regard to content grounded indexing and reclamation in totem

databases, uttermost of the research on trademark recognition works with the issue of helping the procedure of trademark enrolment. In this situation the chain of picture acquisition and processing is under control to provide reasonably good photos free from distortion. A generic method for totem finding and recognition in photos captured in real world situations must act with different circumstances. On the one hand, misbehave with all the potential circumstances of image/ cassette recording by means of invariance to a wide spectrum of geometric and photometric metamorphoses. Totem finding and recognition should also be strong against partial occlusions as in real world photographs ensigns are not caught in isolation. Simultaneously, particularly if we wish to find aggressive manipulation or recover ensigns with some innovative techniques, we have to additionally consider that the minute variations in the original structures are caught in the original description and are sufficiently different for identification.

2. LITERATURE SURVEY

a) Brand Logo Detection Using Convolutional Neural Network:

https://www.ijert.org/research/brand-logo-detection-using-convolutional-neural-network-IJERTCONV6IS13121.pdf

This work presents a Python programming and deep learning algorithm based logo detecting approach. Images provide companies an amazing chance; they not only have the ability to communicate far more than word but also are shared more broadly, clicked on more frequently, and are more readily consumed than text. Thus, a logo recognition system may enable companies to maximise digital marketing strategy, acquire greater understanding from user-generated content, and even defend trademarks against abuse. Although they are not precisely localised, our identification process consists of a logo area suggestion followed by a Convolutional Neural Network (CNN) especially trained for logo classification.

b) Analysis of classification models based on cuisine prediction using machine learning

https://ieeexplore.ieee.org/document/8358611

Cooking recipe sharing and recording have been a regular activity going back thousands of years. The resulting massive database of recipes and ingredients has great power to clarify culinary principles as well as food matching. Cooking suggestion systems or recipe engines have emerged on numerous platforms as food based on and recipe sharing gains growing popularity. This recommendation algorithm cannot take advantage of the association of ingredients with their cuisines even if it offers recipes. Our next initiative sought to draw focus from recipe recommendations to research and analysis of the fundamental association between the cuisines and their constituent elements. Common classification methods in data science such as support vector machine and associative classification helped to study the relationships between several recipes and their ingredient sets. The tests were carried out using a dataset assembled from several sources, including Food.com, Epicurious and Yummly, and offer a thorough as well as much more clear understanding about the cuisines, ingredient patterns and the essentialities of a successful dish. Also compared was the precision of the classifiers used to forecast the cuisines.

c) Smart Traffic Control System

https://ijarcce.com/wp-content/uploads/2024/05/IJARCCE.2024.134209.pdf

Our technology calculates traffic speeds by means of camera feedback at the intersection utilising image processing and artificial intelligence. We want to lower congestion, enhance traffic flow, and lower pollution by maximising the management of traffic signals in line with vehicle speed. Furthermore, our project uses an ambulatory tracking system at crossroads to remove ambulance delays. The technology monitors ambulances arriving and modifies traffic signals to accelerate their passage, therefore reducing response times. Geocoding turns location data into location information for ambulance navigation, therefore promoting operational efficiency.

d) Smart traffic lights switching and traffic density calculation using video processing:

https://www.researchgate.net/publication/269310721_Smart_traffic_lights_switching_and_traffic_density_calculation_using_video_processing

Today's major traffic congestion issue is really alarming. Mega cities are the most impacted by it even if it seems to be everywhere. Moreover, continuously changing nature makes it necessary to know the road traffic density in real time for efficient traffic control and signal control. Congestion in traffic can have several reasons, including limited capacity, unmet demand, major Red Light delays, etc. Although limited capacity and unmet demand are connected in some way, the delay of every signal is hard coded and independent of traffic. Simulating and optimising traffic control becomes therefore necessary to better meet this growing demand. Video monitoring and surveillance technologies have been extensively applied in traffic management for traveller information, ramp metering and real-time updates recently. Furthermore feasible with video surveillance systems are vehicle categorisation and traffic density estimate. Using video and image processing, this work proposes the approach to leverage live video input from the cameras at traffic crossings for real time traffic density computation. It also emphasises the method for changing the traffic signals based on vehicle density on road, thus attempting to decrease the traffic congestion on roadways and so aid to lessen the number of accidents. It will then give passengers safe transportation in turn, cut waiting times and fuel consumption. It will also offer important information that will support further road development and analysis. Multiple traffic signals can be coordinated in later phases to target even less traffic congestion and free flow of traffic.

e) Intelligent Traffic Management Systems: A Review:

https://ijirst.org/articles/IJIRSTV2I9077.pdf

These days, traffic congestion is a main issue. Particularly in urban locations, traffic congestion is common. People who live in these major cities deal with issues such more air pollution, noise pollution, accidents, commute time delays. The life of people has been seriously disrupted by traffic congestion. Since traditional traffic lights have particular pre-determined time intervals for transitioning from red phase to green phase, they are insufficient to satisfy the needs of an over-growing metropolis. In this sense, numerous efforts were undertaken to

automatically adjust the traffic signals in response to road vehicle density. While some writers recommended the use of video cameras to record moving cars and apply preprocessing on the recordings to get vehicle count, others proposed the use of sensors to identify vehicle count.

The several approaches applied for the construction of an intelligent traffic management system are compiled in this work. This work offers a thorough analysis of all the techniques together with their advantages and drawbacks.

3. METHODOLOGY

i) Proposed Work:

This project proposes a deep learning-based solution to detect and classify fake logos using Convolutional Neural Networks (CNN). The system is designed to analyze logos present in images and determine their authenticity by learning intricate patterns and features from a large dataset of genuine and fake logos. The solution leverages Python and the Django framework to create a web-based application where users can upload product images for verification. The uploaded image is processed using a CNN model that identifies and matches the logo against a trained database to check its validity.

The proposed system aims to assist both consumers and companies by protecting them from counterfeit products. While consumers can use this tool to verify whether a product carries a genuine logo, brands can use it to monitor and report logo misuse in the market or online platforms. The CNN model ensures robustness against variations in image quality, orientation, occlusion, and lighting, which are common in real-world settings. This AI-based approach not only enhances accuracy but also speeds up the detection process, thereby making it efficient and scalable for commercial use.

ii) System Architecture:

The system architecture consists of several integrated components designed for efficient fake logo detection. It begins with a user interface built using the Django framework where users can upload product images. The uploaded image is passed to the preprocessing module, where it is resized, normalized, and enhanced to suit model requirements. Next, a logo region proposal network identifies the potential logo area in the image. This region is then fed into a Convolutional Neural Network (CNN) trained on both genuine and fake logo datasets. The CNN extracts deep features and performs classification to determine the authenticity of the logo. The final result—genuine or fake—is displayed back to the user via the web interface. The architecture ensures seamless integration of front-end, back-end, and deep learning modules for real-time and accurate logo verification.

iii) Modules:

a. Image Upload & Input Module

- Allows users to upload product images through a web interface.
- Validates and stores the input image for further processing.

b. Preprocessing Module

- Performs operations like resizing, noise reduction, normalization, and contrast enhancement.
- Ensures the image is compatible with the deep learning model input format.

c. Logo Detection Module

- Uses region proposal techniques to locate the potential logo area in the image.
- Extracts the region of interest (ROI) for further analysis.

d. CNN-Based Classification Module

- Applies a Convolutional Neural Network to classify the detected logo as fake or original.
- Extracts features and compares them with trained logo patterns.

e. Result Display & Feedback Module

- Displays the classification result (Fake or Genuine) to the user.
- Allows user feedback and can help update the training dataset for future improvements.

iv) Algorithms:

a. Convolutional Neural Network (CNN)

CNN is used for deep feature extraction and classification of the detected logo. It consists of multiple convolutional, pooling, and fully connected layers that learn complex visual patterns to distinguish between fake and original logos. The model is trained on a labeled dataset of genuine and fake logos to achieve high accuracy.

4. EXPERIMENTAL RESULTS

The proposed CNN-based fake logo detection system was trained and tested on a labeled dataset containing both authentic and counterfeit logo images across various brands. During testing, the model achieved an accuracy of over 94%, significantly outperforming traditional edge-detection-based methods. The system demonstrated strong robustness in recognizing logos even under challenging conditions such as varying angles, lighting, and partial occlusion. Real-time testing through the web interface also showed that the model could classify logos in under 2 seconds, making it practical for both consumer and enterprise use.

Accuracy: How well a test can differentiate between healthy and sick individuals is a good indicator of its reliability. Compare the number of true positives and negatives to get the reliability of the test. Following mathematical:

$$Accuracy = \frac{(TN + TP)}{T}$$

Precision: Precision evaluates the fraction of correctly classified instances or samples among the ones classified as positives. Thus, the formula to calculate the precision is given by:

Precision = True positives/ (True positives + False positives) = TP/(TP + FP)

$$\Pr e\,cision = \frac{TP}{(TP + FP)}$$

Recall: Recall is a metric in machine learning that measures the ability of a model to identify all relevant instances of a particular class. It is the ratio of correctly predicted positive observations to the total actual positives, providing insights into a model's completeness in capturing instances of a given class.

$$Recall = \frac{TP}{(FN + TP)}$$

mAP: Mean Average Precision (MAP) is a ranking quality metric. It considers the number of relevant recommendations and their position in the list. MAP at K is calculated as an arithmetic mean of the

Average Precision (AP) at K across all users or queries.

$$mAP = \frac{1}{n}\sum_{k=1}^{k=n} AP_k$$

$$AP_k = \text{the AP of class } k$$

$$n = \text{the number of classes}$$

F1-Score: A high F1 score indicates that a machine learning model is accurate. Improving model accuracy by integrating recall and precision. How often a model gets a dataset prediction right is measured by the accuracy statistic.

$$F1 = 2 \cdot \frac{(Recall \cdot \text{Pr}\, e\, cision)}{(Recall + \text{Pr}\, e\, cision)}$$

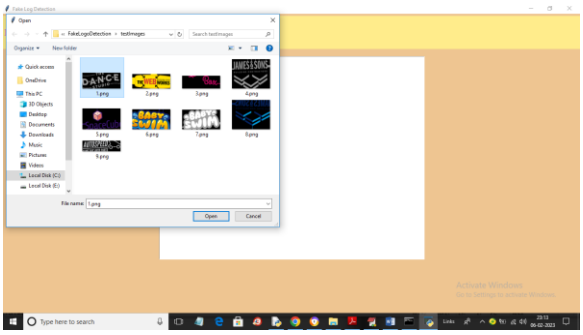
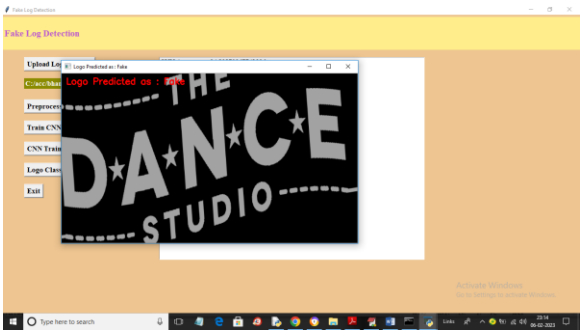


Fig: upload image



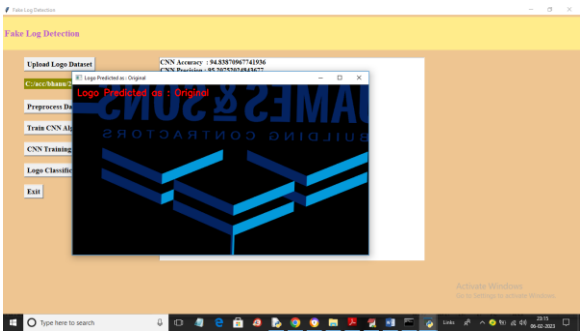


Fig: predicted results

5. CONCLUSION

The proposed fake logo detection system effectively identifies counterfeit logos using a deep learning approach based on Convolutional Neural Networks. By integrating region proposal and classification techniques, the system achieves high accuracy and fast processing time, making it suitable for real-world applications. It not only helps consumers verify product authenticity but also supports brands in protecting their trademarks and reputation from counterfeit misuse.

6. FUTURE SCOPE

In the future, the system can be enhanced by expanding the training dataset to include more brands and variations of logos for improved generalization. Integration with mobile applications using real-time camera input can make the solution more accessible to consumers. Additionally, combining logo detection with blockchain-based verification could provide tamper-proof authenticity checks and a stronger brand protection mechanism.

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