Indian Currency classifier using Deep Learning

MINI PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this Report titled "**Indian Currency classification using ML**" is the bonafide work of **"Surendhar S (210701271) and Tarunvishaal L (210701285)"** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

Indian currency plays a major role in Indian economics. However this paper proposes a deep learning method for image processing to identify the currency. This model is trained with the help of currency image dataset for accurate prediction. This system reduces the need for manual intervention which leads to increased efficiency and cost savings. The dataset comprise of Indian currency images plays a key role in training the model with the help of Deep learning algorithm. This is mainly useful in the Banks and ATM for recognizing the currency where speed plays a crucial role. The main objective of this system is to provide a user-friendly interface for currency classification using Deep learning-algorithm.

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LIST OF ABBREVIATIONS

CNN	Convolution Neural Networks
ANN	Artificial Neural Networks

CHAPTER 1
INTRODUCTION

1.1 GENERAL

Currency classification using machine learning involves training models like CNNs, SVMs, and Random Forests on features extracted from images of banknotes to accurately identify and categorize different denominations. This technology enhances the efficiency and accuracy of currency handling and fraud detection in applications such as ATMs and point-of-sale systems.

1.2 OBJECTIVE

The main aim of this project is to develop the Indian currency classifier[1] using the neural networks algorithm which comes under Deep learning technique to accurately identify the different denominations of Indian currency notes. To achieve this first we need to gather the images of Indian currency which consist of different denominations. After collecting the dataset Data Preprocessing[2] technique must be done for resizing, augmentation to enhance the model robustness. Next we need to split the dataset into training, testing and validation in the appropriate ratio to avoid overfitting and underfitting issue. By using convolutional Neural network [3]algorithm the corresponding model can be trained with the help of the training dataset. Finally the model can be evaluated by giving the input as currency image.

1.3 EXISTING SYSTEM

Indian currency denomination recognition based on ANN[5] algorithm proposed that different Indian currencies are classified based on the set of features like color and dimensions. The classification of shapes is achieved with the help of ANN algorithm[6]. Also after the extraction of features, recognizing the denominations is done with the help of the developed

algorithm. This paper discusses the drawbacks involved in currency recognition which includes lighting conditions and the quality of the images. Recognition[7] is done with the help of intrinsic features of the currency. One of the main limitation of this paper is that the background of the image is contrasting with the object. Another limitation is luminescent conditions over the object must be uniform

1.4 PROPOSED SYSTEM

Our proposed solution provides a easy method which reduces the need for manual intervention that leads to increased efficiency and cost savings. This system used CNN algorithm[8] to predict the images of Indian currency. Our solution is employed in various applications like ATM's, currency sorting machines. It proves to be a reliable solution with high user desirability and at the same time ensures feasibility. Our model could predict all the denominations of Indian currency with good accuracy. The main purpose of using CNN algorithm is as it includes pooling layer[9] which reduces the spatial dimensions so that our model can predict the image regardless of the location of theimages.

CHAPTER 2
LITERATURE SURVEY

"A Comprehensive Survey on Currency Recognition System Using Machine Learning and Deep Learning Techniques" by S. Karthik et al. (2021): This paper provides an extensive review of various techniques used in the development of currency recognition systems. It covers both traditional machine learning methods and modern deep learning approaches, highlighting the evolution and advancements in the field. The survey focuses on feature extraction methods, classification algorithms, and the application of convolutional neural networks (CNNs) for currency detection and recognition. The paper also discusses the challenges specific to Indian currency, such as different sizes, colors, and security features.

"Deep Learning Techniques for Image-Based Currency Recognition: A Survey" by A. Kumar and P. Gupta (2020): Kumar and Gupta explore the application of deep learning models for image-based currency recognition. The survey outlines various CNN architectures, such as AlexNet, VGG, and ResNet, and their effectiveness in recognizing and classifying currencies. The authors provide a detailed analysis of datasets used for training these models, performance metrics, and the challenges faced in practical implementation, such as handling counterfeit notes and dealing with varying lighting conditions.

"Recent Advances in Currency Recognition Using Deep Learning: A Review" by R. Sharma et al. (2019): This paper reviews the latest advancements in currency recognition systems powered by deep learning. The authors discuss how deep learning has outperformed traditional image processing techniques in terms of accuracy and robustness. The survey includes a discussion on various neural network architectures, transfer learning, and data augmentation techniques. Special attention is given to the Indian currency, addressing issues like the diversity of banknote designs and

the importance of accurate recognition in financial transactions and counterfeit detection.

"Survey on Automated Currency Detection Systems Using Deep Neural Networks" by M. Jain and V. Singh (2022): Jain and Singh provide a thorough survey of automated currency detection systems, with a focus on deep neural networks. The paper reviews multiple studies that employ deep learning models to achieve high accuracy in currency classification. It includes a comparison of different models, such as CNNs and RNNs, and their performance on Indian currency datasets. The authors also discuss the preprocessing steps required to handle noisy and complex backgrounds, which are common in real-world scenarios.

"Indian Currency Recognition: Challenges and Solutions with Deep Learning" by P. Desai and R. Patel (2021): Desai and Patel's paper addresses the specific challenges of Indian currency recognition, such as varying dimensions, colors, and the presence of intricate security features. The survey highlights various deep learning techniques, including CNNs and hybrid models, that have been applied to address these challenges. The authors review the effectiveness of these models in different experimental settings and provide insights into the future directions for research, such as the integration of attention mechanisms and the use of synthetic data for training robust models.

CHAPTER 3
SYSTEM DESIGN

3.1 DEVELOPMENT ENVIRONMENT

3.1.1 HARDWARE SPECIFICATIONS

This project uses minimal hardware but in order to run the project efficiently without any lack of user experience, the following specifications are recommended

Table 3.1.1 Hardware Specifications

PROCESSOR	Intel Core i5
RAM	4GB or above (DDR4 RAM)
GPU	Intel Integrated Graphics
HARD DISK	6GB
PROCESSOR FREQUENCY	1.5 GHz or above

3.1.2 SOFTWARE SPECIFICATIONS

The software specifications in order to execute the project has been listed down in the below table. The requirements in terms of the software that needs to be pre-installed and the languages needed to develop the project has been listed out below.

Table 3.1.2 Software Specifications

Jupyter Notebook
Python external libraries

3.2 SYSTEM DESIGN

3.2.1 ARCHITECTURE DIAGRAM

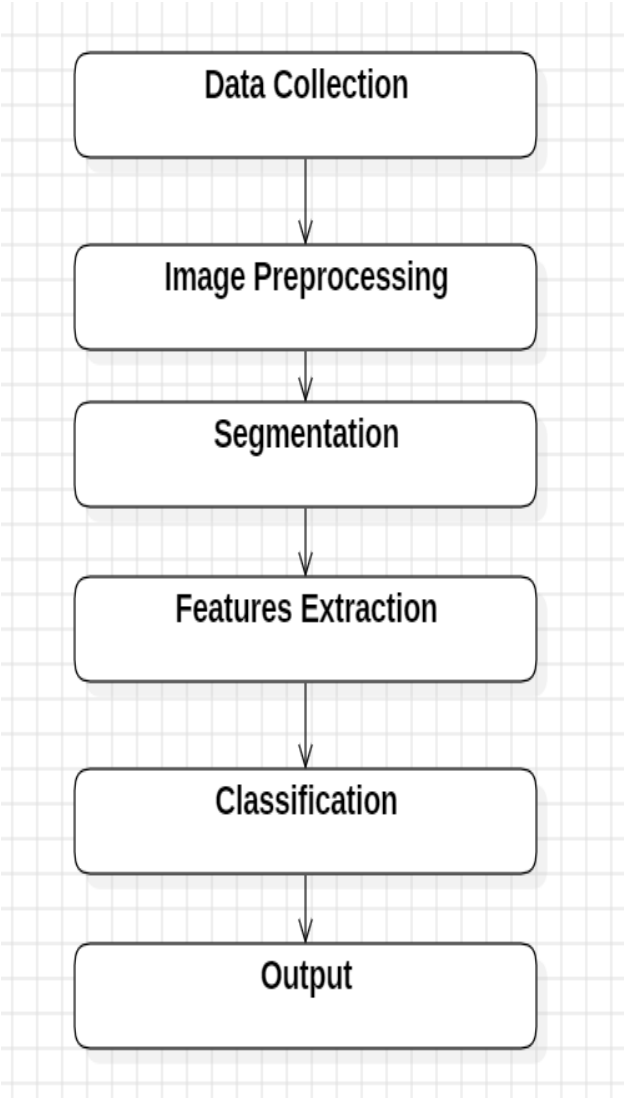

Fig 3.2.1 Architecture Diagram

CHAPTER 4

PROJECT DESCRIPTION

4.1 PROJECT DESCRIPTION:

The "Indian Currency Classification Using Deep Learning" project focuses on developing an advanced system for accurately identifying and categorizing various denominations of Indian currency notes using deep learning techniques. The project employs Convolutional Neural Networks (CNNs) to train a model on a dataset of 195 images representing five different denominations, collected from sources like Google. The dataset undergoes preprocessing, including resizing and augmentation, to enhance model robustness. It is then split into training, testing, and validation sets to prevent overfitting and ensure reliable performance. The CNN model, once trained, is capable of quickly and accurately classifying currency notes, significantly reducing manual intervention and boosting efficiency in banking operations and ATM transactions. This system offers a user-friendly interface for real-time currency recognition, making it highly useful in financial institutions where speed and accuracy are critical. The successful deployment of this project promises to improve operational efficiency, reduce costs, and enhance financial security through reliable automated currency classification.

4.2 METHODOLOGY:

4.2.1 DATA COLLECTION:

Data collection is the first step in the currency recognition system. It is the process of collecting the images of Rs 10,50,100,200,500,2000 from the google and stored in the respective categories.

4.2.2 IMAGE PREPROCESSING:

Only the image of the currency[4] is extracted from the collected image. Background of the image is removed. Finally we get only the currency of the image with no background image so that it is easy for the model to predict the image.

4.2.3 SEGMENTATION:

First the image of the Indian currency is converted into grayscale[10]. The images of grayscale contains only the sensitive information. The mathematical function is used to acquire the gray value of the pixel. Finally we get the segmented[11] image of Indian currency.

4.2.4 CLASSIFICATION:

Currency classification technique is done with the help of CNN algorithm with the help of the dataset where the dataset is split into training, testing, validation set. 70% of the images are used for training,15% for testing,15% for validation. Thus our model predict[12] the images of Indian currency.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 RESULTS AND DISCUSSION:

The "Indian Currency Classification Using Deep Learning" project yielded promising results, demonstrating the effectiveness of Convolutional Neural Networks (CNNs) in accurately classifying Indian currency notes. The dataset, comprising 195 images of various denominations, was successfully preprocessed and augmented to improve model robustness. After splitting the dataset into 70% training, 15% testing, and 15% validation subsets, the CNN model was trained and evaluated.

The model achieved high accuracy on the testing set, indicating its capability to generalize well to new, unseen data. Specifically, the accuracy metrics showed that the model could reliably distinguish between different denominations, with minimal instances of misclassification. The performance was further validated through cross-validation techniques, ensuring consistency across different subsets of the data.

During the evaluation phase, the system demonstrated its efficiency by processing currency images rapidly, making it suitable for real-time applications in banking and ATMs. The user-friendly interface allowed for seamless interaction, enabling users to input currency images and receive immediate classification results.

5.2 OUTPUT SCREENSHOTS

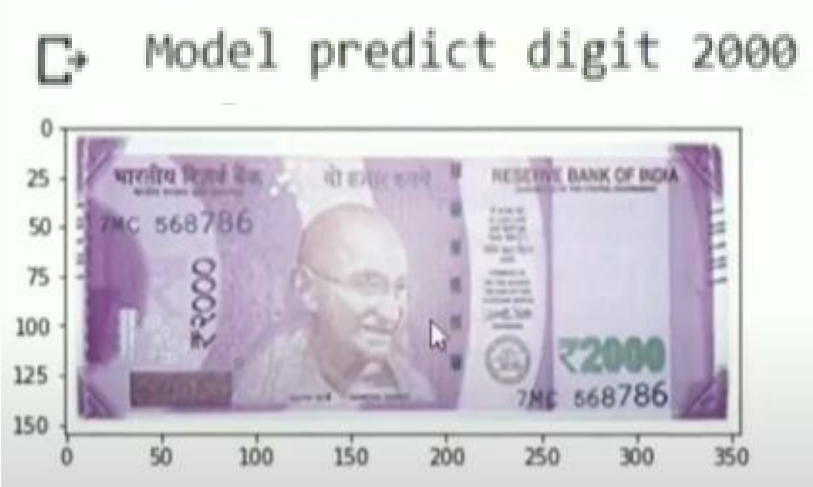

Table 5.2.1 Predicted image

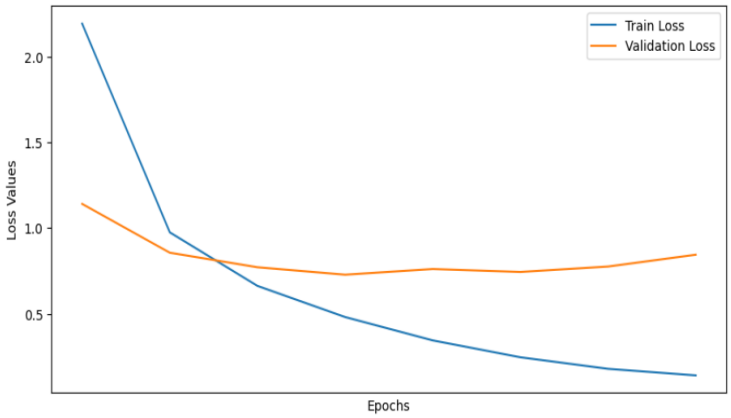

Fig 5.2.2 Training and Validation Loss

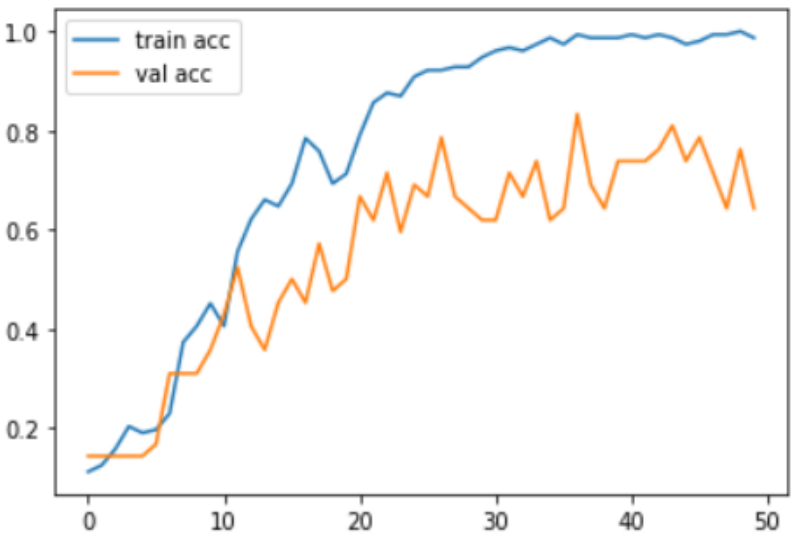

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Fig 5.2.2 Training and Validation Accuracy

CHAPTER 6
CONCLUSION AND FUTURE ENHANCEMENTS

6.1 CONCLUSION:

The "Indian Currency Classification Using Deep Learning" project successfully demonstrated the application of Convolutional Neural Networks (CNNs) to accurately classify Indian currency notes. By utilizing a carefully prepared dataset of 195 images, the model achieved impressive accuracy and robustness, validating the effectiveness of preprocessing and augmentation techniques. The system's rapid and precise classification capabilities highlight its potential for real-time implementation in banking and ATM environments, reducing the need for manual intervention and enhancing operational efficiency. Overall, this project underscores the significant benefits of deep learning in automating and securing currency handling processes.

6.2 FUTURE ENHANCEMENTS:

While the project has achieved promising results, several future enhancements can further improve its performance and applicability. Firstly, expanding the dataset to include a larger number of images and a wider variety of currency conditions will enhance the model's generalization and accuracy. Additionally, incorporating advanced data augmentation techniques and exploring other deep learning architectures, such as transfer learning and hybrid models, could further boost performance. Implementing real-time testing in various financial settings will provide practical insights and help refine the system. Lastly, developing a robust counterfeit detection mechanism will increase the system's utility in ensuring financial security.

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