ISSN No:-2456-2165

Indian Currency Fake Note Detection System Using Resnet 50

Riddhi Shinde[1]
Rajiv Gandhi Institute of Technology, Mumbai

Aishwarya Thorat[2]
Rajiv Gandhi Institute of Technology, Mumbai

Aditi Yadav[3]
Rajiv Gandhi Institute of Technology, Mumbai

Jyoti Singh[4]
Rajiv Gandhi Institute of Technology, Mumbai

Rahul Jiwane[5]
Department of Information Technology
Rajiv Gandhi Institute of Technology, Mumbai

Abstract:- The printing and scanning industry has made significant technological advancements, but unfortunately, this has also led to a rise in counterfeiting. Counterfeit currency can negatively impact the economy and reduce the value of genuine money. Therefore, detecting fake currency is crucial. Traditional methods have relied on hardware and image processing techniques, which can be inefficient and time-consuming. To address this issue, we have proposed a new approach that uses a deep convolutional neural network to detect counterfeit currency. Our method analyzes currency images and can efficiently identify fake currency in real time. We trained a transfer learned convolutional neural network using a dataset of two thousand currency notes to learn the feature map of genuine currency. Once the feature map is learned, the network is able to identify counterfeit currency quickly and accurately. Our proposed approach is highly effective and significantly reduces the time required to identify fake currency among the 500 notes in our dataset.

I. INTRODUCTION

Counterfeit currency is a growing problem that affects economies around the world. The use of advanced printing and scanning technology has made it easier for criminals to produce fake currency, which can reduce the value of genuine money and cause significant economic damage. In response to this issue, researchers have developed various methods to detect counterfeit currency, with machine learning being a particularly promising approach.

In this project, we propose a novel method for detecting counterfeit currency using machine learning. Specifically, we use a deep convolutional neural network to analyze images of currency notes and identify fake ones. Our approach involves training the network using a large dataset of genuine currency images, enabling it to learn the features that distinguish genuine notes from fake ones. Once trained, the network can quickly and accurately identify counterfeit currency in real-time, providing a valuable tool for law enforcement agencies, financial institutions, and other organizations.

Overall, this project represents an important contribution to the field of counterfeit currency detection, demonstrating the potential of machine learning to address this challenging problem. By improving the efficiency and accuracy of counterfeit currency detection, we hope to contribute to the prevention of financial crime and the protection of the global economy.

II. LITERATURE SURVERY

The feasibility of a software-assisted counterfeit currency detection system is demonstrated through a detailed methodology for extracting existing features of banknotes using image processing. The Bangladeshi bank notes are analyzed to identify the following features for testing purposes: micro- printing, watermark, optically variable ink, iridescent ink, security thread, and ultraviolet lines, with the BDT 1000 parameters used in the analysis. To detect counterfeit currency, the proposed approach extracts multiple features from Indian currency through various image processing algorithms, with the image acquired using an image acquisition device. Template matching is then used to identify fake currency. To improve the accuracy of the system, different parameters will be used to recognize the difference between fake and original currency notes through image processing techniques.[1]

Convolutional Neural Networks (CNNs) are a type of neural network architecture commonly used in image processing tasks, such as image classification and object detection. They use convolutional layers to automatically learn and extract features from the input image, which are then used for classification or other tasks.

The paper "Neural Networks for Image Analysis and Processing" focuses on applying neural network algorithms to image processing tasks such as feature detection, segmentation, and classification. The authors explore different neural network architectures and techniques for feature extraction, including the use of integral images for convolution, and simplify these methods to their essential components. The result is a new approach to feature detection and matching, which can be applied in various areas of technology.[8]

To address the issue of counterfeit notes, various

ISSN No:-2456-2165

minutiae parameters will be utilized, along with deep learning algorithms, to effectively distinguish between fake and genuinecurrency notes. This will be achieved through the application of image processing techniques such as Convolutional Neural Networks (CNN), pattern recognition, and RESNET50, amongother algorithms.

III. METHODOLOGY

Motivated by recent advancements in image processing andthe increasing availability of low-cost image acquisition devices, we propose an approach for detecting counterfeit currency using Convolutional Neural Networks (CNN). Our approach involves extracting multiple features from Indian currency and using them for fake currency detection. The system architecture outlining our proposed work is presented below. To identify fake currency, the proposed approach acquires an image using an image acquisition technique and extracts security features from it using ResNet50 a Convolutional Neural Networks algorithm. Template matching is then performed to differentiate between real and counterfeit currency. The approach is unique in that it applies image processing to extract security features from currency images and uses multiple security features instead of just one.

A. *Currency Features*

The features that have been extracted thus far can be classified as general features, which are features that are not specific to any application, such as texture, color, contrast, andshape. The specific features that are used for counterfeit currency detection systems vary depending on the notes of each country. In the case of Indian currency notes, the following features are considered:

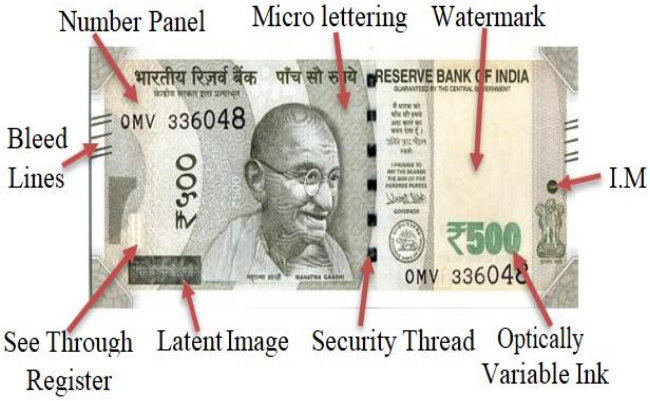

Fig 1 Security Features of Indian Currency

Feature extraction is a process of obtaining relevant information or features from an image by applying image processing algorithms. In the context of detecting fake currency, images of a currency note are acquired using a digital camera or scanner. Once the image is acquired, it undergoes pre-processing to enhance its quality, and then feature extraction is performed to extract specific features that can distinguish between genuine and counterfeit notes. Both these steps are explained in detail in this section.

B. *System Block Diagram*

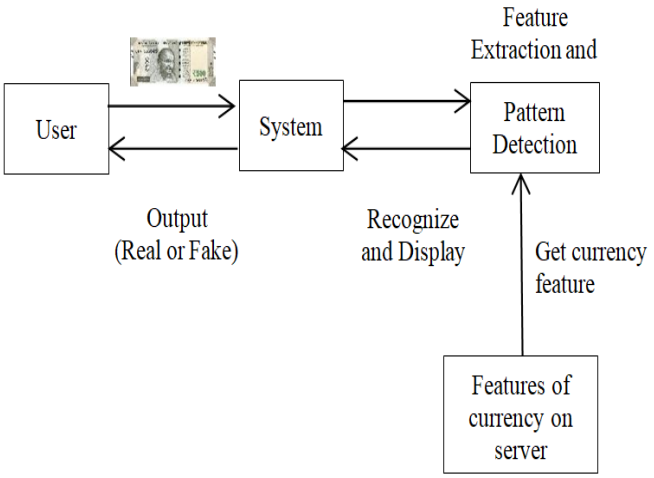

Fig 2 System Block Diagram

C. *Work flow*

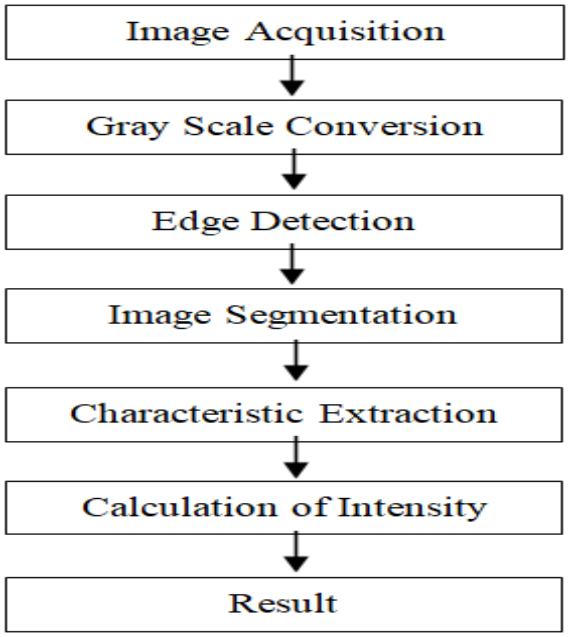

Fig 3 Steps of Implemented System

- *The first step is to acquire the image of the currency note using a digital camera and preserving it under UV light.*
- *Pre-processing the image is done before data analysis and information extraction can take place. This includes resizing the image.*
- *The RGB image is converted to grayscale to extract intensity information. Edge detection is applied to identify the boundaries of the grayscale image.*
- *Image segmentation involves dividing the image into multiple sections or crops.*
- *Edge-based segmentation is used for feature extraction.*
- *The intensity of each extracted feature is computed, and if the intensity is above 70%, the note is considered genuine. Otherwise, it is considered a forgery.*
- *The conclusion is based on the intensity of all retrieved characteristics.*

➢ *The Categorization Procedure is Outlined in the Stages below.*

- *Pre-Processing*

In pre-processing the images for fake currency detection using ResNet-50, we typically perform the following steps:

✓ *Image Resizing: ResNet-50 is a deep CNN architecture that was designed for image recognition tasks on large datasets. Hence, it is important to resize the input images to a fixed size that ResNet-50 can handle efficiently. A typical size used for ResNet-50 is 224x224 pixels.*

✓ *Normalization: To normalize the pixel values of the images, we can subtract the mean pixel value of the training set from each pixel and divide it by the standard deviation. This helps to bring the pixel values of the images to a similar scale and can improve the accuracy of the model.*

✓ *Data Augmentation: Data augmentation is a useful technique to improve the performance of a machine learning model. It involves creating new training data by applying different transformations to the existing data. Popular data augmentation techniques include random cropping, flipping, rotation, and zooming, which can help increase the diversity of the training set and make the model more robust to variations in the input data.*

✓ *Class Balancing: Ensure that the dataset used for training ResNet-50 has a balance between the number of genuine and counterfeit currency notes. A dataset with imbalanced classes can result in a biased model that performs poorly on the minority class.*

✓ *Data Split: The dataset should be partitioned into three subsets: training, validation, and testing. The ResNet-50 model should be trained using the training set while the validation set should be utilized to fine-tune the hyperparameters of the model. Finally, the testing set should be used to assess the model's performance.*

Overall, pre-processing is an important step in fake currency detection using ResNet-50 as it can improve the accuracy of the model and help to avoid overfitting.

- *Feature Extraction*

Feature extraction is a crucial step in fake currency detection using ResNet-50, where we extract relevant features from the images and use them to train a classifier that can distinguish between genuine and counterfeit currency notes. Here are the steps involved in feature extraction using ResNet-50:

✓ *Load the Pre-Trained ResNet-50 Model: ResNet-50 isa pre-trained deep CNN model that has been trained on a large dataset for image classification. We can load this pre-trained model into our code using popular deep learning libraries such as TensorFlow, Keras or PyTorch.*

✓ *Remove the Fully Connected Layer: The pre-trained ResNet-50 model typically ends with a fully connected layer that outputs the predicted class probabilities for the input image. However, for feature extraction, we want to remove this layer and extract the output of the last convolutional layer as features.*

✓ *Forward Pass through the Network: Pass the pre-processed input image through the ResNet-50 model up to the last convolutional layer. This will produce a tensor of feature maps that captures the image's high-level visual patterns.*

✓ *Global Average Pooling: ResNet-50's final convolutional layer produces a feature map of size 7x7x2048. To extract features, we perform global average pooling over this feature map, which results ina 2048-dimensional feature vector for each image.*

✓ *Feature Extraction: We can extract features for all images in the dataset using the above steps and store them in a separate file or database. These features can be used as inputs to a classifier model that is trained to distinguish between genuine and counterfeit currency notes.*

Overall, feature extraction using ResNet-50 can be an effective way to extract discriminative features from images, even when the dataset is small. These features can then be used to train a classifier that can accurately classify genuine and counterfeit currency notes.

IV. CONCLUSION

In conclusion, fake currency detection using machine learning techniques like ResNet-50 is a promising area of development that can help enhance the security of financial transactions. By leveraging the power of deep learning algorithms, it is possible to accurately detect counterfeit currency notes and prevent their circulation. While ResNet-50 has been shown to be a highly effective algorithm for fake currency detection, there are several other algorithms that can be used for this task, and their performance can vary depending on the specific problem being solved.

Advancements in technology, integration with existing systems, multi-currency support, real-time detection, mobile applications, and enhancing accessibility are some of the potential areas of development. As technology continues to evolve, we can expect even more accurate and efficient ways to detect counterfeit currency notes, enhancing the security of financial transactions and reducing the risk of counterfeit notes being circulated.

FUTURE SCOPE

The future scope of fake currency detection using machine learning techniques like ResNet-50 is vast and promising. Here are some potential areas of development:

The integration of fake currency detection algorithms in mobile applications can be a game-changer, especially in countries where counterfeit notes are widespread. This can help users to easily and quickly check the authenticity of currency notes using their mobile phones. Real-time detection of fake currency notes using machine learning algorithms can be useful in scenarios like ATMs and banks, where large numbers of notes are processed every day. Integration of fake currency detection systems with existing systems such as ATMs, vending machines, and point-of-sale terminals can enhance the security of transactions and reduce the risk of counterfeit notes being circulated. Overall, the future scope for fake currency detection systems is promising, and there are several avenues for further development and improvement. As technology continues to evolve, we can expect even more accurate and efficient ways to detect counterfeit currency notes.

REFERENCES

[1]. Zahid Ahmed, Sabina Yasmin, Md Nahidul Islam, Raihan Uddin Ahmed “Image Processing Based Feature Extraction of Bangladesh Banknotes.”
[2]. "Detection of Fake Indian Currency Using Machine Learning Techniques." International Journal of Research in Engineering and Technology, vol. 5, no. 8, 2016, pp. 302-307.
[3]. "Detection of Counterfeit Currency Using Machine Learning Techniques." 2018 IEEE 2nd International Conference on Inventive Systems and Control, pp.152-157.
[4]. "Currency Recognition Using Machine Learning." International Journal of Computer Applications, vol. 143, no. 6, 2016, pp. 22-28.
[5]. "Banknote Recognition Based on Convolutional Neural Networks." 2019 International Conference on Robotics, Control and Automation, 2019, pp. 92-96.
[6]. "Banknote Recognition Using Convolutional Neural Networks and Principal Component Analysis." 2020 14th International Conference on Application of Information and Communication Technologies, 2020, pp. 1-5.
[7]. "Fake Indian Currency Detection Using Machine Learning Techniques." 2017 International Conference on Inventive Communication and Computational Technologies, 2017, pp. 580-584.
[8]. N. Rathee, A. Kadian, and R. Sachdeva, “Feature fusion for fake Indian currency detection,” Computing for Sustainable Global Development (INDIACom), 2016 3rd International Conference on IEEE, 2016.