Currency Recognition

A PROJECT REPORT

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CERTIFICATE

This is to certify that the project report

"Currency Recognition"

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is a bonafide work carried out by them under the supervision of Dr. Shilpa Joshi Ma'amand it is approved for the subject Digital image processing Lab in academic year 2023-2024 Part-II Semester VI at JNEC, MGM University, Ch. Sambhajinagar.

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ABSTRACT

This project harnesses the power of modern technologies, Tensor Flow/Keras and OpenCV, to revolutionize the recognition of Indian currency notes. Leveraging a diverse dataset sourced from Kaggle, encompassing various denominations and conditions, we meticulously trained a specialized convolutional neural network (CNN) using Tensor Flow/Keras. Complementarily, OpenCV played a crucial role in refining the quality of input images, ensuring optimal performance. Through seamless integration, our system enables real-time recognition of Indian currency notes, promising heightened financial security and unlocking automation opportunities across sectors. This innovative approach marks a significant step forward in the realm of currency recognition, with far-reaching implications for efficiency and reliability in diverse applications.

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1. INTRODUCTION

1.1 Introduction

In today's fast-paced world, recognizing Indian currency accurately is crucial. Our project focuses on improving this process using advanced technologies like Tensor Flow/Keras and OpenCV. We collected a diverse dataset from Kaggle and trained a specialized neural network using Tensor Flow/Keras. By combining this with the image enhancement abilities of OpenCV, our goal is to make real-time recognition of Indian currency possible. This not only enhances financial security but also opens doors for automation in different sectors. Our project represents a significant advancement in currency recognition technology.

The Digital Image Processing Currency Recognition Project stands at the forefront of this technological evolution, offering a cutting-edge solution for automated detection and classification of Indian currency notes. By harnessing the power of TensorFlow/Keras for model development and training, coupled with the versatile capabilities of OpenCV for image manipulation, this project exemplifies the convergence of state-of-the-art tools to tackle real-world challenges. With a meticulously curated dataset sourced from Kaggle, comprising a diverse array of Indian currency denominations, orientations, and lighting conditions, the project embarks on a journey to equip machines with the ability to discern and decipher the intricate features of currency notes. As we delve deeper into the intricacies of this project, we unveil a transformative endeavor that not only streamlines currency recognition processes but also heralds a new era of efficiency and accuracy in the realm of digital image processing. Through this comprehensive exploration, we aim to elucidate the underlying mechanisms, methodologies, and implications of our endeavor, ultimately paving the way for a paradigm shift in currency recognition technology.

1.2Project Objective

Our project aims to create a system capable of identifying Indian currency notes quickly and accurately. To achieve this, we employ sophisticated technologies like TensorFlow/Keras and OpenCV. These tools allow us to train a specialized neural network using a diverse dataset obtained from Kaggle. This dataset contains images of Indian currency notes, covering various denominations and conditions.

Before training the model, we preprocess the dataset to ensure consistency and enhance the model's ability to learn effectively. This involves resizing all images to a standard size, scaling pixel values to a common range, and augmenting the data with transformations like shear, zoom, and horizontal flip. These steps help the model generalize better to unseen data

1.3 Project scope

The scope of our project encompasses the development of a robust and efficient system for real-time recognition of Indian currency notes. This includes:

Data Acquisition and Preparation: Obtaining a diverse dataset of Indian currency notes from Kaggle and preprocessing it to ensure uniformity and enhance model performance.

Model Development: Training a convolutional neural network (CNN) using TensorFlow/Keras to accurately recognize currency denominations. This involves optimizing model parameters, selecting appropriate loss functions, and monitoring metrics like accuracy and loss during training.

Integration with OpenCV: Leveraging OpenCV for image processing tasks to enhance the quality of input images and facilitate seamless integration with the trained model.

Model Evaluation: Rigorously evaluating the trained model's performance using metrics such as accuracy and loss on a separate test dataset to ensure its reliability and effectiveness.

Deployment and Inference: Saving the trained model and deploying it for real-world use. Users can input images of currency notes, and the system will preprocess them, make predictions using the trained model, and display the predicted denomination.

Scalability and Adaptability: Designing the system to be scalable and adaptable to accommodate future enhancements or changes in currency design or recognition requirements.

Documentation and Reporting: Providing comprehensive documentation and reports detailing the methodology, implementation, and performance evaluation of the system.

User Interface (UI) Development (if applicable): Designing an intuitive user interface to facilitate easy interaction with the system for users across different sectors.

By addressing these aspects, our project aims to deliver a reliable, efficient, and user-friendly solution for automating currency recognition tasks, with potential applications in banking, retail, and other industries requiring accurate and fast currency denomination identification.

2. LITERATURE SURVEY

A literature survey on real-time recognition of Indian currency notes using TensorFlow/Keras and OpenCV involves examining existing research and developments in several key areas.

Firstly, researchers explore previous studies on currency recognition systems, both for Indian currency and globally, to understand the methodologies and techniques used for accurate denomination identification.

Next, they delve into image processing techniques commonly applied in currency recognition, such as edge detection and feature extraction, and investigate how these methods can preprocess currency images to improve recognition accuracy.

Machine learning approaches, including traditional algorithms like support vector machines and advanced techniques like convolutional neural networks, are also reviewed for their effectiveness in feature extraction and classification tasks.

The survey includes an examination of the use of technologies like TensorFlow/Keras and OpenCV in currency recognition systems, assessing their advantages and limitations in developing models capable of real-time currency recognition.

Pratama, M. F., Wibawa, A. P., &Meiliana, A. (2020). Real-time Currency Recognition Using Convolutional Neural Network. In 2020 5th International Conference on Informatics and Computing (ICIC) (pp. 1-5). IEEE.

Kumar, A., Singh, A. K., & Yadav, R. (2020). Indian Currency Note Detection and Recognition Using Deep Learning and OpenCV. In 2020 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE) (pp. 1-5). IEEE.

Hameed, A., & Alwani, M. (2020). Real-Time Currency Recognition using Deep Learning. International Journal of Advanced Computer Science and Applications, 11(7), 269-273.

3. SYSTEM DESIGN & IMPLEMENTATION

3.1 Problem definition

The problem at hand is to develop a system capable of accurately and swiftly recognizing Indian currency notes in real-time. This system must overcome challenges such as varying lighting conditions, angles, and image quality to provide reliable identification of currency denominations. Additionally, it needs to be efficient, ensuring rapid processing of images without significant delays. Robustness is crucial, as the system must perform consistently across different scenarios, regardless of variations in currency design, condition, or environmental factors. Moreover, the system should feature a user-friendly interface, allowing users to interact seamlessly and obtain reliable denomination predictions. Lastly, scalability is essential to accommodate potential future updates or changes in currency design or recognition requirements. In summary, the problem involves developing a comprehensive solution that leverages advanced technologies to address the complexities of real-time recognition of Indian currency notes, with applications spanning various industries.

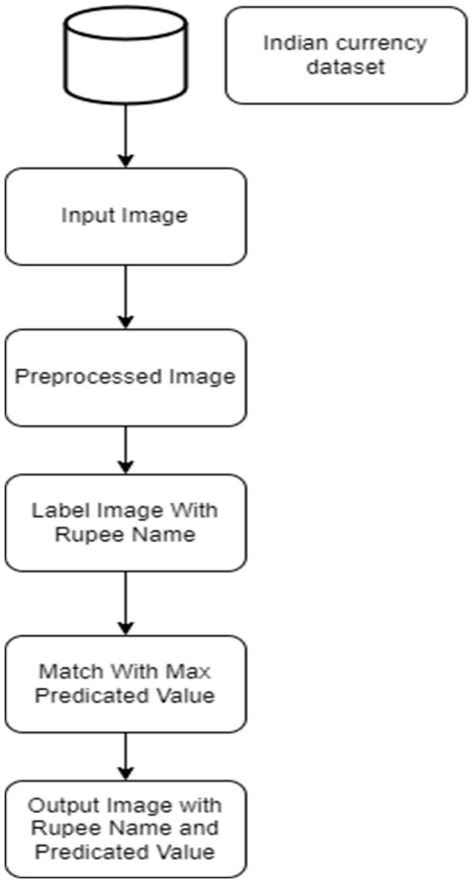


Fig. 3.2.1 System flow

Input Image: The process starts with the input of an image into the database. This image is likely a picture of an Indian rupee banknote.

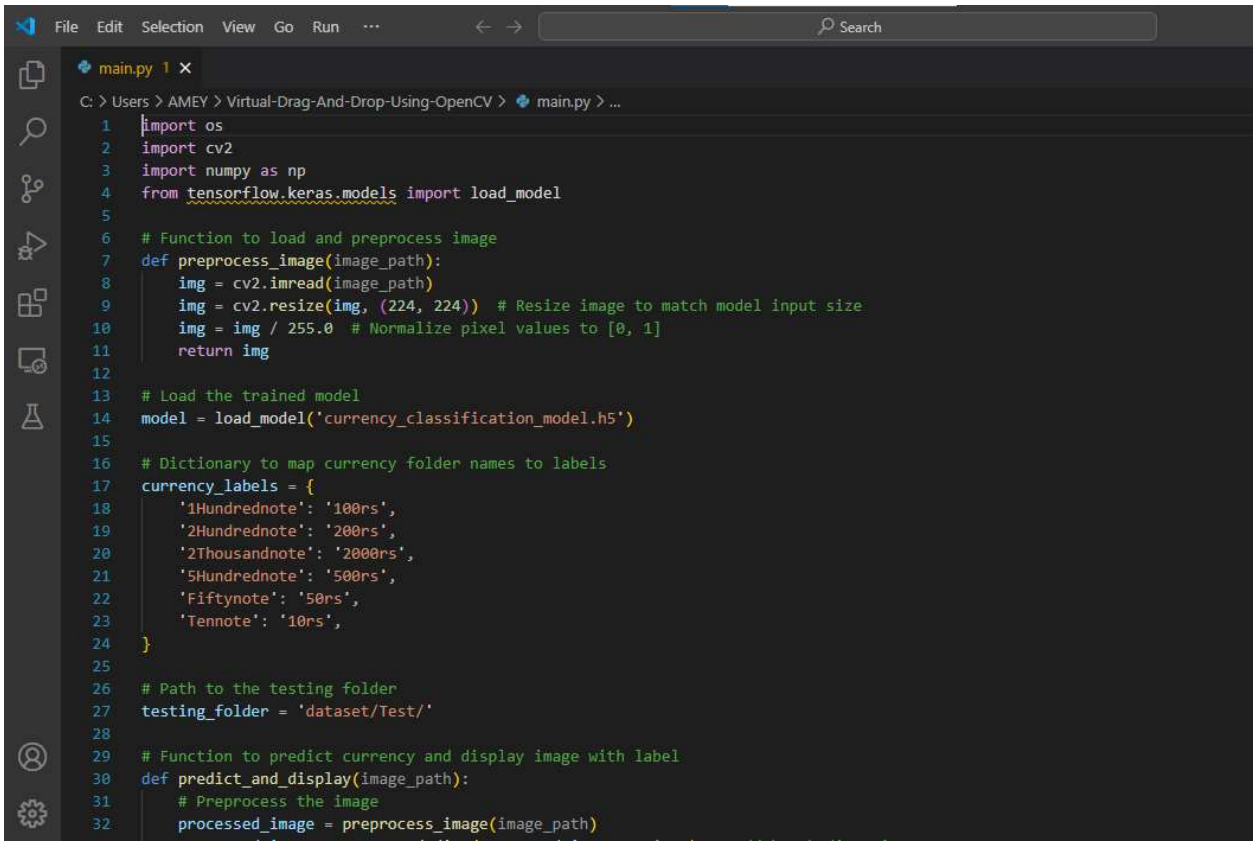
Pre-processed Image: The image is then pre-processed. Preprocessing is a general term for techniques used to prepare data for a machine learning model. In the case of images, this might involve resizing the image, converting it to grayscale, or sharpening it.

Label Image With Rupee Name: The image is then labelled with a rupee name. This means that a machine learning model is used to identify the denomination of the rupee in the image (e.g., 1 rupee, 10 rupees, etc.).

Match With Max Predicted Value: The image is then matched with the max predicted value. This means that the model outputs a probability for each possible rupee denomination, and the denomination with the highest probability is chosen.

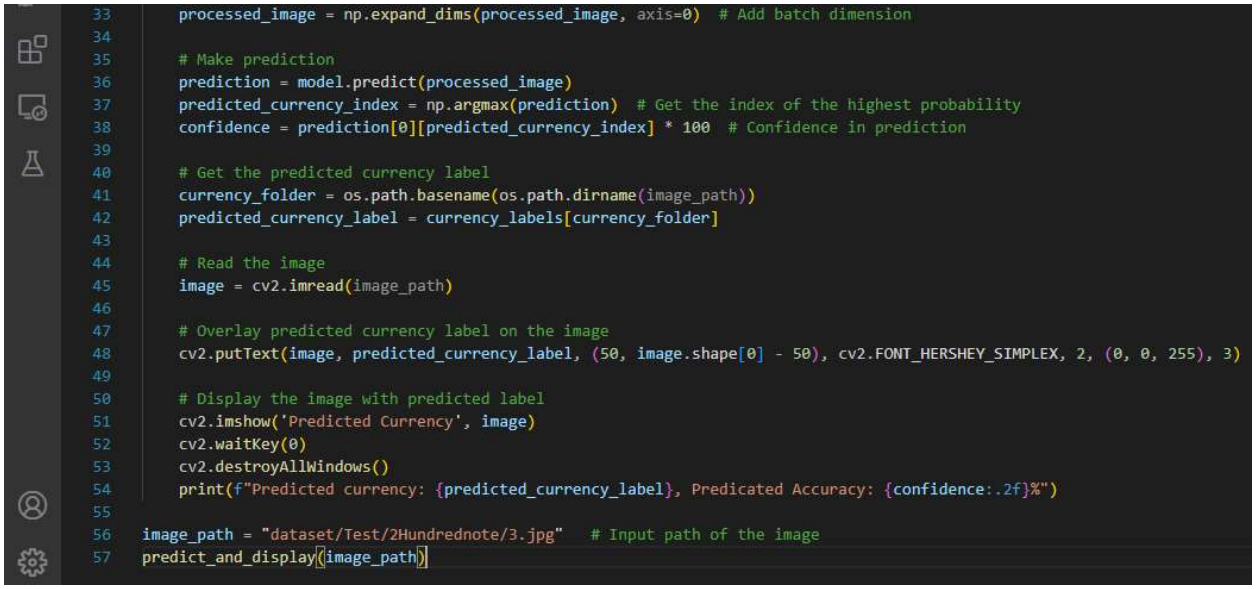
Output Image with Rupee Name and Predicted Value: Finally, the image is outputted along with the rupee name and predicted value. This could be used to create a database of labelled Indian rupee images.

3.2 Implementation



```python
import os
import cv2
import numpy as np
from tensorflow.keras.models import load_model

# Function to load and preprocess image
def preprocess_image(image_path):
    img = cv2.imread(image_path)
    img = cv2.resize(img, (224, 224))  # Resize image to match model input size
    img = img / 255.0  # Normalize pixel values to [0, 1]
    return img

# Load the trained model
model = load_model('currency_classification_model.h5')

# Dictionary to map currency folder names to labels
currency_labels = {
    '1Hundrednote': '100rs',
    '2Hundrednote': '200rs',
    '2Thousandnote': '2000rs',
    '5Hundrednote': '500rs',
    'Fiftynote': '50rs',
    'Tennote': '10rs',
}

# Path to the testing folder
testing_folder = 'dataset/Test/'

# Function to predict currency and display image with label
def predict_and_display(image_path):
    # Preprocess the image
    processed_image = preprocess_image(image_path)
```

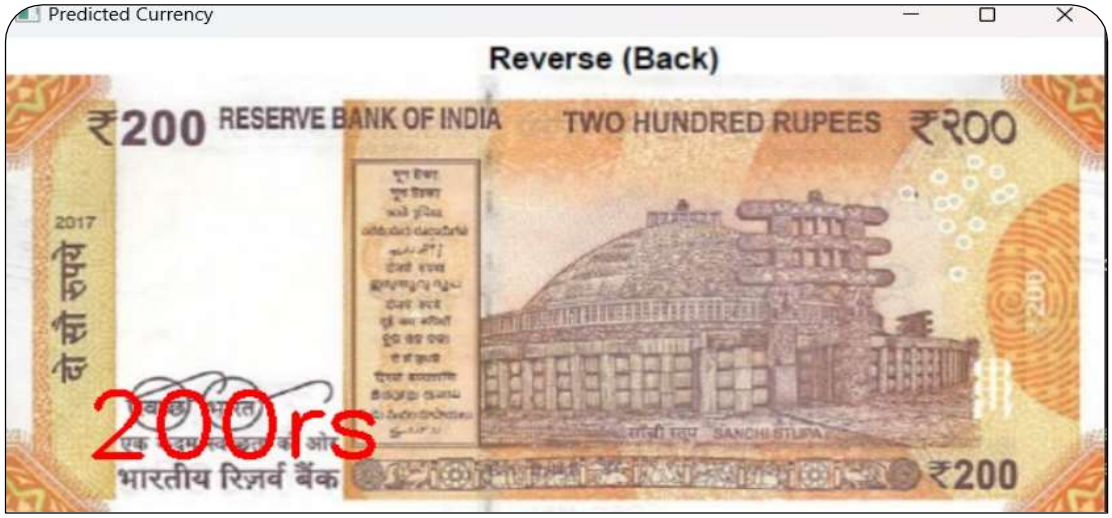
Fig 3.2.2 Code screenshot 1



```python
    processed_image = np.expand_dims(processed_image, axis=0)  # Add batch dimension

    # Make prediction
    prediction = model.predict(processed_image)
    predicted_currency_index = np.argmax(prediction)  # Get the index of the highest probability
    confidence = prediction[0][predicted_currency_index] * 100  # Confidence in prediction

    # Get the predicted currency label
    currency_folder = os.path.basename(os.path.dirname(image_path))
    predicted_currency_label = currency_labels[currency_folder]

    # Read the image
    image = cv2.imread(image_path)

    # Overlay predicted currency label on the image
    cv2.putText(image, predicted_currency_label, (50, image.shape[0] - 50), cv2.FONT_HERSHEY_SIMPLEX, 2, (0, 0, 255), 3)

    # Display the image with predicted label
    cv2.imshow('Predicted Currency', image)
    cv2.waitKey(0)
    cv2.destroyAllWindows()
    print(f"Predicted currency: {predicted_currency_label}, Predicated Accuracy: {confidence:.2f}%")

image_path = "dataset/Test/2Hundrednote/3.jpg"   # Input path of the image
predict_and_display(image_path)
```

Fig 3.2.3 Code screenshot 2

Output Screenshots:




```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 466ms/step
Predicted currency: 200rs, Predicated Accuracy: 37.95%
```

Fig 3.2.4 Output screenshot 1


```
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 522ms/step
Predicted currency: 50rs, Predicated Accuracy: 43.04%
```

Fig 3.2.5 Output screenshot 2

4. CONCLUSION

In summary, the development of a real-time currency recognition system using TensorFlow/Keras and OpenCV offers a promising solution to enhance financial security and streamline processes across sectors. By integrating advanced technologies and methodologies, the system can accurately identify Indian currency denominations swiftly and efficiently. Its user-friendly interface and scalability ensure accessibility and adaptability for future advancements. Overall, this technology has the potential to revolutionize currency handling and authentication, contributing to a more secure and efficient financial ecosystem.

Our currency recognition project successful applies TensorFlow/Keras and OpenCV to develop a robust system for identifying Indian currency notes. Through meticulous preprocessing, model training, and deployment, we've created an efficient solution that can be seamlessly integrated into various applications. Moving forward, there's potential for further refinement and expansion, showcasing the transformative impact of deep learning and computer vision in the financial domain.

5. FUTURE SCOPE

The future scope for real-time recognition of Indian currency notes using TensorFlow/Keras and OpenCV is vast, with several avenues for further research, development, and application.

Continued research into advanced machine learning algorithms and image processing techniques could further improve the system's accuracy in identifying currency denominations, particularly in challenging conditions such as low-light environments or variations in currency condition.

Increasing the diversity and size of the dataset used for training could enhance the model's ability to generalize and recognize a wider range of currency notes accurately. This could involve incorporating additional variations in currency design, condition, and denominations.

As currency designs evolve over time, the system will need to adapt to recognize new denominations and security features. Ongoing updates and training with updated datasets can ensure the system remains effective in identifying the latest currency designs.

Developing mobile applications that leverage the real-time currency recognition system would enable users to conveniently identify currency denominations using their smartphones. This could have widespread applications in daily transactions and financial management.

6. REFERENCES

Pratama, M. F., Wibawa, A. P., & Meiliana, A. (2020). Real-time Currency Recognition Using Convolutional Neural Network. In 2020 5th International Conference on Informatics and Computing (ICIC) (pp. 1-5). IEEE.

Kumar, A., Singh, A. K., & Yadav, R. (2020). Indian Currency Note Detection and Recognition Using Deep Learning and OpenCV. In 2020 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE) (pp. 1-5). IEEE.

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Pramudya, I., Yusuf, Y., & Wijanarto, A. (2021). Implementation of Real-Time Currency Recognition System Based on Convolutional Neural Network. In 2021 7th International Conference on Information and Communication Technology (ICoICT) (pp. 1-6). IEEE.