



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 4, April 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Iris Recognition Using Machine Learning

Mrs.Dakshayini M R, Bhavya PC,Sahana S , Aziz UR Rahman, Arbaz Khan

Assistant professor, Dept. of ECE, Malnad College of Engineering, Hassan, Karnataka, India

UG Student, Dept. of ECE, Malnad College of Engineering, Hassan, Karnataka, India

UG Student, Dept. of ECE, Malnad College of Engineering, Hassan, Karnataka, India

UG Student, Dept. of ECE, Malnad College of Engineering, Hassan, Karnataka, India

UG Student, Dept. of ECE, Malnad College of Engineering, Hassan, Karnataka, India

ABSTRACT: Iris recognition is a biometric technology that has gained significant attention due to its high accuracy and reliability in identifying individuals. In recent years, machine learning techniques have been increasingly utilized to enhance the performance of iris recognition systems. This paper provides a comprehensive review and analysis of machine learning-based iris recognition systems. The proposed system begins with the acquisition of iris images using specialized cameras or smartphone sensors. Preprocessing techniques such as normalization, segmentation, and noise removal are applied to enhance the quality of iris images and extract relevant features. Feature extraction plays a crucial role in iris recognition, and various methods such as Hough transform, and Gabor filters, have been employed for this purpose. Once the features are extracted, machine learning algorithms are utilized for classification and recognition tasks. Supervised learning algorithms such as support vector machines (SVM), k-nearest neighbors (KNN), and deep learning models including convolutional neural networks (CNNs) have demonstrated promising results in iris recognition. These algorithms learn discriminative patterns from the extracted features and efficiently classify iris images into different classes.

KEYWORDS: Iris recognition, PyCharm IDE, Image processing, Image encoding

I. INTRODUCTION

In an era defined by the ubiquitous presence of digital systems and the ever-growing demand for secure authentication methods, biometric technologies have emerged as a cornerstone of identity verification systems. Among these, iris recognition stands out for its unparalleled accuracy and reliability. With the integration of machine learning techniques, iris recognition systems have witnessed remarkable advancements, offering robust solutions for diverse security applications. The human iris, with its unique patterns and textures, has long been recognized as a distinctive biometric trait. Its inherent stability and resistance to tampering make it an ideal candidate for reliable identification purposes. Traditional iris recognition systems relied on handcrafted feature extraction methods and statistical classifiers to match iris patterns. However, the advent of machine learning has revolutionized this field, enabling the development of more sophisticated and efficient recognition algorithms. This project aims to explore the fusion of iris recognition and machine learning, harnessing the power of data-driven approaches to enhance the accuracy and adaptability of biometric authentication systems. By leveraging large datasets and advanced learning algorithms, we seek to overcome the limitations of traditional methods and create a robust framework capable of addressing real-world challenges. The integration of machine learning into iris recognition systems offers several distinct advantages. Firstly, it enables the automatic extraction of discriminative features from iris images, eliminating the need for manual feature engineering and enhancing the system's adaptability to different datasets and environmental conditions. Moreover, machine learning algorithms, such as deep neural networks, have demonstrated superior performance in learning complex patterns and generalizing from limited data, thereby improving the overall recognition accuracy. Furthermore, the scalability and flexibility afforded by machine learning facilitate the integration of iris recognition into various applications, ranging from access control and border security to mobile device authentication and e-commerce transactions. As organizations increasingly prioritize security and user experience, the demand for reliable biometric solutions continues to grow, underscoring the importance of advancing iris recognition technology. In this project, we will delve into the principles of iris recognition, elucidate the mechanisms of machine learning algorithms, and demonstrate their synergistic integration in building a state-of-the-art iris recognition system. Through empirical evaluation and analysis, we aim to assess the performance of different machine learning models and identify optimal strategies for iris feature extraction, classification, and matching.

II.OBJECTIVES

Our project aims to make iris recognition system with Enhanced accuracy develop a system that leverages machine learning algorithms to improve the accuracy of iris recognition, ensuring reliable identification even in challenging scenarios. Robustness create a system capable of handling variations in iris images caused by factors such as illumination changes, occlusion, and aging, by employing machine learning techniques for feature extraction and classification. Real-time performance optimize the system to achieve real-time processing speeds, enabling rapid authentication in various applications, including access control and mobile device authentication. Scalability is design a scalable solution that can accommodate large datasets and adapt to different environments and user populations, ensuring flexibility and usability across diverse settings. Security enhances the security of the system by integrating machine learning-based anomaly detection mechanisms to identify and mitigate potential spoofing attacks or fraudulent attempts at iris recognition.

III.APPROACH

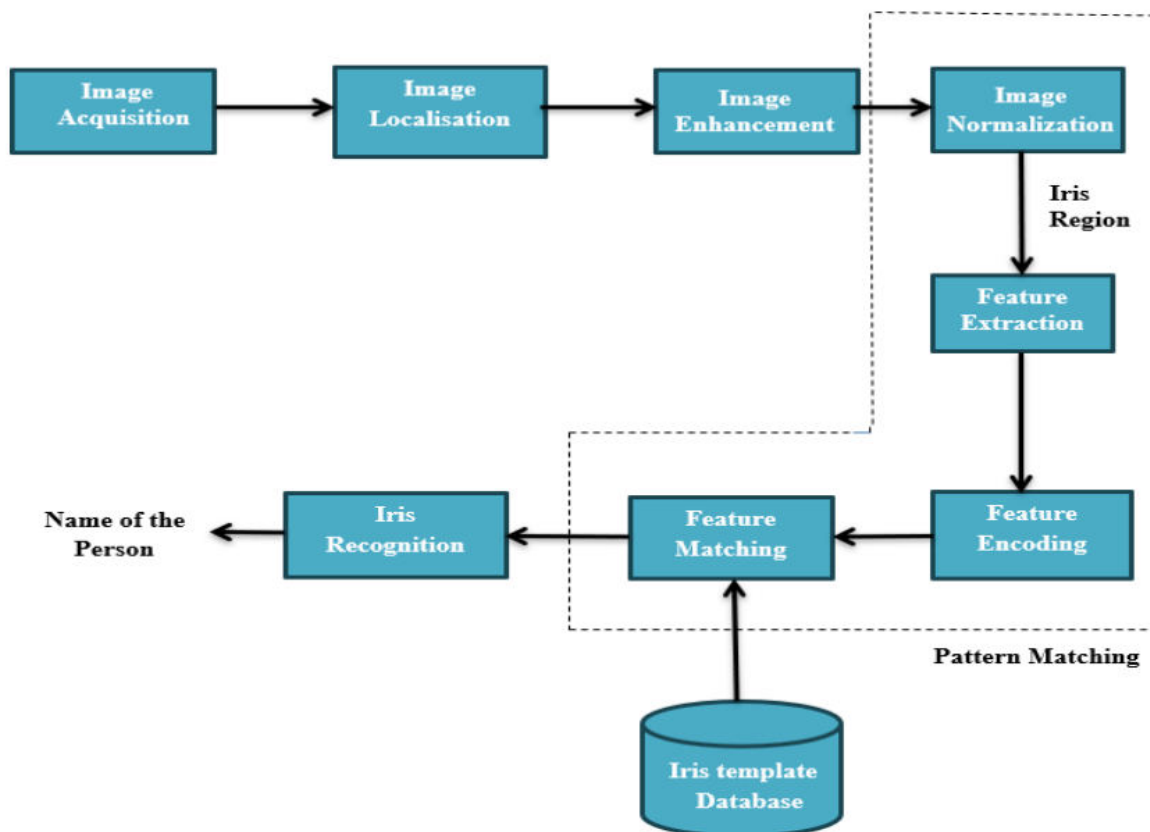


Fig 1. Schematic diagram of iris recognition

IV.METHOD0LOGY

Image acquisition can be defined as the process of capturing digital images using various devices such as cameras, scanners, or other imaging systems. It involves converting the optical information from the scene into a digital format that can be stored, processed, and analyzed by computers. Here in our paper this process is used for capturing the iris image. The iris image should be rich in iris texture as the feature extraction stage depends upon the image quality, high resolution and good sharpness. Thus, the image is acquired by 3CCD camera placed at a distance of approximately 9 cm from the user eye. The approximate distance between the user and the source of light is about 12cm.

Image localization in iris recognition refers to the process of identifying and isolating the iris region within an image. This is a crucial step in iris recognition systems, as it allows for accurate feature extraction and comparison. Techniques for iris localization typically involve detecting the inner and outer boundaries of the iris, which are then used to crop the region of interest. Common approaches include edge detection, circular Hough transform, Gaussian filters and template matching. Once the iris region is localized, it can be processed further for feature extraction and matching against a database for identification or verification purposes. The success of localization depends on the imaging quality of eye images. The center of pupil can be used to detect the outer radius of iris patterns. The iris inner and outer boundaries are located by finding the edge image using the Canny edge detector .

Enhancement In this step it performs the enhancement on the given input image. Applies histogram equalization to the input image using the 'equalizeHist' function of openCV library. This enhances the contrast of an image by redistributing intensity values, which can stretch out intensity and improve the overall appearance of the image for the better analysis in further steps. It uses the following equations

$$H'(i) = \sum_{0 \leq j < i} H(j)$$

The H' function could be used to calculate the cumulative sum of frequency intensity values to certain intensity level. This cumulative sum is used to map original intensity value to new set of values which have more uniform distribution.

$$\text{equalized}(x,y) = H'(\text{src}(x,y))$$

src(x,y) represents the source intensity value of the pixel at coordinates (x,y) in the original image. Then the histogram equalisation is to transform original image intensity values to a new set of uniform distributed values.

In iris recognition, image normalization is a crucial step for ensuring consistent and accurate feature extraction. It involves transforming iris images into a standard form by compensating for variations in pupil size, eyelid occlusions, and iris dilation, position of pupil in the iris, and the iris orientation change person to person, it is required to normalize the iris image, so that the representation is common to all, with similar dimensions. Normalization techniques include polar mapping, rubber sheet model, and Daugman's rubber sheet model, which align iris patterns to a standardized template for reliable matching. The centre of the pupil is considered as the reference point and a Remapping formula is used to convert the points on the Cartesian scale to the polar scale. Normalization process involves unwrapping the iris and converting it into its polar equivalent. It is done using Daugman's Rubber sheet model.

In iris recognition, feature extraction involves analyzing the unique patterns in the iris, such as the arrangement of furrows, crypts, and other structures. Common techniques include Gabor filters, wavelets, and phase-based methods to extract discriminative features for identification. These features are then used to create a template for comparison during authentication. Feature encoding in iris recognition involves converting the unique patterns in an iris image into a format that is array or matrix format using Numpy (Python library) suitable for comparison and recognition. This process typically includes extracting key features from the iris image, such as texture, shape, and intensity, and encoding them into a compact representation. Common techniques include using algorithms like Gabor filters, wavelet transforms, or local binary patterns to extract these features. The encoded features are then compared with those stored in a database to identify or authenticate individuals.

Feature matching in iris recognition refers to the process of comparing the unique features extracted from an iris image to those stored in a database to determine a match. These features often include patterns, textures, and other distinctive characteristics of the iris. Matching algorithms typically employ techniques such as template matching or machine learning to find the best match between the features extracted from the captured iris and those stored in the database. This process is useful for accurate identification and verification in iris recognition systems.

V. EXPERIMENTAL RESULTS

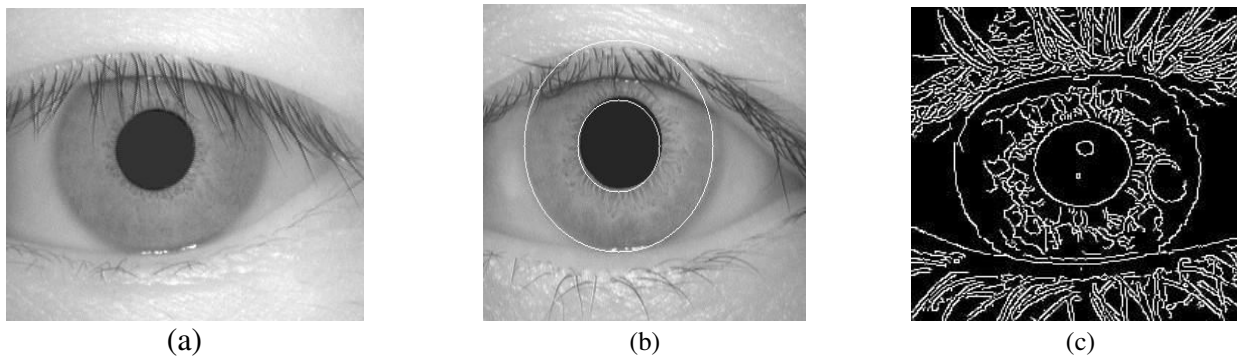


Figure 3. Preprocessing of Image (a) Original input image, (b) Pupil and Iris boundary detection, (c) Canny edge detection image.

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS Python:how_similar_two_images.py
Filename with extension: 1.jpg
1.jpg
2.jpg
3.jpg
4.jpg
Filename with extension: 2.jpg
[ WARN:0@10.836] global_shadow_sift.hpp:15 cv::xfeatures2d::SIFT_create DEPRECATED: cv::xfeatures2d::SIFT_create() is deprecated due SIFT transfer to the main repository, https://github.com/opencv/opencv/issues/16736
Keypoints 1ST Image: 265
Keypoints 2ND Image: 265
GOOD Matches: 0
How good it's the match: 0.0

```

(a)

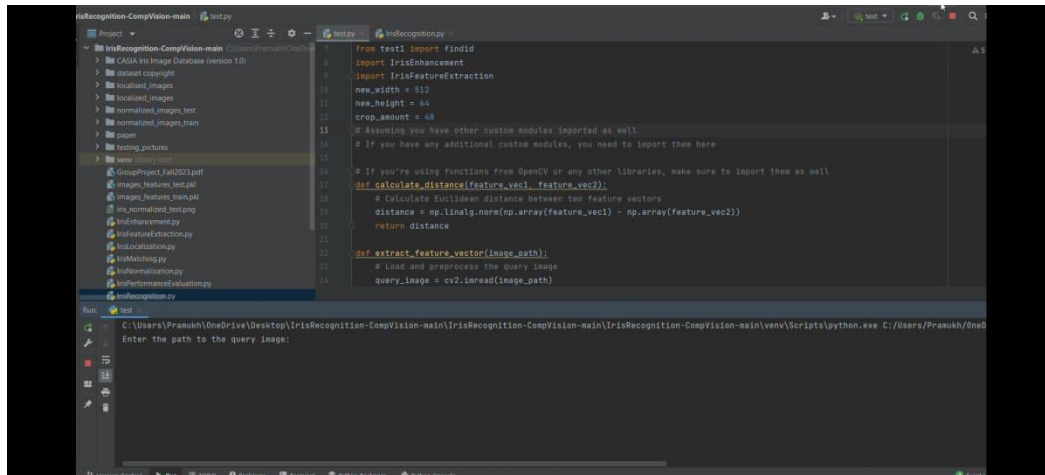
```

PS C:\Users\Rahul D\OneDrive\Desktop\Iris-Segmentation-master> & "C:/Users/Rahul D/AppData/Local/Programs/Python/Python311/python.exe" "c:/Users/Rahul D/OneDrive/Desktop/Iris-Segmentation-master/how_similar_two_images.py"
1.jpg
2.jpg
3.jpg
4.jpg
Filename with extension: 2.jpg
1.jpg
2.jpg
3.jpg
4.jpg
Filename with extension: 4.jpg
[ WARN:0@11.583] global_shadow_sift.hpp:15 cv::xfeatures2d::SIFT_create DEPRECATED: cv::xfeatures2d::SIFT_create() is deprecated due SIFT transfer to the main repository, https://github.com/opencv/opencv/issues/16736
Keypoints 1ST Image: 265
Keypoints 2ND Image: 84
GOOD Matches: 1
How good it's the match: 1.1984761984761985

```

(b)

Figure 4. Matching of two images (a) Not matching of two images, (b) Matching of two images



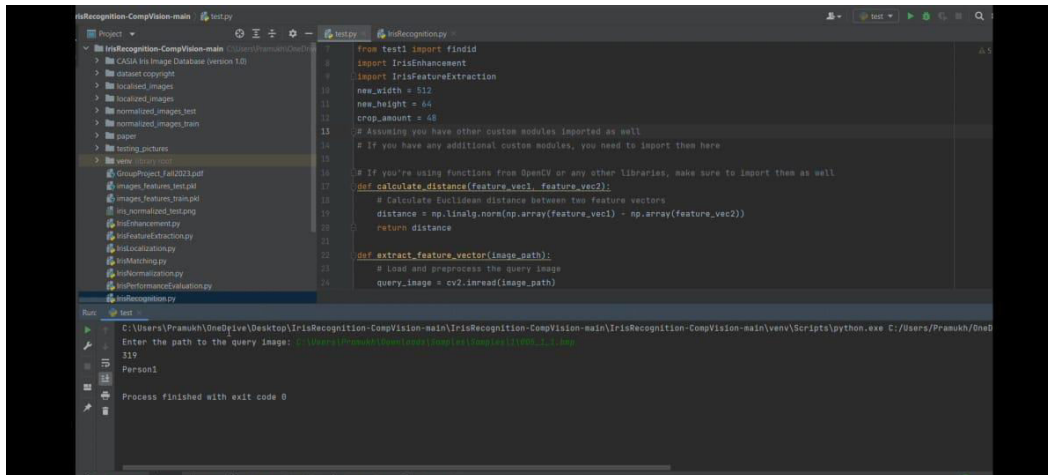
```
from test1 import findid
import IrisEnhancement
import IrisFeatureExtraction
new_width = 512
new_height = 64
crop_amount = 48

# Assuming you have other custom modules imported as well
# If you have any additional custom modules, you need to import them here

# If you're using functions from OpenCV or any other libraries, make sure to import them as well
def calculate_distance(feature_vec1, feature_vec2):
    # Calculate Euclidean distance between two feature vectors
    distance = np.linalg.norm(np.array(feature_vec1) - np.array(feature_vec2))
    return distance

def extract_feature_vector(image_path):
    # Load and preprocess the query image
    query_image = cv2.imread(image_path)
```

(a)



```
C:\Users\Praamukh\OneDrive\Desktop\IrisRecognition-CompVision-main\IrisRecognition-CompVision-main\IrisRecognition-CompVision-main\venv\Scripts\python.exe C:/Users/Praamukh/OneD
Enter the path to the query image: C:\Users\Praamukh\OneDrive\Desktop\IrisRecognition-CompVision-main\IrisRecognition-CompVision-main\venv\Scripts\python.exe C:/Users/Praamukh/OneD
Person1
Process finished with exit code 0
```

(b)

Figure 5. Snapshot of Result window (a) Output window for entering the sample image path, (b) Result of Recognized name of a person from the database.

VI. CONCLUSION

In conclusion, the integration of machine learning techniques into iris recognition systems represents a significant advancement in the field of biometric security. Through this project, we have demonstrated the effectiveness of leveraging machine learning algorithms to enhance the accuracy, robustness, and usability of iris recognition technology. By automating the process of feature extraction and classification, machine learning enables iris recognition systems to achieve higher levels of accuracy and adaptability compared to traditional methods. The ability to learn discriminative patterns from iris images empowers the system to recognize individuals reliably, even in challenging conditions such as varying illumination or occlusion. However, it is essential to acknowledge the ongoing challenges and limitations in this field, including the need for robust privacy protection measures, compliance with regulatory requirements, and addressing potential vulnerabilities to spoofing attacks. Continued research and development efforts are necessary to overcome these challenges and further advance the capabilities of iris recognition technology. Looking ahead, future research directions may include exploring novel machine learning techniques, such as deep learning and generative adversarial networks, integrating multimodal biometric fusion approaches, and enhancing interoperability with other security systems. Additionally, there is a growing emphasis on ethical considerations, data privacy, and user consent, which must be carefully addressed to ensure the responsible deployment and usage of iris recognition systems.



REFERENCES

- [1] Daugman, J. (2004). How iris recognition works. *IEEE Transactions on Circuits and Systems for Video Technology*, 14(1), 21-30.
- [2] Ma, L., Tan, T., Wang, Y., & Zhang, D. (2003). Personal identification based on iris texture analysis. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 25(12), 1519-1533.
- [3] Wildes, R. P., Asmuth, J. C., Green, G. L., Hsu, S., Kolczynski, R. J., Matey, J. R., & McBride, S. E. (1997). A system for automated iris recognition. *Proceedings of IEEE Workshop on Applications of Computer Vision*, 2, 121-128.
- [4] Jain, A. K., Ross, A., & Nandakumar, K. (2016). *Introduction to biometrics*. Springer.
- [5] Belhumeur, P. N., Hespanha, J. P., & Kriegman, D. J. (1997). Eigenfaces vs. fisherfaces: Recognition using class specific linear projection. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 19(7), 711-720.
- [6] Maad, M. S., Fadhel, M. A., & Abdulsahib, G. M. (2020). Iris Recognition System using Deep Learning Techniques. *International Journal of Scientific & Technology Research*, 9(02), 5737-5740.
- [7] Roy, K., & Pal, U. (2017). A review on iris recognition methods using machine learning. *Procedia Computer Science*, 105, 110-115.
- [8] Minaee, S., Abdolrashidi, A., & Abdolrashidi, A. (2018). Deep learning in bioinformatics. *IEEE Signal Processing Magazine*, 35(5), 21-64



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details