Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 4, pp 24-31, April 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.304004
Available Online at https://www.jaiet.com

IRIS Recognition Using Deep Learning Technique

[1]S Waheedha Begum, [2]V Vahini, [3]N Kavya, [4]B Pradeep, [5]G Ajay, [6]R Rohit Kumar

[1,2,3,4,5,6]Department of Computer Science Engineering (Data Science), GATES Institute of Technology, Gooty, Andhra Pradesh, India
E-mail: [1]shaikwaheedabegum998@gmail.com, [2]vennapusavahini@gmail.com, [3]kavyanallampalli@gmail.com, [4]bulugundlapradeep2004@gmail.com, [5]ajayganuga@gmail.com, [6]rohithkumar779080@gmail.com

Abstract: Biometric authentication has become an essential technology for secure identification systems. Among various biometric methods, iris recognition is considered one of the most reliable and accurate techniques due to the uniqueness and stability of iris patterns. This paper presents an iris recognition system using machine learning techniques for secure and efficient identity verification. The proposed system captures iris images, preprocesses them to remove noise, segments the iris region, and extracts unique features for classification. Machine learning algorithms are used to analyze the iris patterns and match them with stored templates in a database. The system ensures high accuracy, reliability, and security compared to traditional authentication methods such as passwords or PINs. Iris recognition systems can be applied in various fields including banking security, border control, mobile authentication, and access control systems. The proposed model aims to improve recognition accuracy and enhance security in biometric identification systems.

Keywords: Iris Recognition, Machine Learning, Biometrics, Image Processing, Authentication.

I. INTRODUCTION

In recent years, the need for secure and reliable authentication systems has increased due to the rapid growth of digital technologies and online services. Traditional security methods such as passwords, PINs, and identification cards are widely used, but they are vulnerable to hacking, theft, and misuse. Users may forget passwords or attackers may gain unauthorized access to sensitive information. Therefore, more secure identification methods are required.

Biometric authentication has emerged as an effective solution to overcome these limitations. Biometric systems identify individuals based on unique biological characteristics such as fingerprints, face, voice, or iris one of the most accurate and reliable biometric technologies because the iris pattern of every person is unique and remains stable throughout life. Even identical twins have different iris patterns, which makes iris recognition highly secure.

Iris recognition systems work by capturing an image of the eye, detecting the iris region, extracting important features, and then comparing these features with stored data for identification. However, traditional iris recognition methods rely heavily on manual feature extraction techniques, which may reduce system performance and accuracy.

With the advancement of artificial intelligence, deep learning techniques have significantly improved image recognition tasks. Convolutional Neural Networks (CNNs), a type of deep learning model, are particularly effective in automatically extracting important features from images and performing accurate classification. By using CNN models, iris recognition systems can achieve higher accuracy and better performance compared to traditional machine learning methods.

In this project, we develop an iris recognition system using deep learning techniques. The system performs preprocessing and segmentation of iris images using image processing methods and then uses a CNN model for feature extraction and classification. The CASIA Iris Dataset is used for training and testing the model. The goal of this project is to build a reliable and efficient biometric authentication system capable of accurately identifying individuals based on their unique iris patterns.

II. RELATED WORK

Daugman introduced one of the earliest iris recognition algorithms based on Gabor filters for iris texture analysis. His approach used mathematical encoding of iris patterns to generate a unique iris code for each individual, achieving high accuracy in biometric

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 4, pp 24-31, April 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.304004
Available Online at https://www.jaiet.com

identification systems and forming the foundation for many modern iris recognition techniques.

Wildes proposed an iris recognition framework that uses image processing techniques such as edge detection and Hough Transform to localize and segment the iris region from eye images. His method focused on extracting iris boundaries and using statistical pattern recognition methods for identification.

Masek developed an open-source iris recognition system that implemented segmentation, normalization, and feature encoding techniques similar to Daugman's approach. The system used circular Hough transform for iris detection and demonstrated reliable recognition performance using publicly available iris datasets.

Later, researchers began applying machine learning algorithms such as Support Vector Machines (SVM) and K-Nearest Neighbors (KNN) for iris classification. These methods improved classification accuracy but still relied heavily on manually extracted iris features, which limited the system's ability to handle large and complex datasets.

With the advancement of deep learning, several studies proposed Convolutional Neural Network (CNN) based iris recognition systems. CNN models automatically learn important features from iris images without manual feature extraction, leading to improved recognition accuracy and robustness against noise and variations in image quality.

Recent research focuses on integrating deep learning models with efficient image preprocessing and segmentation techniques to build more reliable iris recognition systems. These systems aim to achieve high accuracy while reducing computational complexity and improving real-time performance for practical biometric authentication applications.

III. PROPOSED SYSTEM

In the proposed work, an iris recognition system based on deep learning is developed to identify individuals using their unique iris patterns. The system takes an iris image as input either from a dataset or through user upload and then processes the image through several stages including preprocessing, segmentation, feature extraction, and classification. The goal of the system is to provide a secure and reliable biometric authentication method.

Initially, the input iris image is collected from the CASIA Iris Dataset, which contains images from multiple individuals. The input image is first processed using image preprocessing techniques to improve image quality. In this step, the image is converted into grayscale format and Median Blur filtering is applied to remove noise and enhance the clarity of the iris region.

After preprocessing, iris segmentation is performed to isolate the iris region from the surrounding eye structures such as the eyelids, eyelashes, and sclera. For this purpose, the Hough Circle Transform technique is used to detect the circular boundary of the iris. This step helps in accurately locating the iris region which is essential for reliable feature extraction.

Once the iris region is detected, the segmented iris image is resized to 64×64 pixels so that it can be efficiently processed by the deep learning model. Resizing ensures that all input images have the same dimensions, which is necessary for training and testing the neural network model.

In this project, we implemented the following modules:

1. Generate & Load CNN Model:

In this module, a Convolutional Neural Network (CNN) model is created and trained using the iris dataset. After training, the model is saved and later loaded for prediction of the person's identity.

2. Iris Recognition System:

In this module, the system accepts an iris image as input, performs preprocessing and segmentation, extracts important features from

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 4, pp 24-31, April 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.304004
Available Online at https://www.jaiet.com

the iris pattern, and finally uses the trained CNN model to classify and identify the person.

3. Accuracy and Loss Graph:

In this module, the performance of the CNN model is evaluated by displaying accuracy and loss graphs during training. These graphs help analyze how well the model learns from the datasets.

Image Preprocessing

Image preprocessing is an important step in iris recognition. It improves image quality and removes noise before further processing. In this project, the iris image is converted into grayscale format, and Median Blur filtering is applied to smooth the image and reduce unwanted noise. This helps in improving the accuracy of iris segmentation.

Hough Circle Transform for Iris Segmentation

The Hough Circle Transform is used to detect circular shapes in an image. Since the iris has a circular structure, this technique helps locate the exact boundaries of the iris. The algorithm analyzes the edge points in the image and identifies circles based on their radius and center coordinates. This allows the system to isolate the iris region effectively.

CNN Model

The proposed iris recognition system uses a Convolutional Neural Network (CNN) to automatically extract discriminative features from iris images and classify them accurately. CNN models are widely used in image recognition because they can learn spatial patterns such as edges, textures, and shapes directly from images. The CNN architecture consists of multiple layers including convolution layers, activation functions, pooling layers, flatten layers, fully connected layers, and a Softmax output layer. These layers work together to learn unique iris patterns and perform classification.

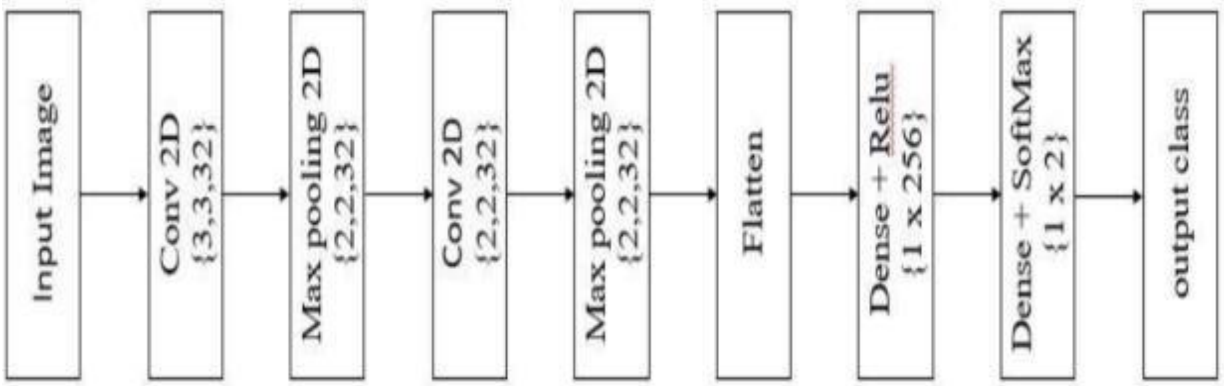


Figure 1: Representation of convolution layer process

The convolution layer is the fundamental component responsible for feature extraction. It preserves spatial relationships by applying a filter (kernel) to small regions of the input data. Mathematically, the convolution operation processes an input image,where spatial coordinates represent rows and columns, and the depth represents the number of channels. A kernel of fixed dimensions slides over the input data to compute feature maps. The resulting feature map highlights essential patterns relevant to vital sign estimation.

The ReLU activation function is applied to introduce non-linearity into the network, allowing it to capture complex patterns in facial motion. This function outputs the input value if it is positive; otherwise, it returns zero, thereby enhancing model efficiency and convergence speed.

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 4, pp 24-31, April 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.304004
Available Online at https://www.jaiet.com

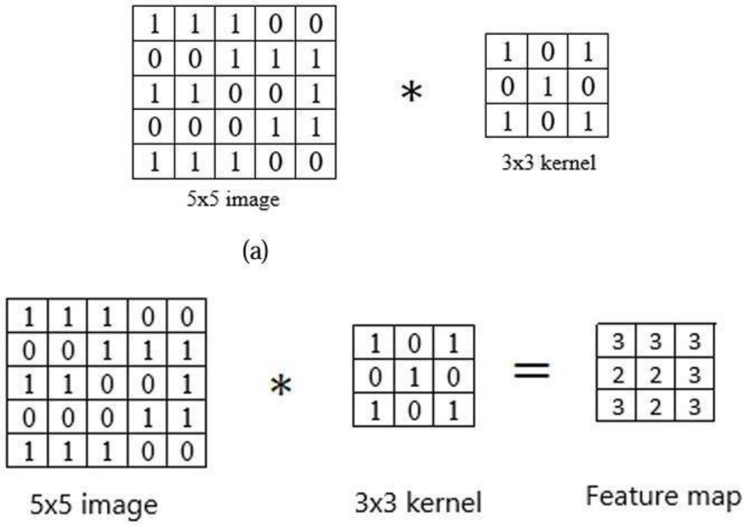


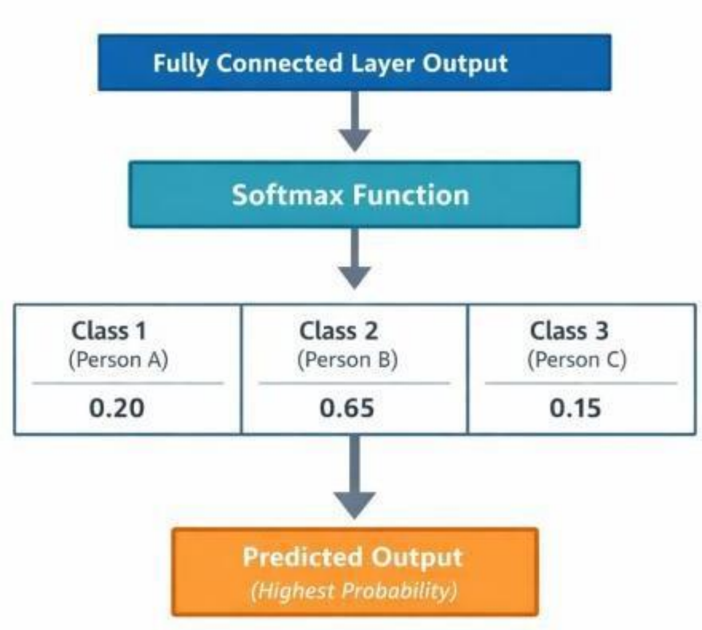
Figure 2: Example of convolution layer process. (a) a speech with size kernel. (b) Convolved feature map

Max pooling is used to reduce the number of parameters and computations in the network by downsampling feature maps while retaining the most significant information. It helps in reducing dimensionality while ensuring that critical spatial features remain intact for further processing.

SoftMax classifier

The final layer of the CNN model uses the Softmax activation function for classification. The Softmax layer converts the output values into probability scores for each class.

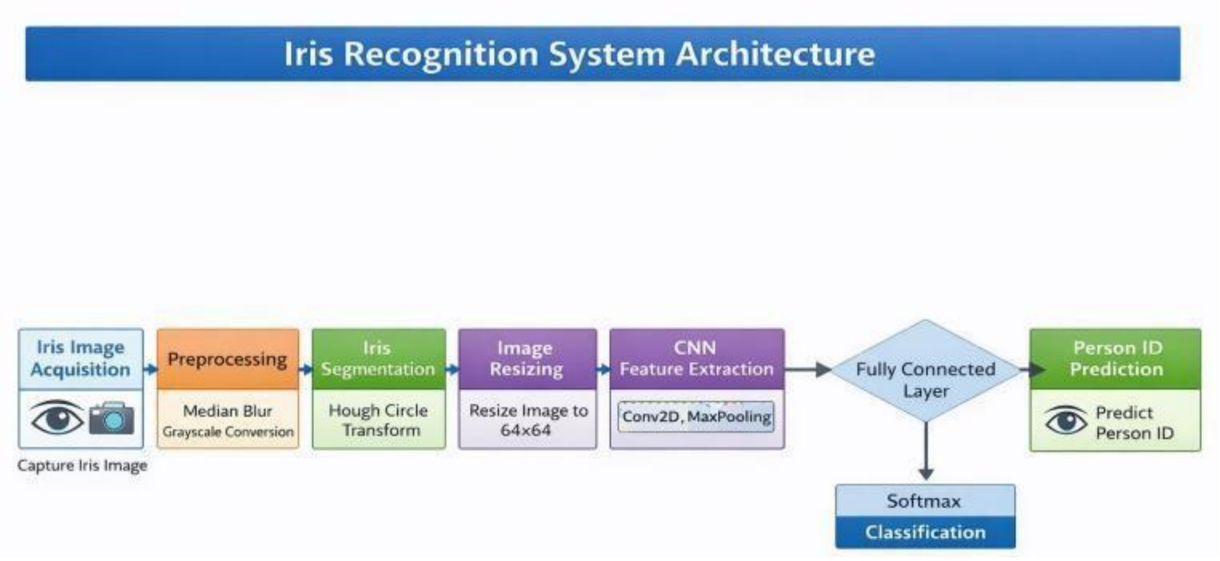
The class with the highest probability is selected as the predicted identity.



In this project, the Softmax layer determines the correct identity based on the unique iris pattern extracted by the CNN model.

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 4, pp 24-31, April 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.304004
Available Online at https://www.jaiet.com

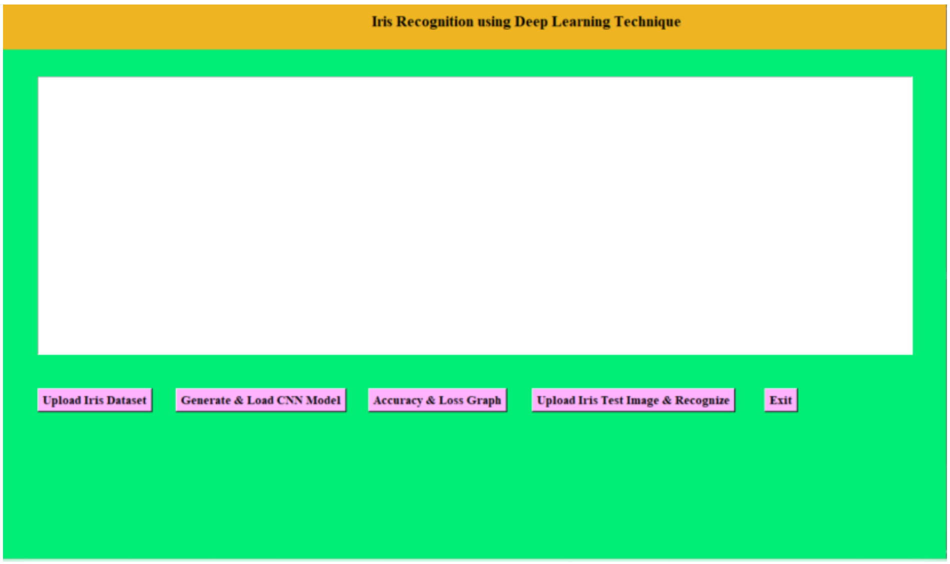
IV. SYSTEM ARCHITECTURE



V. RESULTS

In this project, we used the CASIA Iris Dataset, which contains iris images from multiple individuals. The dataset was used to train a Convolutional Neural Network (CNN) model to recognize individuals based on their unique iris patterns. All iris images were preprocessed using median blur filtering to remove noise and improve image quality. After preprocessing, the Hough Circle Transform technique was used to detect and segment the iris region from the eye image.

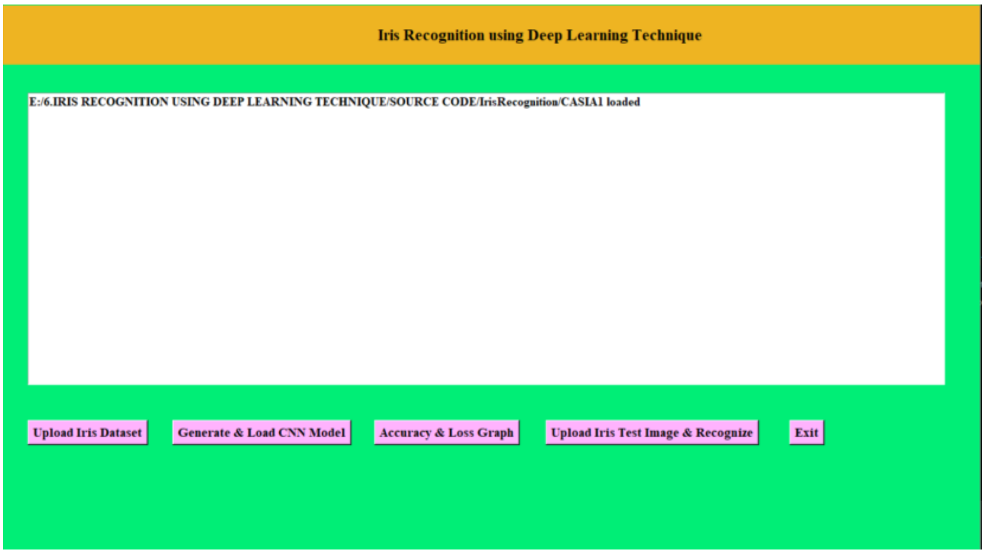
To implement the system, the following modules were designed:



1) Upload Iris Dataset

Using this module, the iris dataset is upload into the system. The dataset contains multiple iris images belonging to different individuals. The images are used to train the CNN model for iris recognition.

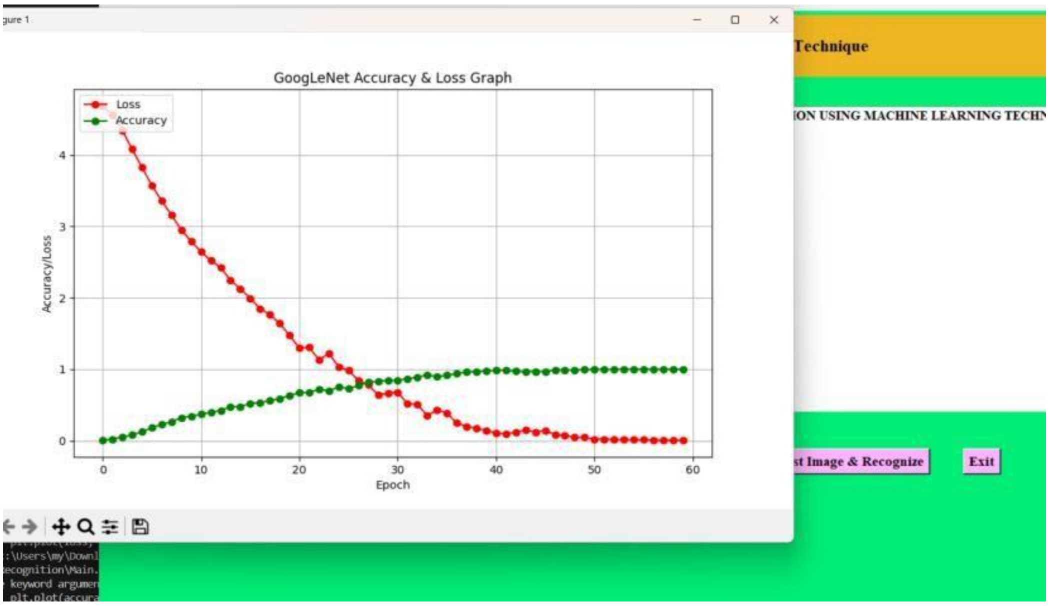
Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 4, pp 24-31, April 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.304004
Available Online at https://www.jaiet.com



2) Generate & Load CNN Model

In this module, the CNN model is generated and loaded for training and prediction. The model consists of convolution layers, max pooling layers, flatten layers, and dense layers. The system trains the model using the iris dataset for 60 epochs with a batch size of 16. After training, the model predicts the identity of a person based on iris patterns.

When the "Generate & Load CNN Model" button is clicked, the system loads the trained CNN model and displays the prediction accuracy in the text area.

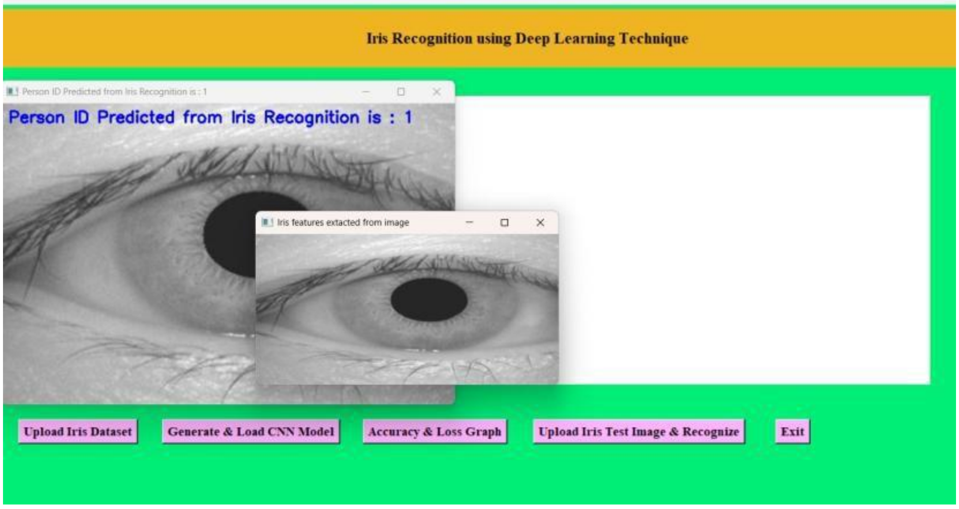


3) Accuracy & Loss Graph

This module displays the training accuracy and loss graph of the CNN model. The graph shows how the model performance improves during the training process. As the number of epochs increases, the accuracy increases and the loss value decreases, indicating better learning by the model.

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 4, pp 24-31, April 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.304004
Available Online at https://www.jaiet.com

In above screen



4) Upload Iris Test Image & Recognize

Using this module, the user uploads a test iris image. The system extracts iris features from the input image using segmentation and preprocessing techniques. The extracted features are then passed to the trained CNN model to predict the Person ID associated with the iris pattern.

The predicted result is displayed on the screen along with the iris image.

In the accuracy and loss graph, the x-axis represents the training epochs, and the y-axis represents the accuracy and loss values of the CNN model. This graph helps evaluate the learning performance of the model during training.

The experimental results demonstrate that the proposed iris recognition system can successfully identify individuals based on iris patterns with good accuracy.

VI. CONCLUSION

In this project, an iris recognition system based on deep learning techniques was successfully developed. The system performs image preprocessing, iris segmentation, feature extraction, and classification using a Convolutional Neural Network (CNN). The Hough Circle Transform method was used to detect the iris region, and the CNN model was trained to learn unique iris features from the dataset.

The experimental results show that the system can accurately identify individuals using iris images. The accuracy and loss graphs indicate that the model learns effectively during the training process. The use of deep learning improves the performance and reliability of iris recognition compared to traditional methods.

Overall, the proposed system demonstrates that CNN- based iris recognition provides a secure and efficient biometric authentication method. In the future, the system can be enhanced by integrating real-time iris detection, larger datasets, and improved deep learning architectures to further improve recognition accuracy.

REFERENCES

[1] J. Daugman, “High confidence visual recognition of persons by a test of statistical independence,” IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 15, no. 11, pp. 1148–1161, 1993.

Journal of Artificial Intelligence and Emerging Technologies

Volume 3, Issue 4, pp 24-31, April 2026

ISSN (online): 3049-1967

DOI: https://doi.org/10.47001/JAIET/2026.304004

Available Online at https://www.jaiet.com

[2] R. Wildes, "Iris recognition: An emerging biometric technology," Proceedings of the IEEE, vol. 85, no. 9, pp. 1348–1363, 1997.

[3] L. Masek, "Recognition of Human Iris Patterns for Biometric Identification," Bachelor's Thesis, University of Western Australia, 2003.

[4] OpenCV Library Documentation. Available https://opencv.org/

[5] TensorFlow and Keras Documentation. Available: https://www.tensorflow.org/

[6] CASIA Iris Image Database. Available: http://www.cbsr.ia.ac.cn/english/IrisDatabase.aspx

[7] A.Krizhevsky, I. Sutskever, and G. Hinton, "ImageNet classification with deep convolutional neural networks," Advances in Neural Information Processing systems, 2012.

****