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AUTHENTICATED RECOGNITION OF CURRENCY NOTES AND DETECTION OF COUNTERFEIT NOTES

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Abstract:

Fake money identification is a major problem all around the world, affecting the economies of nearly every country, including India. Currency notes may be identified and confirmed using a human-visual system. However, our eyesight cannot detect everything, and it is usually difficult for people to distinguish genuine cash without the help of technology. Counterfeiting has gotten increasingly significant in recent years as a result of tremendous technological developments in color printing, duplicating, and scanning. The problem of counterfeiting has a significant impact on the country's economic and financial progress. As a result, the challenge of accurately distinguishing counterfeit banknotes from real ones using an automated Fake money detection system has become increasingly critical. A fake cash detecting system might be employed in shops, bank counters and automated teller machines, auto selling machines, and so forth. The majority of the earlier solutions rely on hardware and image processing techniques. These approaches are less efficient and time-demanding for detecting counterfeit currency. To address the aforementioned issue, we proposed employing a deep convolutional neural network to identify counterfeit cash. The approaches and features utilized for counterfeit money identification were emphasized in this study.

Keywords: Convolutional Neural Network, Currency Features, Counterfeit Currency

I Introduction:

Fabricated currency is a counterfeit of genuine currency. As a consequence, the government dismisses counterfeit money. The RBI is the central body in charge of creating banknotes in India. Every year, the RBI deals with the issue of imitation notes that have been filtered and sold.

Nowadays, several identification techniques are employed to recognize images, faces, license plates, and human behaviors. Currency is the primary medium of trade, and different countries' currencies have different characteristics. However, as cash's value grows, so will the incidence of counterfeit money. Counterfeit money might jeopardize the interests of these countries. As a result, how to use identification technology to actual money is one of the hottest issues and a critical worry right now.

People are so driven to mimic original currencies. Because there was no way to detect counterfeit currency notes at first, the number of fraudulent currency notes increased day by day. Each country has its must create currency detection and recognition to solve this issue.

The system for identifying counterfeit currency should be able to recognize the note quickly and correctly. The counterfeit cash detection system should be able to identify money notes from any orientation. A currency identification system can be used in several places, such as businesses, bank counters, and ATMs.

There are two viable solutions: leverage the currency's chemical qualities or its physical look. The technique given in this study is based on the physical look of Indian cash. Image processing methods have been used to extract elements such as security thread, intaglio printing (RBI logo), and identifying marks, which have been incorporated as security features of Indian money. The majority of the earlier technologies are based on hardware and image processing techniques. Finding counterfeit currency using these methods is less efficient and time-consuming. To address the issue mentioned earlier, we created a deep CNN Algorithm for detecting Indian paper cash.

II Literature Survey:

Money forgery is not a new occurrence; it has been around since the Greeks first coined currency around 600 B.C. During that time, the edges of coins were cut off to get precious metal, which was then used to manufacture counterfeit money. The first paper money developed in China in the 1200s, when mulberry tree wood was used to make money. Guards were in charge of preserving mulberry forests during the time, and forging money was a grave offense. According to history, money

own money. Each size, shape, color, and pattern is unique. Because all notes are tested, it is impossible to count various denominations and identify counterfeit notes. Banks and financial organizations forgery is an old evil. The problem exists today, and as a result, numerous printing methods and the inclusion of various sorts of features in banknotes have happened, to make it simpler to detect forgeries[3]. But as innovation and science advance, new ways of identifying counterfeit money emerge, making the procedure simpler and more precise. Modern techniques include holograms, multi-colored stripes, a counterfeit pen carrying iodine (which reacts with the starch in paper money), and the use of UV light to detect counterfeit banknotes[1,2]. However, the most recent technology used in banks today is inaccessible to non-experts. As a result, society continues to struggle with detecting counterfeit money. In this paper, we present a strategy for detecting counterfeit money that might be utilized by laypeople.

An effective technique for identifying paper money entails a series of procedures, starting with image acquisition and progressing through grayscale conversion, edge detection, segmentation, feature extraction, and image comparison. We reviewed many types of literature in this article that cover various ways of identifying counterfeit cash. The booklet also outlines methods for identifying counterfeit Indian currency.

III Features of Currency Security:

Many experts have been studying currency identification over the last few years. Depending on the characteristics used for categorization as well as the machine learning model, currency may be detected in several ways.

According to the Reserve Bank of India, there are eight security elements

incorporated in Indian currency notes. Watermark, Latent Image, Intaglio, Fluorescence, Security thread, Micro

Some significant noteworthy aspects which this Neural Network model can include for classifying:

1. **Security Thread:** Security threads are thin erected plastic or metal foil strips with lettering cut on them. The security thread may be seen to the left of Mahatma Gandhi's image. The security thread on the Rs.500 and Rs.100 banknotes has identical visible elements including the inscriptions "Bharat" (in Hindi) and "RBI." The Rs.5, Rs.10, Rs.20, and Rs.50 notes include a readable, completely integrated windowed security thread with the inscriptions "Bharat" and "RBI."
2. **Latent Image:** The vertical stripe on the right side of Mahatma Gandhi's photograph has a latent image of denominational value in number. When the banknote is positioned horizontally at eye height the latent picture is revealed.
3. **Serial Number:** Each banknote bears a distinct serial number. The serial number pattern comprises alphabets and digits written on both the obverse and reverse surfaces. These are written horizontally or vertically down the length of the banknote.

IV Existing System:
Because of technological advancements, it is now possible to create and circulate counterfeit notes. So, numerous ways are utilized to distinguish phony notes from actual notes, yet every approach has advantages and disadvantages. There are several systems available on the market, however, the majority of these computers are hardware-based. However, the current method is incapable of detecting counterfeit cash. In addition, performance issues occur in the system. The existing

Lettering, Identification mark, and Optically Variable Ink are some of the characteristics available.

system is mostly utilized for business purposes and hence cannot be used by ordinary people.

- **Counterfeit Detection Pen:** The counterfeit pen is merely a low-cost instrument used to evaluate whether a money note is genuine or counterfeit. If the pen does not affect the currency note, the note is genuine. If the pen reacts with the currency note, the note is considered false, and the reaction is caused by the presence of starch within bogus notes.

  Drawback: When the starch is eliminated from the false notes, they create no reaction when checked with the counterfeit pen, allowing us to presume the note is genuine.

- **Fake Note Detection Using Image Processing Technique:**

  Existing systems based on image processing approaches are less effective and cannot reliably provide system output. It considers physical characteristics such as width and length, as well as interior characteristics such as hue.

  Drawback: When a color replica of the original note with almost the same dimensions as the original note is submitted to the system, it might occasionally fail to recognize phony notes.

V Proposed System:
The suggested system proposes a method for verifying Indian currencies. The suggested system uses Image Processing to determine if the cash is real or counterfeit. Money verification technology tries to recognize and extract visible and unseen

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properties of currency notes. Many strategies for identifying cash notes have been presented up to this point. However, the most effective method is to make use of the currency's visual properties. This strategy employs currency qualities that are utilized by ordinary people to differentiate between different banknote denominations. Security Thread, Serial Number, Latent Picture, and Mahatma Gandhi image are features that may be utilized to verify currency note authenticity.

To detect phony cash in our suggested system, we will first locate and download an online dataset. Following that, we shall pre-process the dataset and then retrieve the characteristics from it. Once these steps are done, we will train and test the dataset to determine its correctness. The algorithm will next be used to construct the CNN model for identifying phony cash notes.

VI Algorithm Used:
CNN(Convolutional Neural Network):
We will construct a convolution neural network that will be trained on the counterfeit and actual cash datasets. When a money note is provided to the model, it guesses if it is legit based on the previously listed characteristics.

- CNN is a machine learning system that can take in an image as input, allocate priority (learnable weights and biases) to different aspects in the image, and distinguish one from the other.CNN operates by extracting characteristics from photos. A CNN is made up of the following components:
- The input layer, a grayscale picture
- The output layer consists of binary or multi-class labels.
- Convolution layers, ReLU (rectified linear unit) layers,

pooling layers, and a fully linked Neural Network comprise the hidden layers.
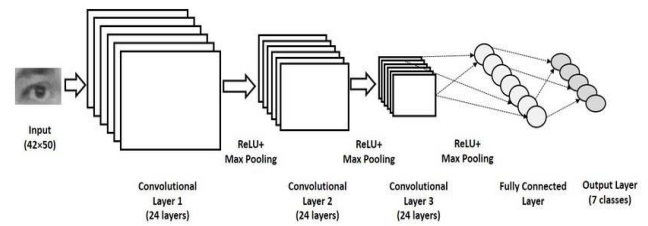
- CONVOLUTIONAL LAYER: The input picture is transformed using a convolution layer in extracting features from it. The picture is convolved using a matrix in this process.

- POOLING LAYER: Pooling is a technique for reducing the number of neurons in the preceding convolutional layer while retaining critical information.

- FULLY CONNECTED LAYER: It links every neuron in one layer to every neuron in the next.

VII Methodology:
The image acquired by the input system should be of high quality. The system receives a photographed or scanned picture in.png format, and the output determines if the cash is real or not. Image pre-processing, gray-scale conversion, edge detection, segmentation, feature extraction, and feature comparison are all part of the process.
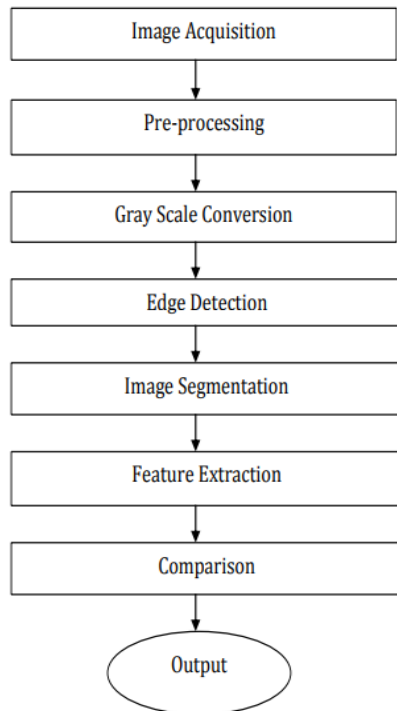
System Design :

Figure 1: Image Processing Flowchart for Detecting Counterfeit Currency

There are eight steps in the design cycle of a counterfeit currency detecting system.

o **Image Acquisition:** The picture of the currency which has to be reviewed or validated as real is fed into the system. An input image can be obtained by scanning the image or taking a photo with the phone and then transferring it to the system. All of the characteristics should be retained in the obtained picture.

Pre-processing: This phase suppresses undesired distortions such as noise and errors while also improving some picture qualities that are useful for subsequent processing. Image scaling is also performed here.

Grey Scale Conversion: The input picture is retrieved in RGB color here. It is converted to greyscale since we just require intensity information and processing the image in greyscale is easier than in RGB color format.

IV. **Edge Detection:** Edge detection is a technique used in image processing to determine the borders of objects inside pictures. It is important in image segmentation. Edge detection is a key method in image processing and computer vision, notably in the fields of feature recognition and feature extraction, which try to locate spots in a digital picture where the brightness of the image varies sharply or, more formally, has discontinuities. It is a method used in image processing to determine the borders of objects inside pictures. Edge detection is used in image processing, computer vision, and machine vision for picture segmentation and data extraction.

V. **Image Segmentation:** Segmentation is the process of dividing an image into constituent areas or objects. The level of the subdivision used is determined by the issue being solved. It is a procedure that divides a digital image into multiple subgroups known as image segments to reduce the image's complexity and make future processing or analysis of the image easier.

Feature Extraction: Feature extraction selects and extracts some of the most effective and relevant characteristics from a big data collection of features useful for detecting counterfeit currencies. The visible characteristics such as security thread, serial number, and latent image are retrieved in this stage.

Comparision: The extracted feature of the input picture and the extracted feature of the original image are analyzed. The extracted features from the preceding stage are compared to the stored features, and

the results are shown to determine if the cash is real or false.

VIII RESULT:

The suggested system employs a convolutional neural network. The network is trained using both fake and real monetary datasets. Figure 2 depicts the currency pictures included in the dataset.
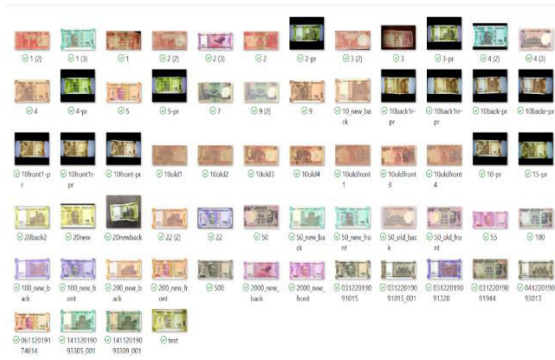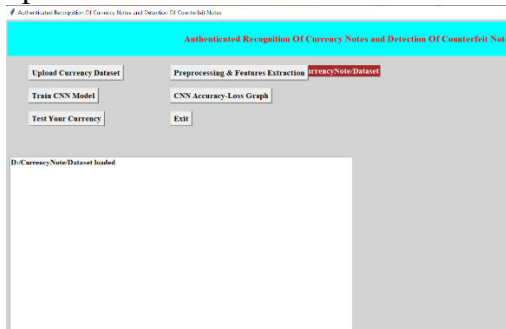

Figure2

Image acquisition in this system is accomplished by snapping a snapshot with the smartphone and then transmitting it to the system. As illustrated in the following GUI, we must first upload the currency dataset and then preprocessing and feature extraction take place. The model must then be trained by clicking the train CNN model option.
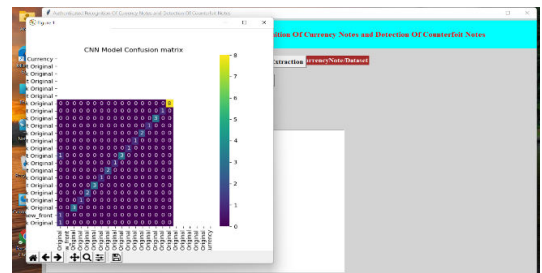
- Uploading the dataset: The following fig depicts the dataset upload.


- Preprocessing and Feature Extraction: In this step the image preprocessing and extraction of features take place. It is represented in the below figure.
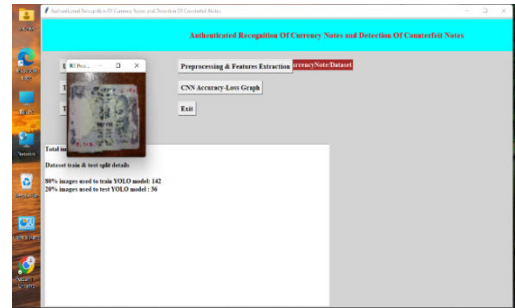

- Train the CNN Model: In this step, the CNN model is trained and a confusion matrix is generated.

- CNN Accuracy- Loss Graph: It depicts how well a model behaves after each iteration of optimization and measures the algorithm's performance in an interpretable way.
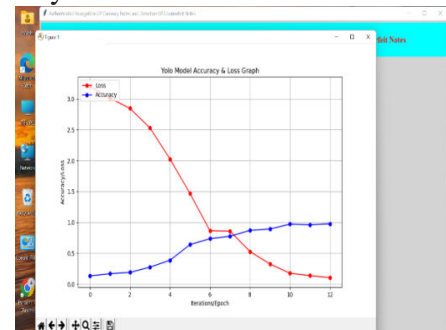
Test Currency: In this step, the currency is fed to the model to predict whether the currency note is fake or not.
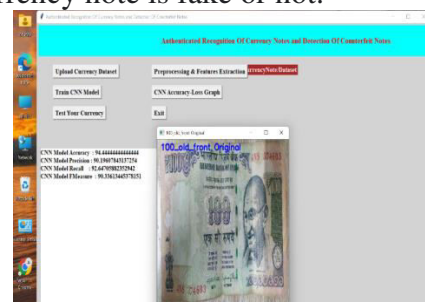
IX Conclusion:

In this study, we proposed a deep learning model for detecting counterfeit money notes. We will effectively extract the features and train and test the dataset using CNN in this project. CNN improves the detection of counterfeit cash notes. The image processing approach is used in this research to identify phony Indian rupee notes. The study also includes the detection and identification of counterfeit cash. We examined numerous fake cash detecting strategies in this paper, each with its own relevance. We discovered that by employing the aforementioned strategies, good results may be attained fast and properly.

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