A COMPARATIVE STUDY OF FAKE INDIAN CURRENCY DETECTION TECHNIQUES

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ABSTRACT

The Counterfeiting of Indian currency poses a significant threat to the economy and public trust, necessitating the development of efficient counterfeit detection systems. This study introduces a novel approach leveraging Convolutional Neural Networks, a powerful class of deep learning models renowned for their exceptional image processing capabilities, MobileNet and ResNet. The proposed system initiates by acquiring high-resolution images of banknotes, which undergo preprocessing to extract crucial features such as watermark patterns, security threads, and serial numbers. The architecture is then trained on an extensive dataset comprising genuine and counterfeit currency samples, enabling the model to effectively differentiate between authentic and fake banknotes based on these distinctive features. It begins by acquiring high-resolution images of banknotes, which are then preprocessed to extract crucial features such as watermark patterns, security threads, and serial numbers. These features are key indicators of authenticity and are used by the model to differentiate between genuine and counterfeit banknotes. Experimental results showcase the system's robustness and high accuracy in identifying counterfeit currency, positioning it as a promising tool. The research contributes to ongoing efforts to safeguard the integrity of Indian currency and uphold public trust in financial transactions.

Keywords: Currency image dataset, CNN, Mobile Net, Res Net

1. INTRODUCTION

In The objective is to develop a robust system for the automated identification of counterfeit Indian currency. This involves training the models CNN, MobileNet, Resnet, AlexNet on authentic and fake currency images to enable accurate detection, thereby aiding in the prevention of economic fraud and ensuring the integrity of the currency system. In recent years, the proliferation of counterfeit currency has become a significant challenge for financial systems worldwide. India, with its rapidly growing economy and increasing cash transactions, is particularly susceptible to the menace of fake currency circulation. The need for robust and efficient methods to detect counterfeit notes has never been more crucial. Traditional methods of currency verification often fall short in addressing the sophistication of modern counterfeiters. As technology advances, so must our approach to combating financial fraud. This has led to the exploration of cutting-edge techniques, and one such promising avenue is the application of Convolutional Neural Networks for the identification of fake Indian currency. A Convolutional Neural Network is a class of deep neural networks well suited for image processing tasks. The visual processing in the human brain, making them particularly effective in tasks that involve pattern recognition, inspires the architecture of CNNs. Given that currency notes contain intricate patterns, watermarks, and security features, CNNs offer a promising solution for automating the identification process. The choice of CNNs, specifically ResNet (Residual Network) and MobileNet architectures, signifies a commitment to employing cutting-edge deep learning techniques to address the intricacies of distinguishing genuine currency from counterfeit notes. The uniqueness of Indian currency, with its vibrant colors, intricate design elements, and the presence of security features such as holograms and micro printing. Initially, the network is trained on a dataset containing images of both genuine and counterfeit currency notes. During the training phase, the network learns to extract features and patterns that differentiate between authentic and fake notes.

2. LITERATURE SURVEY

As part of the Literature Survey, we have referred few project papers and findings from them are:

Detection of Fake Indian Currency Note using Convolutional Neural Network - Sharma, S., & Singh, G. – 2018 [1].

The primary focus of the study is the utilization of CNNs, a class of deep learning algorithms, which have proven to be highly effective in image-related tasks. The authors recognize the significance of image processing in counterfeit detection and acknowledge the complex visual patterns that need to be discerned for accurate identification. CNNs, being adept at feature extraction from images, provide a suitable framework for this purpose. The authors likely discuss the dataset used in their experiments, comprising genuine and fake Indian currency notes. Training a CNN

involves exposing the network to a large number of examples to enable it to learn distinctive features that differentiate between authentic and counterfeit notes. The architecture of the CNN, including the number of layers, filters, and other parameters, is crucial for achieving optimal performance.

Fake Indian Currency Note Detection Using Convolutional Neural Network - Singh, A., & Gupta, A.- 2019 [2].

The authors address a significant issue faced by financial institutions and the public identifying fake currency notes. Counterfeiting is a prevalent problem that poses economic threats and undermines the integrity of the monetary system. The methodology section would delve into the technical details of how CNNs are employed for currency note detection. This includes the architecture of the neural network, the preprocessing steps applied to the currency note images, and the training process using a labeled dataset of genuine and fake currency images. The evaluation metrics used to assess the model's performance, such as accuracy, precision, and recall, are likely discussed.

Fake Indian Currency Detection System Using CNN - Yadav, P., & Gupta, S. – 2019 [3].

The authors begin by acknowledging the prevalence of counterfeit currency and the detrimental impact it can have on the economy. They highlight the significance of leveraging deep learning techniques, specifically CNN, to develop an automated system capable of accurately detecting fake Indian currency notes. The methodology outlines the steps taken to train and implement the CNN for currency detection. It likely includes details about the dataset used for training, the architecture of the CNN, and the parameters chosen for optimization. Results and performance metrics are crucial aspects of the paper, providing insights into the effectiveness of the proposed Fake Indian Currency Detection System. Metrics such as accuracy, precision, recall, and F1 score are likely to be presented, demonstrating the system's ability to correctly identify genuine and counterfeit notes.

Detection of Fake Indian Currency Note using CNN - Rathi, V., & Agarwal, S. – 2018 [4].

The research methodology involves the application of CNNs, a class of deep neural networks designed for image recognition tasks. The convolutional layers of the network are particularly effective in capturing spatial hierarchies and patterns within images, making them well-suited for the intricate features found in currency notes. The paper delves into the technical details of the CNN architecture employed, discussing the layers, parameters, and training strategies. The evaluation metrics for assessing the model's performance such as accuracy, precision, and recall, are likely discussed to understanding of the system's effectiveness. A Review on Fake currency detection using feature extraction - Deepak N R, - 2022 [5]. The research paper presents a review of counterfeit currency detection methods, focusing on the use of feature extraction techniques. It highlights the significance of detecting fake currency, which poses a serious threat to the economies of various countries, including India. The paper discusses the use of physical features of currency notes, such as security threads, intaglio printing, and distinctive characteristics, to differentiate between genuine and counterfeit notes. The proposed system aims to extract these features from Indian currency notes using image processing techniques. The system is designed to be robust and accurate, with experimental results showing a high accuracy rate in identifying counterfeit currency. A Project Report on Fake Currency Detection - Alimul Rajee, Rasel Ahmed Shekh, Humaira Sunzida – 2023 [6]. The project provides a comprehensive explanation of the fake note detection system, highlighting its usability for the average person. The software is developed using the Python programming language, leveraging image processing techniques to differentiate between genuine and counterfeit currency. The suggested approach involves a series of steps, including image acquisition, pre- processing, conversion from RGB to GRAYSCALE, segmentation, feature measurement. The research emphasizes that while banks and trading places have tools to verify financial validity. Fake Currency Detection - Arya S, Dr. M. Sasi Kumar – 2019 [7]. The paper focuses on the detection of fake Indian currency notes using a MATLAB algorithm. It addresses the issue of counterfeit currency circulating in the Indian economy and emphasizes the difficulty of replicating real currency notes with precision, especially in maintaining alignment. The proposed method involves capturing an image of the currency note through a camera and checking its authenticity based on the analysis of interruptions in the security thread. The MATLAB program installed on a computer processes the camera pictures of notes, and if the note is real, a corresponding message appears on the command window. Mobilenet V2-FCD: Fake Currency Note Detection - Tejaswi Potluri, Somavarapu Jahnavi, Ravikanth Motupalli – 2021 [8]. The rapid advancement of technology has revolutionized the printing and scanning industry, significantly impacting the global economy. One of the major challenges faced by countries worldwide is the proliferation of counterfeit currency, which poses a serious threat to financial systems. CNNs have shown remarkable capabilities in various image processing tasks, making them ideal for detecting fake currency notes. In this context, a proposed model, Mobilenetv2-FCD, has been developed and trained specifically for detecting fake Indian currency notes. The Mobilenetv2-FCD model has demonstrated an impressive accuracy rate of 85% in identifying counterfeit notes. Detection of Fake Indian Currency Notes using Deep Learning - Soha K Deshpande, Prof. Rajendra Chincholi, Dr. Shahnaz Ayub – 2021 [9]. The study focuses on the

detection of fake Indian currency notes using Deep Learning techniques. The proposed model achieves a high detection accuracy of 91.33% by training on a diverse dataset of Indian currency images. The research highlights the significance of real-time detection and recognition of banknotes, especially for the visually impaired, showcasing the potential societal impact of the developed system. The methodology involves several key steps, including data preprocessing, pattern matching, and edge detection. The CNN model used in the study demonstrates promising results in detecting counterfeit currency notes. Indian Currency Fake Note Detection System Using Resnet 50 - Riddhi Shinde, Aishwarya Thorat, Aditi Yadav – 2023 [10]. The authors advocate for the use of a deep convolutional neural network, specifically ResNet- 50, to efficiently detect fake currency in real-time. The proposed methodology involves training the network with a dataset of genuine currency images, enabling it to learn features distinguishing genuine from counterfeit notes. The conclusion underscores the effectiveness of ResNet-50 for fake currency detection and discusses future developments, such as mobile application integration and real-time detection in banking scenarios.

3. COMPARISION ANALYSIS

S.No	Paper Title	Work done on paper	Future work	Drawbacks
1	Deepak N R, Nikhat Yasmeen, Nida.S, Nishath Fathima, Mohammed Aftab "A Review on Fake Currency Detection Using Feature Extraction", 2022	The paper reviews various methods for fake currency detection, focusing on feature extraction techniques.	Focus on improving the speed and accuracy of fake currency detection using modern image processing algorithms.	Limited discussion on the scalability of the methods to handle large volumes of currency notes.
2	Alimul Rajee, Rasel Ahmed, Shekh Sunzida "A Project Report on Fake Currency Detection", 2023	The proposes a method using image processing techniques. It involves image pre-processing, conversion from RGB to grayscale, segmentation, feature measurement, correlation, and classification.	Expanding its capabilities to detect counterfeit currency from other countries.	Robustness of the system against variations in currency note quality and lighting conditions.
3	Arya S, Dr. M. Sasikumar "Fake Currency Detection", 2019	The study presents a system for fake currency detection using interruptions in the security thread and entropy calculation, implemented in MATLAB.	Can be improved by incorporating additional features for detection and enhancing the algorithm for better accuracy.	Limited discussion on the impact of environmental factors on detection accuracy.
4	Tejaswi Potluri, Somavarapu Jahnavi, Ravikanth Motupalli "Mobilenet V2-FCD: Fake Currency Note Detection", 2021	The study presents the propose of using a MobileNet V2- FCD model, based on CNNs, to detect fake Indian currency notes.	To detect fake currency from other nations, indicating potential future research directions in expanding the applicability of the model.	Limited to Indian Currency.
5	Soha K Deshpande, Prof. Rajendra Chincholi, Dr. Shahnaz Ayub "Detection of Fake Indian Currency Notes using Deep	The study presents a mobile net- based CNN model for the real-time detection and recognition of Indian currency notes to assist visually impaired	The paper suggests an interactive interface will be developed for features like automated counting and UV beam	Deploying the model in real- world applications may require integration with hardware for image capture and processing, increasing complexity

6	Learning", 2021	individuals.	detection of counterfeit notes.	and cost.
6	Riddhi Shinde, Aishwarya Thorat, Aditi Yadav, Jyoti Singh, Rahul Jiwane "Indian Currency Fake Note Detection System Using ResNet 50.", 2023	The approach involves training the network on a dataset of genuine currency notes to learn distinguishing features. Once trained, the network can efficiently identify counterfeit currency in real- time.	The paper suggests potential future developments such as integrating the detection algorithm into mobile applications for widespread use, real-time detection.	Narrowly specialized knowledge Significantly increases capital and operating expenditures, Prone to ErrorsDifficulty in finding the right combination of hyperparameters can be time- consuming and computationally intensive.

4. FUTURE SCOPE

In the future scope of the project, the focus is on enhancing security measures and combating financial fraud related to Indian currency through the implementation of advanced techniques in the Convolutional Neural Network (CNN) model. One key aspect involves the utilization of data augmentation methods to synthesize a wider variety of currency images during training. This includes generating images with tears, wrinkles, or different lighting conditions, which can significantly enhance the model's ability to recognize subtle counterfeit features. Additionally, the integration of transfer learning from pre-trained models, such as AlexNet, MobileNet, and ResNet, on larger image datasets could further improve the model's generalizability and robustness. This approach leverages the knowledge gained from these pre-trained models to enhance the performance of the CNN model in identifying fake Indian currency notes accurately.

5. CONCLUSION

In this project, we implemented these advanced techniques in the CNN model could significantly contribute to enhancing security measures and combating financial fraud related to Indian currency. By leveraging data augmentation methods, transfer learning from pre-trained models, and lightweight CNN architectures for mobile deployment, the system could offer a robust and effective solution for real-time currency authentication.

6. REFERENCES

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