VERITRUST

A

MAJOR PROJECT REPORT

Submitted by

AASTHA JAIN	MAHI	TARANG PRIYADARSHI
(2100291520002)	(2100291520035)	(21000291520057)

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CERTIFICATE

This is to certified that this major project report **"VeriTrust"** is submitted by **"Aastha jain (2100291520002), Mahi (2100291520035) and Tarang Priyadarshi(2100291520057"** who carried out the project work under my supervision.

I approve this minor project for submission.

Dr. Rekha Kashyap
HOD,CSE(AI/AIML)

PAYAL CHHABRA
(Project Incharge)

ABSTRACT/Problem Statement

The primary goal of this project is to conceive and implement a sophisticated deep learning model capable of accurately discerning both counterfeit and damaged currency notes. As counterfeiters continually refine their techniques and the prevalence of compromised currency grows within financial systems, there arises an urgent necessity for an automated and dependable solution to uphold the integrity of currency transactions.

With advancements in technology, the replication of authentic currency features by counterfeiters has become increasingly intricate, posing a significant challenge to traditional detection methods. Furthermore, the circulation of damaged currency, marred by tears, stains, or other forms of deterioration, further complicates the authentication process. Addressing these dual challenges demands a cutting-edge approach that leverages the power of deep learning to discern subtle nuances and irregularities with precision.

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AASTHA JAIN(2100291520002)

MAHI(2100291520035)

TARANG PRIYADARSHI(2100291520057)

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INTRODUCTION:

In the contemporary financial landscape characterized by rapid technological advancements and global connectivity, the preservation of currency transaction integrity emerges as a critical imperative. The aim of this project is to pioneer the development and deployment of a sophisticated deep learning model meticulously engineered to discern both counterfeit and damaged currency notes with unparalleled accuracy. The proliferation of counterfeit currency, coupled with the circulation of compromised banknotes marred by various forms of damage, poses significant challenges to traditional authentication methods. As counterfeiters continually refine their techniques to mimic genuine currency features, and damaged currency finds its way into financial systems, there exists an urgent and pressing need for an automated solution capable of safeguarding the sanctity of currency transactions. Through the application of state-of-the-art deep learning techniques, this project endeavors to confront these challenges head-on, offering a robust and reliable mechanism to detect counterfeit and damaged currency notes. By harnessing the power of advanced technology, we aspire to establish a new standard of trust and security in currency transactions, fortifying financial systems against the ever-evolving threats posed by counterfeiters and ensuring the integrity of currency exchange worldwide.

OBJECTIVE

The objective of this project is to develop and deploy a sophisticated deep learning model capable of accurately detecting both counterfeit and damaged currency notes. In response to the increasing sophistication of counterfeiters and the prevalence of compromised currency within financial systems, the primary goal is to create an automated and dependable solution that ensures the integrity of currency transactions. By leveraging advanced deep learning techniques, this project aims to provide financial institutions, retailers, currency exchange services, government agencies, cash processing centers, and participants in international trade with a robust tool to combat counterfeit currency and manage damaged banknotes effectively. Through this endeavor, we seek to enhance the security and trustworthiness of currency transactions, safeguarding the integrity of financial systems and contributing to the stability of global commerce.

METHODOLOGY

The methodology employed in this project encompasses a multi-faceted approach to develop and deploy a deep learning model for counterfeit and damaged currency detection. Initially, an extensive dataset comprising high-quality images of both counterfeit and damaged currency notes is curated, ensuring comprehensive coverage across various denominations and conditions. Preprocessing techniques such as image normalization and augmentation are applied to enhance the model's robustness and generalization capabilities. Next, a convolutional neural network (CNN) architecture is meticulously designed and trained using the curated dataset, leveraging transfer learning and fine-tuning strategies to optimize performance. Rigorous evaluation and validation protocols are employed to assess the model's accuracy, precision, recall, and F1 score on both training and testing datasets. Finally, the trained model is deployed into practical systems, such as ATMs, point-of-sale terminals, and currency sorting machines, enabling real-time detection of counterfeit and damaged currency notes. Continuous monitoring and refinement mechanisms are implemented to ensure the model's efficacy and adaptability to evolving threats and challenges in currency authentication. Through this methodical approach, we strive to deliver a robust and reliable solution to address the critical need for automated counterfeit and da maged currency detection in financial syste

TECHNOLOGY USED

The project utilizes a range of cutting-edge technologies, including:

- Machine Learning Libraries: TensorFlow, Keras, and PyTorch are used for building and training deep learning models. These libraries provide a range of tools and techniques for building and training neural networks, including convolutional neural networks (CNNs) and recurrent neural networks (RNNs).
- Computer Vision Libraries: OpenCV, Pillow, and scikit-image are used for image processing and feature extraction. These libraries provide a range of tools and techniques for processing and analyzing images, including image filtering, thresholding, and feature extraction.

DATABASE USED

The project uses a custom dataset of images of Indian currency notes, labeled with their respective denominations and damage status. The dataset is used to train and test the deep learning models, and to evaluate their performance.

The dataset includes images of Indian currency notes of various denominations, including:

- Denominations: 10, 20, 50, 100, 200, 500, and 2000
- Damage Status: Damaged and undamaged

The dataset is divided into training and testing sets, with 80% of the images used for training and 20% used for testing.

TECHNIQUE ANALYSIS

The project employs various techniques and analysis methods, including:

- Denomination Classification: Convolutional Neural Network (CNN) and Random Forest Classifier are used for image classification. The CNN is used to extract features from the images, and the Random Forest Classifier is used to classify the images based on the extracted features.
- Damage Detection: Convolutional Neural Network (CNN) and Principal Component Analysis (PCA) are used for image classification and feature extraction. The CNN is used to extract features from the images, and the PCA is used to reduce the dimensionality of the features and improve the performance of the classifier
.

The techniques and analysis methods used in the project are:

- Convolutional Neural Network (CNN): A deep learning model that is used for image classification and feature extraction. The CNN is trained on the dataset and used to classify the images into different denominations and damage status.
- Random Forest Classifier: A machine learning model that is used for classification. The Random Forest Classifier is trained on the features extracted by the CNN and used to classify the images into different denominations.
- Principal Component Analysis (PCA): A technique that is used for dimensionality reduction and feature extraction. The PCA is used to reduce the dimensionality of the features extracted by the CNN and improve the performance of the classifier.

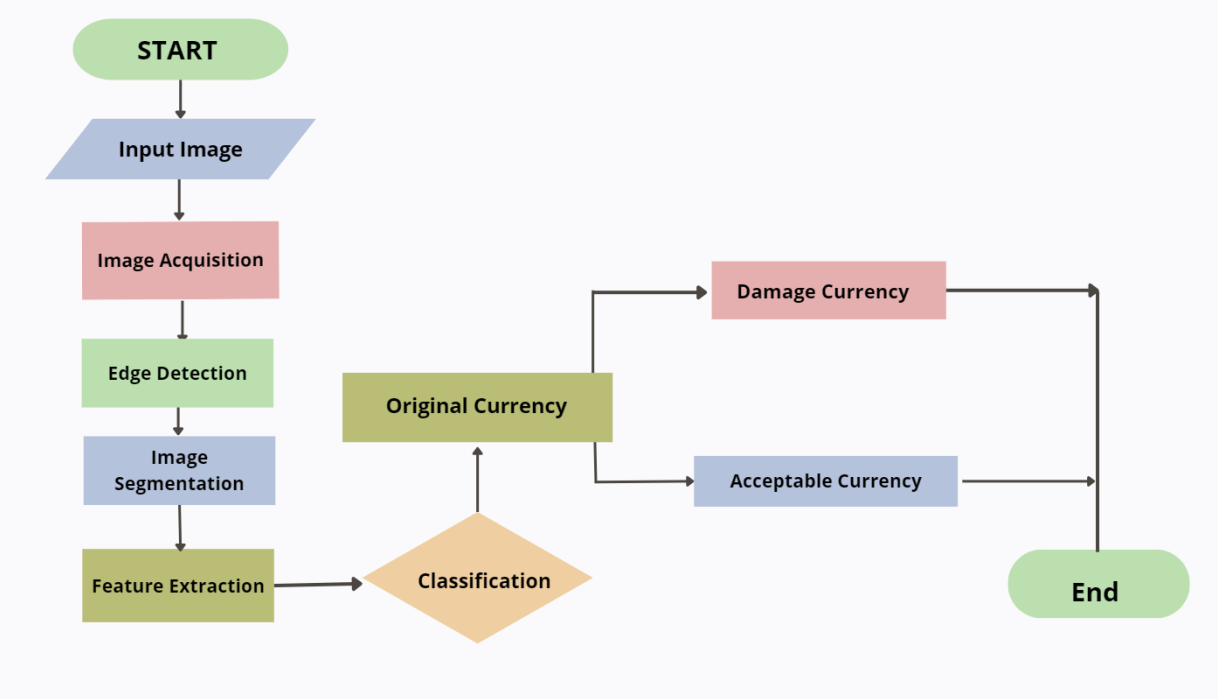
Literature Summary

Dataset	Algorithm	Result/discussion
Indian currency note of 500 and 2000.	Grey Scaling algorithm, Edge Detection algorithm	By making this project they recognized fake currencies by taking advantage of cheaper and high quality equipment.[3]
Image type dataset Source: Kaggle Sample items: 995	KNN algorithm, machine learning algorithms	They analyzed all related existing architectures and discovered some flaws in the currently existing system to recognize fake currencies.[12]
Image type dataset of currencies	Image Scaling, binarization algorithm, KNN classifier	This project enables a visually impaired person to detect whether the currency is original or fake.[4]
Image type dataset of currencies	Machine learning algorithms.	This project helps to obtain false money through image processing.[5]
Image type dataset of currencies	Canny edge detection algorithm.	They ended up using OpenCV along with python programming language to detect fake currencies.[1]
Image type dataset of currencies	Digital image processing algorithms are used.	In this project, the authentication of currency is made by applying image processing.[2]
Image type dataset Source: OpenML sample items: 1,372.	The K-means clustering algorithm	Using K-Means algorithm with several clusters equal to two can help to identify genuine or forged banknotes efficiently. Accuracy: 87%
Image type dataset, having 3 columns: type, filter shape and input size. Sample items: 500	Data Augmentation, Transfer Learning algorithm	This CNN model (Mobilenetv2-FCD) has been trained on a real time dataset and then deployed into a mobile application to determine fake currencies. Accuracy: 85%.[11]
Image type dataset. Source: Kaggle	CNN model training, currency pre-processing algorithm.	a system that uses convolutional neural networks using deep training to detect fake currencies.[10]

Image type dataset.	Fluorescence, dimension Detection and color composition algorithm.	using image processing techniques they detected the fake currencies.[9]
Image type dataset. Sample items: 1372	SML, Decision tree, KNN SVM algorithm.	In this project, SML algorithm SVM, DT, and KNN are applied to authenticate banknotes.[6]
Images of Indian currency of 10, 20, 50 and 100. Sample items: 327	Deep learning and neural network algorithms, CNN algorithm.	The detection of the currency is done within seconds and the recognition is done easily.[13]
Image type dataset	Digital image processing algorithm	The proposed system seems to be useful to detect whether the currency is genuine or not.[7]
Image type dataset	Digital image processing algorithm	The study includes effective method for recognizing the properties to detect fake notes.[8]
Image type dataset of Bangladeshi currencies	CNN model, deep learning technique	With the use of deep learning and image processing, fake currencies are detected.[14]
Image type dataset of Pakistani currencies	Digital image processing algorithm.	suggested an approach for identifying real notes using the image processing technique.[15]
Srilanka Rupee Notes of 100, 500, 1000 and 2000	SIFT	95% is achieved with note displays of 100 and 500 note.[16]
Total 10 different data is used.	SUFT	The accuracy of the system proposed is close to 70%. Further implemented for the foreign currencies.[17]
MATLAB, Ultraviolet Ray and different notes.	SVM	Approximately accuracy is more than 90%.[18]
UV with digital camera or scanner, RGB images	Apply here a simple algorithm which works properly.	The result isn't contentment. More features are highly needed.[21]

11 different data is used	ORB	The accuracy of the system is more than 85%.[22]
1000 rupees note	SVM	Features hence it is considered as fake note.[25]
100, 500 rupees notes.	a simple algorithm was applied	The system compares more features for feature extraction than other proposed systems.[28]
Approximately 10 data are used.	Canny Edge detection Algorithm	The accuracy of the system proposed above is close to 80%.[34]

DATA FLOW DIAGRAM



FUTURE SCOPE

The Indian currency note classification and damage detection system has immense potential for future development and expansion. Some potential areas of future scope include:

- Real-time Implementation: Integrating the system with real-time image capture devices for instant classification and detection.
- Mobile Application: Developing a mobile application for users to classify and detect Indian currency notes on-the-go.
- Expansion to Other Currencies: Adapting the system to classify and detect currency notes of other countries.
- Improving Accuracy: Improving the accuracy of the system by collecting more data and training the models on a larger dataset.
- Reducing Computational Complexity: Reducing the computational complexity of the system by optimizing the models and using more efficient algorithms.