ISSN (Online): 2456-0448
International Journal Of Innovative Research In Management, Engineering And Technology
Vol. 9, Issue 3, April 2024

Enhanced system for the Blind through Currency Recognition Technologies

[1] M. Menakapriya, [2]Jagadeshvarran M.V, [3]Karthik .S, [4]Kamalanathan P.V, [5]Jagatheesh .P
[1] Associate Professor Department of MCA Muthayammal Engineering College Namakkal, Tamilnadu, India
menakaroshan@gmail.com
[2] [3] [4] [5] Department of MCA Final Year Muthayammal Engineering College Namakkal, Tamilnadu, India
jagavijay21@gmail.com, dukekarthik22@gmail.com, Itsmekamal2002@gmail.com,jagatheeshp06@gmail.com

Abstract: ***Indian currency identification for visually impaired persons with audio output using a CNN algorithm is a technology designed to enhance the independence and quality of life of visually impaired individuals in India. The system recognises and identifies various denominations of Indian rupee by using a machine learning model trained on images of Indian cash. The CNN algorithm can analyse photos captured by a camera, such as those from a smartphone or other device, and differentiate various denominations of currency, such as 10 rupees, 50 rupees, etc. The system uses audio output in which the denomination of the money is read aloud to the user, hence aiding visually handicapped individuals in identifying and recognising Indian cash. The technology is compatible with mobile applications and smart devices. This technology is still in its developmental stages, but it has the ability to change the lives of visually impaired individuals in India. Even though, the technology presents a number of challenges, including lighting conditions, picture clarity, and the many variances of Indian rupee notes. The study tries to overcome these obstacles and improve the robustness and dependability of the technology.***

Index Terms—Neural networks, Machine learning, Assistive technology, Image processing, Visually impaired.

I. INTRODUCTION

According to the WHO, over 253 million people worldwide are visually impaired, with 36 million of them being blind. This number is anticipated to increase as the global population ages and the incidence of dis- eases such as diabetes, which may cause blindness, increases. In this work, we present a cutting-edge technique enabling visually impaired people to effortlessly and independently identify currency notes. Our system combines advanced image processing technologies and deep learning algorithms, in particular CNNs, to consistently recognise and classify different currency notes. The device also includes an audio feedback module that use text-to-speech technology to provide audio notifications of the determined currency note denomination to the user. Individuals with visual impairments must be able to recognise currency in order to engage in ordinary transactions with confidence. Traditional methods of identifying banknotes, such as braille markings or raised writing, are not always accurate and may not be easily accessible to all visually impaired individuals. In order to solve this issue, we propose a CNN-based, image-processing-based identification solution for Indian rupee notes. The system was trained on a massive collection of images of Indian currency and its real-time performance was tested. Our approach can accurately differentiate between the new and old series of various denominations of Indian currency notes. Additionally, the proposed system includes an auditory feedback module that uses text-to-speech technology to vocally tell the user of the denomination of the recognised currency note. This feature is particularly useful for the visually impaired, who may not be able to read braille or raised print. The pro- posed system is designed to recognise various denominations of Indian currency notes (10, 20, 50, 100, 200, 500, and 2,000) and provide audio feedback through voice notes that correspond to the determined cash amount. As soon as the system recognises a currency note, the associated voice note is enabled. Because the Indian money system uses a variety of note and coin denominations, it can be challenging for those who are visually impaired to distinguish between them. Confusion and challenges with daily transactions may result from this. A CNN based Currency Recognition System for Visually Impaired People can be created to solve this problem.

A CNN is a specific kind of deep learning system that excels at image identification tasks. A CNN model may be taught to correctly determine the denomination of a specific currency note based on a picture by training it on a big dataset of photos of Indian currency notes. Visually impaired people can take a picture of a bill and receive an audio or text-based output showing its denomination by integrating the trained model into a smartphone app or other device with a camera. This would significantly increase the freedom and simplicity of daily transactions for those who are blind or visually impaired and help to lessen the challenges they encounter when identifying Indian cash.

It would take a huge collection of photos of the different notes for the CNN model to correctly identify the denomi- nation of Indian currency notes. Images of the notes would need to be included in this dataset from various perspectives, in various lighting situations, and showing both the front and back of each note. As the design and security features of the notes can change over time, the dataset would also need to include a wide variety of notes.

The dataset could be created utilising a variety of sources to gather this data. For instance, pictures might be pulled straight from the Reserve Bank of India website, which includes pictures of all the Indian banknotes currently in use. Additionally, photos could be gathered from visually impaired users of the programme who upload images of notes they come across. Before being included in the dataset, a team could validate and classify these photos. It is also crucial to keep in mind that the model needs to be trained using a variety of lighting conditions, angles, backgrounds, and note versions. To make sure that all of the photos are of the highest quality and correctly tagged with the appropriate denomination, the dataset would need to be pre-processed and cleaned after it has been gathered. The CNN model would next be trained using the dataset after it had been divided into training and testing sets.

To make sure the model can recognise the denomination of Indian currency notes accurately after it has been trained, it must then be evaluated on the testing set. It's important to note that creating and implementing this kind of application would require a team of specialists in the fields of computer vision, deep learning, and image processing.

II. RELATED WORKS

In paper[1] a study aimed at developing a system for visually impaired people to detect and recognise different currency notes. The authors of the paper aimed to address the difficulties that visually impaired people have in identifying currency notes, which can make it difficult for them to perform daily tasks like shopping or paying bills. The authors used a CNN model, a type of deep learning model commonly used for image classification tasks, to achieve this goal. The CNN model was trained on a dataset of images of currency notes from various countries and was able to correctly identify the note's denomination.

In paper[2] A study aimed at developing a system for visually challenged people that can detect and distinguish different things, including cash notes. The authors of the article aimed to address the difficulties that visually impaired people have in identifying items, which might make it difficult for them to do everyday chores like shopping or identifying objects in their surroundings. The authors used a combination of computer vision and acoustic feedback to accomplish this goal. The system used a camera to acquire photos of the objects, which were then analysed using image processing techniques to identify the objects. The selected object is then read aloud to the user using TTS technology to provide audio feedback.
In paper[3] a research project aimed at developing a system capable of classifying and identifying Indian cash notes as well as detecting counterfeit notes. The authors of the study aimed to address the issue of counterfeit notes in circulation, which can result in financial losses for individuals and businesses. The authors employed a combination of feature extraction and ensemble learning techniques to achieve this goal. The system extracted texture, colour, and edge information from photos of currency notes using image processing techniques. These

features were then used to train an ensemble learning classifier, which combines many classifiers to increase performance.
In paper[4] proposes a system for recognising and identi- fying paper currency using a combination of SURF and LBP features. The technology is intended to function with Indian currency notes, which contain sophisticated and dynamic properties such as watermarks, security threads, and printed patterns. The authors begin by reviewing existing systems for cash detection and recognition, stressing their limits and problems. They then present a new approach that uses SURF and LBP features to extract robust and unique features from money photos. The system also uses a SVM classifier to categorise the cash images based on their attributes.

In paper[5] presents a system that uses machine learning to recognise and identify cash for those with visual impairments. The method is made to work with Indian banknotes and is meant to help persons who are visually impaired determine the denomination of banknotes. The authors begin by reviewing the current technologies for visually impaired people to iden- tify and recognise currency while stressing their drawbacks. They then suggest a brand-new method that extracts features from photographs of currency and categorises them according to their denomination by using machine learning techniques. CNN technology is used by the system to categorise the images of cash.

In paper[6] provides a smartphone application to help people with vision impairments navigate their environment. The Android-based programme, called BlindAid, employs machine learning methods to give users real-time direction and information. The authors begin by reviewing the current assistance programmes for those who are visually impaired and identifying their shortcomings. Then, they suggest a brand-new system called BlindAid, which extracts information from camera images using machine learning techniques and directs people based on their surroundings. CNN technology is used by the system to classify and identify items in the camera images.

In paper[7] a thorough investigation into the application of image processing methods in currency recognition systems. The study examines numerous systems that are currently in use and the methods they use, stressing their drawbacks and difficulties. The scientists then go on to suggest a brand-new methodology for identifying currencies that combines several image processing methods, including edge detection, feature extraction, and pattern recognition. They evaluate the proposed system against other current systems using a collection of photos of Indian cash.
In paper[8] created to function with Indian rupee notes, which include intricate and dynamic elements like watermarks, security threads, and printed patterns. First, the authors analyse current methods for detecting and identifying cash while underlining its drawbacks. Then, they suggest a brand-new approach that makes use of image recognition methods to extract features from photos of currency and categorise them according to their denomination. To categorise the images currency, the system uses a CNN . The authors evaluate the proposed system against other existing methods using a dataset of photographs of Indian cash.

In paper[9] describes a system that uses deep learning to recognise and detect counterfeit currency. The system is made to function with a range of banknotes and is meant to help identify fake currencies. The authors begin by reviewing the shortcomings and difficulties of the current technologies for detecting counterfeit cash and banknotes. They then put out a novel system that extracts features from photos of currency and categorises them according to their denomination and authenticity using deep learning techniques. CNN technology is used by the system to categorise the images of cash.
In paper[10] shows a system for blind and visually impaired people to identify Indian paper cash. The framework is made to work with Indian banknotes and is meant to help persons who are blind recognise the denomination of banknotes. The authors begin by reviewing the current technologies enabling visually impaired people to recognise currencies while underlining their drawbacks. They then suggest a brand-new framework called IPCRF that extracts features from photos of cash and categorises them according to their denomination by combining image processing and machine learning techniques. CNN technology is used by the framework to categorise the images of cash.

In paper[11] describes a system that uses deep neural networks to help visually challenged people recognise Sinhala cash notes (DNN). The technique is made to work with Sinhala banknotes and is meant to help persons who are blind recognise the denomination of banknotes. The authors begin by reviewing the current technologies enabling visually impaired people to recognise currencies while underlining their drawbacks. Then, they suggest a brand-new method that makes use of DNN to extract features from photos of currency and categorise them according to their denomination. CNN technology is used by the system to categorise the images of cash.

In paper[12] It is intended to help blind individuals recog- nise the denomination of currency notes and is made to work with a range of currency notes. The authors begin by reviewing the current technologies for blind people to recognise currencies while emphasising their drawbacks. They then suggest a new system that extracts features from photos of currency and categorises them according to their denomination using the ORB algorithm. Support Vector Machine (SVM) classifier is used by the system to categorise the money images according to their attributes.

In paper[13] a CNN-based method allowing visually im- paired people to recognise Ethiopian banknotes (CNNs). The device is made to work with Ethiopian banknotes and is meant to help those who are visually impaired determine the denomination of banknotes in real- time. The authors begin by reviewing the current technologies enabling visually impaired people to recognise currencies while underlining their draw- backs. They then suggest a new method that extracts features from photos of currency and categorises them according to their denomination using CNNs. The system classifies the images of cash using a multi-layer CNN architecture.

In paper[14] shows a method for visually impaired people to recognise banknotes. The technique is made to work with a range of banknotes and is meant to help persons who are blind recognise the denomination of banknotes. The authors begin by reviewing the current technologies enabling visually impaired people to recognise currencies while underlining their drawbacks. They then put out a brand-new method that extracts features from photos of currency and utilises machine

learning to categorise them according to their denomination. CNN technology is used by the system to categorise the images of cash.

In paper[15] proposes a framework for deep learning-based object detection and recognition for visually impaired people. By recognising and describing items in the environment, the framework is made to give users real-time direction and information. The authors begin by reviewing the shortcomings and difficulties of the current methods for helping people who are visually impaired. They then suggest a brand-new framework that makes use of deep learning methods to find and identify things in photographs and provide users instructions based on their surroundings. The framework makes use of both object identification algorithms like Inception v3 and object detection techniques like YOLO. The outcomes demonstrate that the suggested framework is capable of precisely identi- fying and detecting things in the photographs and offering helpful instructions to users.

III. PROBLEM STATEMENT

Despite technological advancements, handling and identi- fying paper money still poses considerable difficulties for blind and visually impaired people, who may occasionally fall victim to fraud. A recent poll revealed that there are more people with vision impairments. There were 165 visually impaired people out of every lakh people. Currently available options, like tactile markers or braille labels, are frequently challenging to use and can wear out or become damaged. This issue serves as a reminder of the need to implement a cash identification system due to safety concerns.

IV. PROPOSED METHOD

CNN algorithms from deep learning are used in our strategy. CNNs are typically utilized in computer vision, but more recently, they have been used for a variety of image cate- gorization applications.
There are two main components to CNN: Feature Extrac- tion: The network will carry out a series of convolutions and pooling operations during the feature extraction phase, which is where the features are found. Utilize the parameters such as rotation range, width shift range, height shift range, rescale, horizontal flip, etc. to generate batches of tensor image data with real-time data augmentation.

Classification: Using these extracted features as the foun- dation, the fully connected layers will work as a classifier in this case. For each object on the image that matches the algorithm's prediction, they will assign a probability. The key
elements from the input image are extracted by the CNN algorithm using a combination of convolution, pooling, and fully connected layers, and the currency is then classified using those features. It is regarded as a reliable algorithm for image identification tasks and performs well for money recognition due to its capacity to extract intricate patterns and characteristics from the input image.

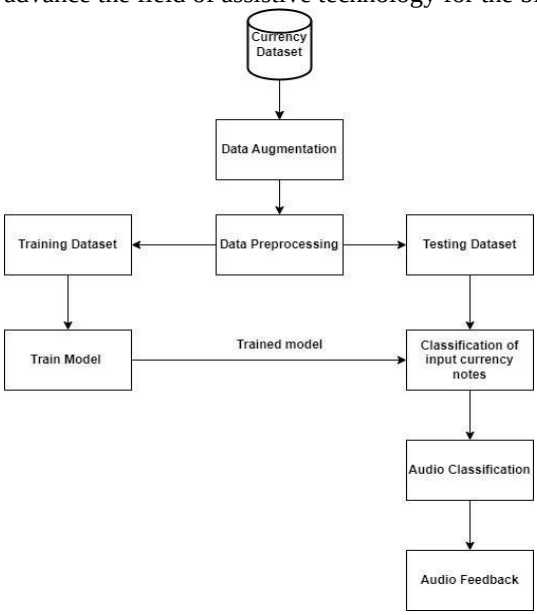
A set of filters are applied to the input image during the initial stage of the CNN algorithm, which involves passing the image through a sequence of convolutional layers. These filters are applied to images in order to identify particular features, such as edges or patterns. Each convolutional layer outputs a feature map, which is a group of filtered images.
The feature maps are then transferred through pooling lay- ers, where a down sampling procedure is implemented, in the next stage. The feature maps' spatial size can be shrunk while still preserving the key features by using the pooling layer. This aids in lowering the network's computational expense and raising model performance.

In the last step, the feature maps are transferred via fully connected layers where the features are used to categorise the currency. The final determination of the currency's denomina- tion rests with the completely connected layers. Using TTS technology, the CNN algorithm may transform a currency's denomination into voice and play that speech back to the user through the device's speakers when the denomination has been determined. The user has the option to manually initiate the audio feedback or to have it activated automatically after the money is detected.

V. CONCLUSION

The proposed system may be a useful tool for helping those who are visually impaired recognise and manage money. To increase its robustness and generalizability, the system should be further tested in real-world circumstances and with a wide variety of cash pictures. Overall, this research advances the field of assistive technology for persons who are blindor visually

impaired and has the potential to enhance their independence and quality of life. This study has the potential to significantly advance the field of assistive technology for the blind and visually impaired.



REFERENCES

[1] L. Chinmay and H. S. Gururaja, ”Currency Detection for Visually Challenged People using Convolutional Neural Network Model,” 2021 International Conference on Forensics, Analytics, Big Data, Security (FABS), 2021, pp. 1-4, doi: 10.1109/FABS52071.2021.9702694.

[2] K. K. S. N. Reddy, C. Yashwanth, S. KVS, P. A. T. V. Sai and S. Khetarpaul, ”Object and Currency Detection with Audio Feedback for Visually Impaired,” 2020 IEEE Region 10 Symposium (TENSYMP), 2020, pp. 1152-1155, doi: 10.1109/TENSYMP50017.2020.9230687.

[3] P. Narra and J. S. Kirar, ”Indian Currency Classification and Fake Note Identification using Feature Ensemble Approach,” 2021 International Conference on Computational Performance Evaluation (ComPE), 2021, pp. 022-029, doi: 10.1109/ComPE53109.2021.9752109.

[4] P. Dhar, M. B. Uddin Chowdhury and T. Biswas, ”Paper Currency De- tection System Based on Combined SURF and LBP Features,” 2018 In- ternational Conference on Innovations in Science, Engineering and Tech- nology (ICISET), 2018, pp. 27-30, doi: 10.1109/ICISET.2018.8745646.

[5] B. Nayak, N. P. Thota, J. D. Kumar, D. R and B. S, ”Currency Detector for Visually Impaired using Machine Learning,” 2021 International Conference on System, Computation, Automation and Networking (IC- SCAN), 2021, pp. 1-5, doi: 10.1109/ICSCAN53069.2021.9526494.

[6] G. Senarathne, D. Punchihewa, D. I. Liyanage, G. Wimalaratne and H. De Silva, ”BlindAid - Android-based Mobile Application Guide for Visually Challenged People,” 2021 IEEE 12th Annual Information Tech- nology, Electronics and Mobile Communication Conference (IEMCON), 2021, pp. 0039-0045, doi: 10.1109/IEMCON53756.2021.9623189.

[7] G. V. Rajan, D. M. Panicker, N. E. Chacko, J. Mohan and V. K. Kavitha, ”An Extensive Study on Currency Recognition System Using Image Processing,” 2018 Conference on Emerging Devices and Smart Systems (ICEDSS), 2018, pp. 228-230, doi: 10.1109/ICEDSS.2018.8544310.

[8] K. Gautam, ”Indian Currency Detection using Image Recognition Tech- nique,” 2020 International Conference on Computer Science, Engi- neering and Applications (ICCSEA), 2020, pp. 1-5, doi: 10.1109/ICC- SEA49143.2020.9132955.

[9] M. Jadhav, Y. k. Sharma and G. M. Bhandari, ”Currency Identification and Forged Banknote Detection using Deep Learning,” 2019 Interna- tional Conference on Innovative Trends and Advances in Engineering and Technology (ICITAET), 2019, pp. 178-183, doi: 10.1109/ICI- TAET47105.2019.9170225.

[10] M. Singh, J. Chauhan, M. S. Kanroo, S. Verma and P. Goyal, ”IPCRF: An End-to-End Indian Paper Currency Recognition Framework for Blind and Visually Impaired People,” in IEEE Access, vol. 10, pp. 90726- 90744, 2022, doi: 10.1109/ACCESS.2022.3202007.

[11] C. Y. Gamage, J. R. M. Bogahawatte, U. K. T. Prasadika and

S. Sumathipala, ”DNN based Currency Recognition System for Visually Impaired in Sinhala,” 2020 2nd International Conference on Advancements in Computing (ICAC), 2020, pp. 422-427, doi: 10.1109/ICAC51239.2020.9357295.
[12] Yousry, Ahmed, Mohamed Taha, and Mazen Mohamed Selim. ”Cur- rency Recognition System for Blind people using ORB Algorithm.” Int. Arab. J. e Technol. 5.1 (2018): 34-40.
[13] Meharu, Mekonnen Legess, and Hussien Seid Worku. ”Real-time Ethiopian currency recognition for visually disabled peoples using convolutional neural network.” (2020).
[14] Abilash, C. S., M. Dinakaran, and A. Anju. ”Currency Recognition For The Visually Impaired People.” 2022 IEEE Delhi Section Conference (DELCON). IEEE, 2022.
[15] S. Bhole and A. Dhok, ”Deep Learning based Object De-tection and Recognition Framework for the Visually-Impaired,” 2020 Fourth International Conference on Computing Method- ologies and Communication (ICCMC), 2020, pp. 725-728, doi: 10.1109/ICCMC48092.2020.ICCMC-000135.