AUTHENTICATION OF AN INDIVIDUAL USING IRIS RECOGNITION FOR VOTING SYSTEM

A PROJECT REPORT

Submitted by

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DECLARATION

I undersigned hereby declare that the project report on **Authentication of an Individual Using Iris Recognition**, submitted for partial fulfillment of the requirements for the award of degree of Master of Computer Application of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of Prof.Natheera Beevi M. This submission represents my ideas in my own words and where ideas or words of others have been included,I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University..

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2022 - 23

CERTIFICATE

This is to certify that the report entitled **Authentication of an Individual Using Iris Recognition** submitted by **SONA.V.MORRIS** (TKM21MCA-2035) to the APJ Abdul Kalam Technological University partial fulfillment of the Master's degree in Computer Applications is a bonafide record of the project work carried out by her under our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

Internal Supervisor | Head of the Department | External Examiner

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ABSTRACT

India has a parliamentary system as defined by its constitution, with power distributed between the central government and the states. Elections play an important role in the democracy of India. If the election process is not transparent, secure and tamper proof then the reliability and authenticity of the whole process are at stake. The most familiar issue faced by the election commission is inappropriate confirmation with respect to the arrangement of casting the votes, duplication, or illegal casting of votes. The proposed biometric electoral authentication system allows the user to upload his/her biometric iris image so that his/her credentials can be compared to existing iris images already stored in the system's database. Using authentication using iris verification decreases the chance of duplicating a vote and those who are registered prior to the election and are recognized by the system will be allowed to vote. Hence, the approach makes the system the best way to vote. In the proposed project, Deep Learning models such as Resnet50 and VGG19 are compared based on accuracy, and an iris Recognition system is made using the model which has the highest accuracy, by using the iris recognition we will upload a biometric IRIS image and check those details in our database for a match and only if the match is found he/she is allowed to caste the vote. A biometric-based authentication avoids anonymity and the focus is on making the voting system more robust and reliable by eliminating dummy voters.

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Chapter 1

Introduction

India has a parliamentary system as defined by its constitution, with power distributed between the central government and the states. The election system is the pillar of the democracy. The democratic administration is totally dependent on the results of the election. The election process provides the right to every citizen of a country to select a legitimate representative among themselves who can guide the democratic system toward the welfare of the society. The voting system has observed many effective changes over the past few decades, right from traditional paper voting to electronic voting and now to online voting. The voting system is improving step by step; advancement in the new system eliminates the drawbacks of the previous system. Every system tries to overcome the loopholes of the previous system. The primary goal of this paper is to understand the traditional voting system with the recently proposed voting systems.

A biometric system provides automatic identification of an individual based on a unique feature or characteristic possessed by an individual. The iris is an externally visible, yet protected organ whose unique epigenetic pattern remains stable throughout adult life. These characteristics make it very attractive for use as a biometric for identifying individuals. The human iris is rich in features that can be used to quantitatively distinguish one eye from another. The iris contains many collagenous fibers, contraction furrows, coronas, crypts, color, serpentine vasculature, striations, freckles, rifts, and pits. Measuring the patterns of these features and their spatial relationships to each other provides other quantifiable parameters useful to the identification process. Statistical analyses of iris indicate that the IRT process uses 240 DOF (Degree Of Freedom), or independent measures of variation to distinguish one iris from another. The availability of these many degrees of freedom allows iris recognition to identify persons with an accuracy that is greater than other biometric systems. The biometric electoral authentication system that we create using a deep learning model allows the user to upload his/her biometric iris image so that his/her credentials can be compared to existing iris images already stored in the system's database. Using authentication using iris verification decreases the chance of duplicating a vote and those who are registered prior to the election and are recognized by the system will be allowed to vote. Hence, the approach makes the system the best way to vote.

1.1 Problem Statement

The problem statement for this project is to develop an Iris Recognition system using deep learning techniques.

- Traditional voting systems rely on manual processes, which are vulnerable to fraud and tampering.
- Each individual has to be verified manually in order to allow them to cast their vote which is time-consuming.
- The lack of transparency in traditional voting systems can result in doubts and suspicions about the fairness of the election process.

1.2 Objectives

The goal is to accomplish the following:

- To create an iris recognition system with a deep learning model that is cost-efficient and reliable.
- To create an Iris recognition system for authentication that is resistant to fraud and tampering.
- To create an easy-to-use recognition system.
- To develop a technology that makes the voting process more accessible to people.

Chapter 2

Literature Survey

Literature review is that the comprehensive study and interpretation of literature that relates to a selected topic.When doing a literature review, research questions are defined, and then relevant literature is sought for and analysed to address these issues. By reanalyzing the study's data, it is possible to acquire fresh insights, which is an advantage of literature reviews. A literature review is both a summary and an explanation of the complete and current state of information on a topic as contained in academic books and journal articles. There are two types of literature reviews you may be required to write in college: one is written as a stand-alone assignment in a course, while the other is done as an introduction to or preparation for a longer piece of writing, typically a thesis or research report. The primary objective and perspective of your review, as well as the hypothesis or thesis argument you develop, depend on the type of review you are writing. You can learn the distinctions between these two types by reading published literature reviews or the introductory chapters of theses and dissertations in your subject area. Note the framework of their arguments and the manner in which they approach the issues.

2.1 Purpose of the Literature Review

1. It chooses top-notch research papers or studies that are pertinent, significant, important, and valid and summarises them into a single comprehensive report to provide readers with quick access to information on a certain issue.
2. By requiring them to describe, assess, and compare original research in this particular field, it gives researchers who are starting their research in a new area a great place to start.
3. It makes sure that researchers don't repeat already completed studies.
4. It can indicate potential directions for future research or suggest topics to concentrate on.
5. It emphasises the important findings.
6. It points up gaps, discrepancies, and inconsistencies in the literature.
7. It offers a helpful critique of the methods and strategies used by other researchers.

2.2 Related Works

Nagalla, et al.[1] introduce a novel method for iris recognition using deep learning algorithms such as Alexnet Convolutional Neural Network to create a secure and efficient voting system. The authors highlight the importance of having secure and efficient voting systems while discussing the vulnerabilities of traditional systems like paper ballots and electronic voting machines. To tackle these challenges, the authors propose iris recognition as a solution due to its highly accurate and secure identification capabilities. The paper elaborates on their proposed iris recognition system, which uses deep learning algorithms to perform feature extraction and classification on iris images. The authors explain the various components of the system, including the image acquisition module, preprocessing module, feature extraction module, and classification module. They detail how the image acquisition module captures high-resolution iris images, and the preprocessing module enhances and normalizes the images to maintain consistency and quality. The feature extraction module then utilizes the deep learning algorithm Alexnet to extract unique iris features like texture, shape, and color, while the classification module uses a neural network to match the iris images with the appropriate individuals in the voting database. The authors also discuss their experimental setup, which involved testing the accuracy of the system on a subset of iris images collected from 50 participants. They report an accuracy rate of 96 percent, demonstrating the effectiveness of their proposed iris recognition system. Finally, the article concludes by discussing the potential applications of their system, such as in secure voting systems, access control systems, and biometric identification systems. The authors acknowledge the study's limitations, including the small sample size and the need for further testing on larger datasets. Nonetheless, the article presents a promising approach to iris recognition using deep learning algorithms with potential applications in various security and identification systems.

2.2.1 Voting System

Abimanyu, S., et al.[2] aims of developing a secure voting system using iris detection-based authentication. It emphasizes the importance of secure voting systems in preventing electoral fraud, ensuring voter anonymity, and maintaining the integrity of the electoral process. The authors proposed a new voting system that employed iris detection to authenticate voters. To develop the iris detection system, it utilizes several algorithms including the Gaussian Mixture Model (GMM), Daugman's algorithm, and the Haar cascade classifier. The proposed iris detection system used a camera to capture images of the voter's face and iris, which were then processed using the GMM algorithm to extract the iris region. Subsequently, Daugman's algorithm was utilized to perform iris recognition and create an iris code that was then compared with the stored iris codes in the database to authenticate the voter. It employs performance metrics such as accuracy, precision, recall, and F1-score to ensure the accuracy of the iris detection system. The results indicated that the proposed system achieved high accuracy and F1-score, demonstrating its ability to accurately authenticate voters. The paper concludes that iris detection-based authentication can be a reliable method for developing secure voting systems. The proposed iris detection system demonstrated high accuracy and F1-score, which proved its ability to accurately authenticate voters. The proposed voting system's overall architecture, which utilized iris detection-based authentication, can prevent electoral fraud and maintain the integrity of the electoral process.

BalaMurali A.,et al.[3]focuses on the development of a biometric-based voting machine that aims to enhance the security and efficiency of the voting process. The paper highlights the significance of secure and transparent elections in a democratic society. They emphasize the need for advanced technology to overcome the limitations and challenges associated with traditional voting systems. Biometrics, with its ability to uniquely identify individuals based on their physiological or behavioral traits, is proposed as a promising solution. The paper presents a detailed description of the proposed smart voting machine architecture. The system utilizes biometric authentication techniques, specifically fingerprint and iris recognition, to verify the identity of the voters. These biometric traits are chosen due to their high accuracy and uniqueness. The authors provide insights into the working principles of both fingerprint and iris recognition technologies and explain how they can be integrated into the voting machine. To ensure the integrity of the voting process, the authors propose the use of cryptographic techniques. The voting machine employs cryptographic algorithms to secure the transmission and storage of data. This helps prevent unauthorized access, tampering, or manipulation of the voting data. The authors discuss the importance of using strong encryption algorithms to protect sensitive information and maintain the privacy of voters. In addition to biometric authentication and cryptography, the authors introduce a user-friendly interface for the voting machine. They describe the graphical user interface (GUI) that allows voters to interact with the machine easily. The GUI provides clear instructions and prompts, ensuring a smooth and intuitive voting experience for all users. To evaluate the performance and effectiveness of the proposed system, the authors conducted experiments using a prototype of the smart voting machine. They collected a dataset of fingerprints and iris scans from a group of participants and tested the accuracy of the biometric identification algorithms. The results demonstrated a high level of accuracy and reliability in identifying individuals, validating the feasibility of the proposed approach. They also discuss the security measures implemented to protect against various attacks, such as replay attacks, impersonation attacks, and insider attacks. They highlight the importance of continuous monitoring and auditing of the system to detect any suspicious activities or vulnerabilities

2.2.2 Image Enhancement

Lee et al. [4] proposed an enhanced iris recognition method by using a generative adversarial network (GAN) to reconstruct iris images for improved recognition accuracy. The study aimed to address the issue of image quality and occlusion in iris recognition systems, which can lead to false recognition and identification errors. The proposed method consists of two stages:

image reconstruction and recognition. In the first stage, GAN is used to generate high-quality iris images by learning the underlying distribution of the input data. Specifically, the generator network of GAN is trained to produce realistic iris images from the random noise input, while the discriminator network is trained to distinguish between real and fake images. The training process of GAN is iteratively performed until the generated images are indistinguishable from real ones. In the second stage, the reconstructed images are fed into the iris recognition system for feature extraction and matching. The recognition system uses two main algorithms: the circular Gabor filter and the local binary pattern (LBP) histogram. The circular Gabor filter is used to extract iris texture features, while the LBP histogram is used to extract iris shape features. The extracted features are then fused to form a final feature vector for matching. To evaluate the proposed method, the authors conducted experiments on three public iris databases: CASIA-IrisV4, IITD, and UBIRIS.v2. The results showed that the proposed method outperformed several state-of-the-art iris recognition methods in terms of recognition accuracy and robustness to occlusion and noise.

Liu, Ming, et al.[5] presents a novel approach for enhancing iris images to improve the performance of deep learning-based iris recognition systems. The authors propose a fuzzified image enhancement method that effectively addresses the challenges posed by image quality variations and noise in iris recognition.The authors begin by highlighting the importance of iris recognition as a reliable biometric authentication technique and the growing interest in deep learning for iris recognition systems. However, the performance of deep learning models heavily depends on the quality of input images. Hence, the need for effective image enhancement techniques arises to mitigate the impact of low-quality images on iris recognition accuracy. To tackle this problem, the authors introduce a fuzzified image enhancement algorithm that integrates image enhancement with fuzzy logic. The proposed method is designed to adaptively enhance iris images while preserving important features for subsequent deep learning-based recognition tasks. The algorithm consists of four major steps: preprocessing, fuzzification, enhancement, and postprocessing. In the preprocessing step, the iris image is preprocessed to remove any noise and artifacts. This is achieved through a combination of techniques such as noise filtering, normalization, and segmentation to isolate the iris region of interest. Next, the fuzzification step is performed, where the image is transformed into a fuzzy image representation. Fuzzy sets are defined for each pixel intensity value to capture the uncertainty and imprecision associated with image quality. Fuzzy membership functions are used to assign membership values to different intensity levels, allowing the representation of image information in a fuzzy domain. In the enhancement step, the fuzzy image is processed to enhance its quality while considering the fuzzy information. The authors propose a novel fuzzy image enhancement algorithm that takes into account the fuzzy membership values and applies adaptive enhancement techniques based on the local image characteristics. This ensures that enhancement is performed selectively, preserving the important details while suppressing noise and artifacts. Finally, in the postprocessing step, the enhanced image is refined to further improve its quality. This involves denoising and smoothing operations to reduce the impact of residual noise and to enhance the overall clarity of the image. To evaluate the effectiveness of their proposed method, the authors conducted experiments using a publicly available iris image database. They compared the performance of their fuzzified image enhancement approach with several existing image enhancement techniques, including traditional and deep learning-based methods. The evaluation metrics considered include recognition accuracy, receiver operating characteristic (ROC) curves, and equal error rates (EER). The experimental results demonstrate that the proposed fuzzified image enhancement method outperforms other enhancement techniques in terms of recognition accuracy. The approach effectively enhances iris images while preserving crucial details and mitigating noise and artifacts. The authors attribute this improvement to the integration of fuzzy logic, which allows for adaptive enhancement based on the fuzzy information.

Singh, Tanushree, et al[9] explore the effect of pupil dilation on the accuracy of biometric iris recognition systems for personal authentication. The proposed system was conducted on a sample of 50 individuals, with and without dilation of the pupils induced by using dilating eye drops. The iris images of each individual were captured using a high-resolution camera and then processed using two different iris recognition algorithms: Daugman's algorithm and the Scale-Invariant Feature Transform (SIFT) algorithm. The result showed that pupil dilation had a significant effect on the accuracy of iris recognition systems. The study found that Daugman's algorithm was more robust to the effect of pupil dilation compared to the SIFT algorithm. When the pupils were dilated, the recognition accuracy of Daugman's algorithm decreased from 99.4 percent to 94.7 percent, while the accuracy of the SIFT algorithm decreased from 98.3 percent to 87.4 percent. It was also found that the effect of pupil dilation on iris recognition accuracy was more pronounced in individuals with darker irises compared to those with lighter irises. This finding suggests that iris recognition systems may be less reliable for individuals with darker irises, particularly when the pupils are dilated.

2.2.3 Feature Extraction

Yifeng Chen, et al [12] state that existing iris recognition algorithms have limitations in handling large-scale datasets due to their feature extraction approaches. The proposed algorithm addresses this issue by extracting features based on the T-center approach, which uses the concept of radial symmetry to find a central point in the iris that is most representative of its features. The paper begins by providing an overview of iris recognition and the existing algorithms used for feature extraction. The authors argue that traditional iris recognition algorithms use methods such as wavelet transform, Gabor filter, and histogram equalization to extract features, which are not suitable for large-scale datasets due to their high computational complexity. They propose the T-center approach as an alternative, which is based on the concept of radial symmetry. The T-center approach involves finding the center of the iris based on its radial symmetry, which is defined as the degree of similarity between the iris features on either side of a line passing through the center. The algorithm starts by locating the pupil and iris boundaries using a Hough transform and a circular Hough transform, respectively. Next, it calculates the radial symmetry for each point on the iris boundary and selects the point with the highest symmetry as the T-center. Once the T-center is identified, the algorithm extracts the iris features by dividing the iris into multiple concentric circles centered on the T-center. The features are extracted by calculating the mean value of the pixels within each circle and then normalizing the values to eliminate any variations caused by differences in lighting and camera angles. The authors tested the T-center algorithm on two publicly available iris datasets: the CASIA-IrisV3-Interval and UBIRIS.v2 datasets. The results showed that the T-center algorithm outperformed existing algorithms in terms of recognition accuracy and computational efficiency. The T-center algorithm achieved recognition accuracy of 99.75 percent on the CASIA-IrisV3-Interval dataset and 99.72 percent on the UBIRIS.v2 dataset, which was significantly higher than the existing algorithms.

Rana, Humayan Kabir, et al [14] presents a novel approach to developing a fast iris recognition system by using optimal feature extraction techniques. Iris Recognition is a biometric identification system that uses iris patterns for identifying individuals. In recent years, it has become an important area of research due to its accuracy and reliability. However, the main challenge in iris recognition is the high computational cost and the need for efficient feature extraction techniques. The proposed system uses a combination of Gabor filters and local binary patterns (LBP) for iris feature extraction. Gabor filters are used to extract texture information from the iris image, while LBP is used to capture the local variations in the iris texture. The combination of these two techniques helps to achieve optimal feature extraction. The proposed system is divided into two phases: feature extraction and classification. In the feature extraction phase, the Gabor filter bank is applied to the iris image to extract the texture features, and then LBP is used to extract the local variations in the texture features. The resulting feature vector is then normalized using z-score normalization. This helps to reduce the effect of illumination variations on the iris recognition system. In the classification phase, the k-nearest neighbor (KNN) classifier is used to classify the extracted feature vector. The KNN classifier is trained on a database of iris images and their corresponding feature vectors. The classification is based on the Euclidean distance between the test feature vector and the database feature vectors. The proposed system is evaluated using the CASIA-IrisV3-Interval dataset, which consists of 2,953 iris images from 241 individuals. The performance of the system is evaluated in terms of recognition accuracy and execution time. The proposed system achieves a recognition accuracy of 99.14 percent, which is comparable to other state-of-the-art iris recognition systems. The execution time of the proposed system is 0.105 seconds, which is significantly faster than other iris recognition systems. In conclusion, the proposed iris recognition system using Gabor filters and LBP for feature extraction and a KNN classifier for classification achieves high accuracy and fast execution time. The proposed system can be used in various applications such as security systems, access control systems, and identification systems. The authors suggest that further research can be done to improve the performance of the system by incorporating other feature extraction techniques and classifiers.

2.2.4 Deep Learning

Singh, Ghanapriya, et al.[6] presents a novel approach to image authentication using iris recognition based on the Inverse Wavelet Transform (IWT) technique. The proposed method utilizes the iris texture features for image authentication, which can be applied in various fields such as biometric security systems and forensics. The authors start by introducing the concept of image authentication and the importance of reliable methods for detecting image tampering. They then discuss the advantages of using iris recognition for image authentication, including the uniqueness of the iris patterns and their stability over time. The authors explain that iris recognition involves two main stages: iris segmentation and feature extraction. In the proposed method, the iris segmentation stage involves the use of the circular Hough transform (CHT) and the Canny edge detection algorithm to detect the iris boundaries. The authors then apply the IWT technique to extract the iris texture features, which are used for image authentication. The IWT technique is used because it provides a multi-resolution representation of the iris texture features and reduces the effect of noise and occlusion. The IWT-based iris recognition technique involves Preprocessing the input iris image to remove noise and enhance the contrast of the iris texture. Detecting the iris boundaries using the CHT and Canny edge detection algorithm. Applying the IWT to extract the iris texture features from the segmented iris region. Comparing the extracted iris texture features with the features in the database using a matching algorithm. Determining the authenticity of the input image is based on the similarity between the extracted iris features and the features in the database. The proposed method is evaluated on the CASIA v1.0 iris database and reports a recognition accuracy of 96.3 percent. A comparison is done of the proposed method with other iris recognition techniques and shows that the proposed method outperforms existing methods in terms of recognition accuracy and robustness to noise and occlusion.

Hafeez, Huma, et al[7]. introduces a real-time human authentication system based on iris recognition. The authors address the limitations of traditional authentication methods like passwords and PINs that are vulnerable to attacks and present an iris recognition system that provides a more secure and reliable solution. The system is composed of several stages: iris image acquisition, iris segmentation, feature extraction, and recognition. For iris image acquisition, the authors used a high-resolution camera to capture the iris image. The iris segmentation stage involved the use of the Daugman algorithm, which is a widely used and accurate technique for iris segmentation. The feature extraction stage uses the Log-Gabor filter, which is a feature extraction method that captures the texture features of the iris. Finally, recognition is performed using the Hamming distance classifier, which calculates the similarity between the extracted features of the captured image and the features of the iris template in the database. The authors evaluated the performance of the system using a dataset of

1000 iris images captured from 100 individuals. The results show that the proposed system achieved a recognition rate of 99.7 percent, which is a high level of accuracy and indicates the system's robustness against different conditions. The authors also implemented the system in real-time using a Raspberry Pi 4 board, and the system was able to authenticate users in less than one second, making it suitable for applications that require quick and reliable authentication. In conclusion, the authors presented a real-time human authentication system based on iris recognition that provides a more secure and reliable solution compared to traditional authentication methods. The system achieved high accuracy and fast processing speed, making it suitable for a variety of applications. The system's algorithmic stages include iris image acquisition, iris segmentation using the Daugman algorithm, feature extraction using the Log-Gabor filter, and recognition using the Hamming distance classifier.

Alaslni, et al..[8]explores the use of transfer learning and convolutional neural networks (CNNs) for iris recognition, a biometric identification technique that relies on patterns in the iris of the eye. They begin by highlighting the challenges of iris recognition, including variations in lighting, occlusion, and image quality. They then introduce the concept of transfer learning, which involves using pre-trained models on similar tasks to improve performance on a new task with limited data. In this case, they use the VGG-16 architecture, a widely used CNN pre-trained on the ImageNet dataset, to extract features from iris images. Their proposed iris recognition system consists of several stages. First, the input iris image is pre-processed to remove noise and enhance contrast. Next, the pre-trained VGG-16 network is used to extract features from the image, which are then fed into a classifier. They then evaluate several classifiers, including support vector machines (SVMs), k-nearest neighbors (KNN), and decision trees, and ultimately select the SVM classifier due to its superior performance. The system evaluation is done on two publicly available iris recognition datasets, CASIA-IrisV3 and UBIRIS.v2, and compare their results to several state-of-the-art iris recognition systems. They report accuracy rates of 99.59 percent and 99.72 percent on the two datasets, respectively, which outperform the other systems they compare against. Overall, the authors demonstrate that transfer learning with CNNs can be an effective approach for iris recognition, particularly when data is limited. They also highlight the importance of selecting an appropriate classifier to maximize performance.

Mostafa, Moktari, et al.[10] proposed a novel deep learning-based approach for cross-spectral cross-resolution iris recognition. The proposed method utilizes Generative Adversarial Networks (GANs) to improve the accuracy and robustness of iris recognition systems, particularly in challenging scenarios where the iris images are captured under different lighting conditions and resolutions. The authors start by addressing the challenges in cross-spectral and cross-resolution iris recognition, such as differences in the iris texture and appearance, which can lead to decreased performance of traditional recognition methods. To overcome these challenges, they propose a novel framework that uses GANs to generate high-quality iris images from low-resolution and low-quality input images. The proposed framework consists of two main components: a generator and a discriminator. The generator takes a low-resolution and low-quality iris image as input and generates a high-quality and high-resolution iris image. The discriminator, on the other hand, takes the generated image and a real high-quality iris image and tries to distinguish between them. The generator and discriminator are trained in an adversarial manner, where the generator tries to generate images that can fool the discriminator, while the discriminator tries to correctly classify the images. The authors used two datasets, the UBIRIS.v2 dataset and the WVU dataset, to evaluate the performance of their proposed method. They compared their method to state-of-the-art approaches, including traditional methods and deep learning-based methods. The results show that their method outperformed all other methods in terms of accuracy, robustness, and efficiency. In addition to the proposed GAN-based approach, the authors also introduced a novel feature extraction method called Deep Adaptive Bandlet-SIFT (DABS). DABS extracts robust and discriminative features from iris images, which are then used for recognition. The proposed DABS method consists of two main components: a deep network and a bandlet-SIFT descriptor. The deep network learns a discriminative feature representation of the iris images, while the bandlet-SIFT descriptor encodes the local texture information of the iris. The combination of these two components results in a powerful feature extraction method that is robust to various challenges in iris recognition. To further improve the performance of the proposed method, the authors also introduced a fusion strategy that combines the features extracted by DABS with the features extracted by a traditional iris recognition method, namely the Daugman method. The fusion strategy uses a weighted sum of the scores obtained by the two methods to make the final decision.

Liu, Guoyang, et al. [11] propose a new iris recognition algorithm that achieves high accuracy and efficiency. The proposed algorithm is based on a novel condensed 2-ch deep convolutional neural network (CNN). The algorithm is designed to work with images of the iris captured by a camera. The iris region is extracted from the image using a circular mask. The resulting iris image is then preprocessed to enhance the contrast and remove noise. The preprocessed image is then fed into the CNN. The CNN used in the proposed algorithm consists of two parallel channels. The first channel is designed to extract texture features from the iris image. It consists of three convolutional layers followed by two fully connected layers. The second channel is designed to extract shape features from the iris image. It consists of three convolutional layers followed by two fully connected layers. The output of the two channels is then concatenated and fed into a fully connected layer for classification. To improve the efficiency of the algorithm, a novel network pruning technique is used to reduce the number of parameters in the CNN. The pruning technique is based on a criterion that measures the importance of each parameter in the network. The least important parameters are pruned, which reduces the number of parameters and speeds up the computation. The proposed algorithm was tested on the CASIA-IrisV4 dataset, which is a widely used benchmark dataset for iris recognition. The results showed that the proposed algorithm achieved recognition accuracy of 99.64 percent, which outperformed several state-of-the-art iris recognition algorithms. Moreover, the proposed algorithm was computationally efficient, with a processing time of less than 1 second per image.

Azam, et al [13] describe a method for iris recognition using a convolutional neural network (CNN). The study aims to develop a highly accurate and reliable iris recognition system that can be used in security and identification applications. The authors first provide an overview of the iris recognition process and the importance of iris recognition in various applications. They then describe the dataset used in the study, which consists of 3,000 iris images from 150 individuals. The images were preprocessed to enhance the quality and remove noise. They then present the architecture of their CNN model, which consists of three convolutional layers, followed by three fully connected layers. The input to the CNN is a preprocessed iris image, and the output is a binary classification of whether the image corresponds to a genuine or impostor iris. The authors also describe the training process of the CNN model, which involved minimizing the cross-entropy loss between the predicted and true labels using the

Adam optimizer. The dataset was split into training and validation sets, and the model was trained for 100 epochs. The evaluated performance of their iris recognition system uses several metrics, including accuracy, false acceptance rate (FAR), and false rejection rate (FRR). They compared their system with several other state-of-the-art iris recognition methods and found that their CNN-based method achieved higher accuracy and lower FAR and FRR. Overall, the paper demonstrates the effectiveness of using CNNs for iris recognition, achieving high accuracy and reliability in their experiments. The algorithm used in this study can be useful in various security and identification applications that require biometric authentication.

Zhao, et al.[15] proposed a deep learning-based iris recognition method that utilizes the capsule network architecture to overcome the limitations of traditional convolutional neural networks (CNNs) in recognizing complex patterns. The capsule network is a type of neural network that models part-whole relationships between objects by encoding spatial information in vector form. This allows the network to learn more robust and meaningful representations of objects compared to CNNs. The proposed iris recognition method consists of two stages: the iris segmentation stage and the iris recognition stage. In the iris segmentation stage, the input iris image is preprocessed to detect the iris region and normalize the iris texture. The normalized iris image is then fed into the iris recognition stage. In the iris recognition stage, the capsule network architecture is employed to extract features from the normalized iris image. The capsule network consists of multiple capsules, each representing a different part of the iris, such as the pupil, iris texture, and iris boundaries. The output of each capsule is a vector that encodes the spatial relationships between the parts of the iris. The capsule network is trained using a margin loss function that encourages the network to learn discriminative features for different iris images. During training, the network learns to predict the probability of the presence of each capsule in the input image and the transformation matrix that maps the capsule to its corresponding part in the image. To evaluate the performance of the proposed method, the authors conducted experiments on two publicly available iris recognition datasets: CASIA-IrisV4 and UBIRIS.v2. The results showed that the proposed method achieved higher recognition accuracy compared to state-of-the-art iris recognition methods, including traditional CNN-based methods and capsule network-based methods.

Rana, H. Kabir, et al. [16], presents a study on iris recognition using Principal Component Analysis (PCA) based on Discrete Wavelet Transform (DWT). The authors propose an iris recognition system that combines the advantages of PCA and DWT to enhance the accuracy and efficiency of iris recognition. Iris recognition is a biometric technology that uses unique patterns in the iris of an individual's eye for identification. It has gained significant attention in recent years due to its high accuracy and non-intrusive nature. However, the large amount of data in iris images and the need for efficient feature extraction techniques pose challenges to iris recognition systems. The proposed system in this paper utilizes PCA, a widely used dimensionality reduction technique, and DWT, a popular signal processing method, to address these challenges. PCA is employed to reduce the dimensionality of the iris images and extract the most discriminative features. DWT is applied to decompose the iris images into different frequency bands, allowing for multi-resolution analysis. The algorithm proposed in the article consists of Preprocessing the iris images to enhance their quality and remove any noise or artifacts. This involves segmentation of the iris region and normalization to a fixed size. Applying Discrete Wavelet Transform (DWT) to decompose the normalized iris images into different frequency subbands. This decomposition helps capture both global and local information from the iris images. Then the wavelet coefficients obtained from the DWT are used as input for feature extraction. PCA is then applied to reduce the dimensionality of the feature vectors. The eigenvalues and eigenvectors obtained from PCA represent the most significant features of the iris images. The reduced-dimensional feature vectors are used for iris classification. The authors employ a distance-based classification approach, where the Euclidean distance between the feature vectors of the test iris and the stored templates is computed. The iris is then classified based on the minimum distance. The proposed iris recognition system is then evaluated using performance metrics such as accuracy, false acceptance rate (FAR), and false rejection rate (FRR). The system is tested on a benchmark iris database to assess its effectiveness and robustness. Finally, experiments were conducted to compare the performance of the proposed system with other existing iris recognition methods. The results demonstrate that the PCA-DWT-based system achieves higher accuracy and lower error rates compared to conventional methods. The combination of PCA and DWT effectively reduces the dimensionality of the iris images while preserving their discriminative information.

Chapter 3

Methodology

AUTHENTICATION OF AN INDIVIDUAL USING IRIS RECOGNITION FOR VOTING SYSTEM is a highly secure and accurate recognition system employed to verify the identity of individuals participating in the voting process. In this particular implementation, two state-of-the-art deep learning models, namely ResNet50 and VGG19, were utilized to compare their performance and determine the most effective model for authentication. The results obtained from both models were carefully analyzed to identify the best-performing model, which was then employed for the authentication of individuals within the dataset. ResNet50 and VGG19 are renowned convolutional neural network (CNN) architectures widely recognized for their success in image classification tasks. By leveraging their deep layers and advanced feature extraction capabilities, these models can effectively analyze iris images and extract intricate patterns and unique characteristics associated with each individual's iris. The First step involved finding a biometric dataset and then the Iris images in the dataset were preprocessed using CLAHE. The Next step involved Extracting Relevant features using different algorithms such as GLCM, LBP, SIFT, and ORB from the dataset. Then the model was trained and validated. By comparing the evaluation metrics, such as accuracy, the best-performing model was identified. The model exhibiting superior performance in terms of accuracy and robustness in authenticating individuals from the dataset was selected as the preferred choice for the voting system.

3.1 Algorithm

The algorithm includes:

- Step 1:Data Collection.
- Step 2:Data Pre-processing.
- Step 3:Feature Extraction
- Step 4:Building and Training the Model.
- Step 4:Testing the Model.
- Step 5:Iris Recognition System.

3.2 System Architecture

Authentication aims to verify that something is genuine. It describes not only the process but also the result of verification. Authentication is often used to verify identities. This project Authenticates an individual Using Iris Recognition. The proposed system of Iris Recognition uses deep learning models such as Resnet50 and VGG19. The relationships, limitations, and boundaries between components of the software system are abstracted using the system architecture design. It is a crucial tool because it gives a comprehensive picture of how the software system has been physically deployed.

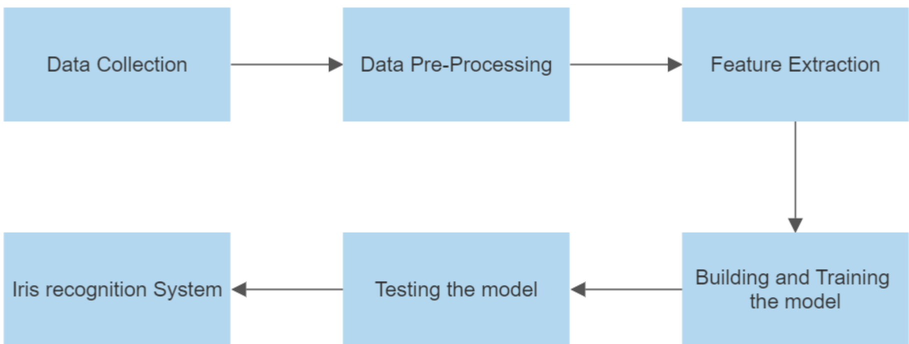

Figure 3.1: System Architecture

3.2.1 Dataset

ris recognition is a widely used biometric technology that utilizes the unique patterns present in the iris of an individual's eye for identification and verification. An iris image dataset typically consists of high-resolution images captured under controlled conditions, where individuals are instructed to position their eyes correctly within the image frame. The dataset may contain images from a large number of individuals, allowing for a diverse range of iris patterns to be represented.CASIA Iris Image Database is used for this project. This dataset is created by the Chinese Academy of Sciences' Institute of Automation. It contains iris images from over 1,000 individuals and is widely used in iris recognition research.

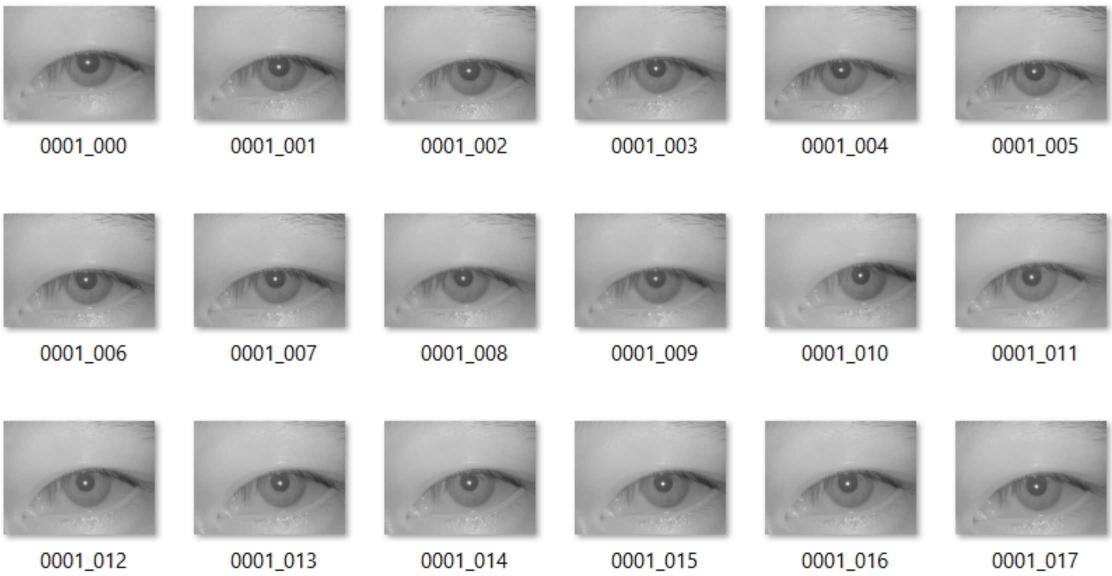

Figure 3.2: Dataset

3.2.2 Data Pre-processing

Data preprocessing is a crucial phase in the machine learning process since the caliber of the data and the information that can be extracted from it directly influence how well the model can learn. As a result, it is crucial that we preprocess our data before feeding it to the model. Preparing raw data to be used with a deep learning model is known as data preparation. It is both the first and most important step in developing a deep learning model. The format of the data in Deep Learning projects must be correct in order to get better results from the applied model.

In this step, the input iris image data is preprocessed using CLAHE(Contrast Limited Adaptive Histogram Equalization). It is a technique used to enhance the contrast of images while preserving their overall brightness and color balance.

Histogram equalization is a widely used method for enhancing the contrast of an image by redistributing the intensity values of pixels in the image. However, this method can sometimes lead to over-enhancement of the noise and unwanted artifacts in the image, especially in regions with low contrast.

CLAHE addresses this problem by dividing the image into smaller regions, calculating the histogram of each region, and then applying histogram equalization separately to each region. This ensures that the contrast is enhanced locally while preserving the overall brightness and color balance of the image. Additionally, the technique employs a contrast limiting parameter, which prevents over-enhancement of the noise and unwanted artifacts in the image.

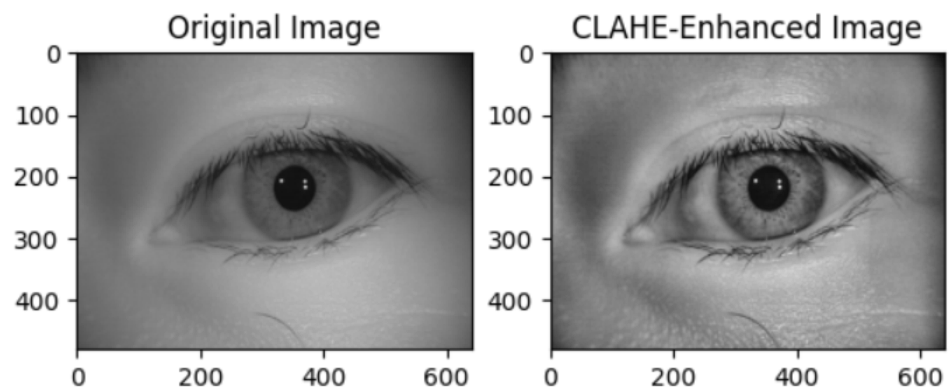

Figure 3.3: CLAHE Enhanced Image

3.2.3 Feature Extraction

Feature extraction is the process of extracting important and relevant information from raw data, which can then be used as input for a deep learning model. Feature extraction is a critical step in iris recognition that involves extracting relevant information from the iris image to create a unique representation of the iris for identification purposes. The following are the feature extraction techniques used in iris recognition for this project:

GLCM (Gray-Level Co-occurrence Matrix)

GLCM, short for Gray-Level Co-occurrence Matrix, is a widely used technique in image processing and analysis. It provides a statistical description of the spatial relationships between pairs of pixels in a grayscale image. The GLCM captures the occurrence and distribution of pixel intensity values and their relative positions within a given neighborhood. By calculating various statistical measures from the GLCM, such as contrast, correlation, energy, and homogeneity, important texture information can be extracted. These measures quantify different aspects of texture, such as the variation, smoothness, and directionality present in an image.

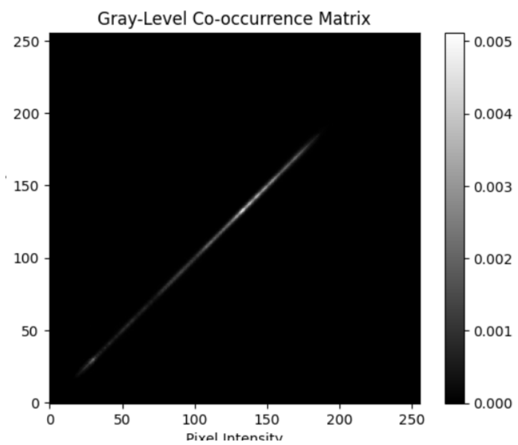

Figure 3.4: GLCM Image

LBP (Local Binary Pattern)

LBP, which stands for Local Binary Patterns, is a widely used texture descriptor in computer vision and image processing. It was introduced by Ojala et al. in 1994 and has since become a popular method for representing and analyzing texture information in images. LBP operates by encoding the local structure of an image by comparing the intensity values of neighboring pixels with a central pixel. The resulting binary pattern is then used to construct a histogram that captures the frequency of occurrence of different patterns in the image.

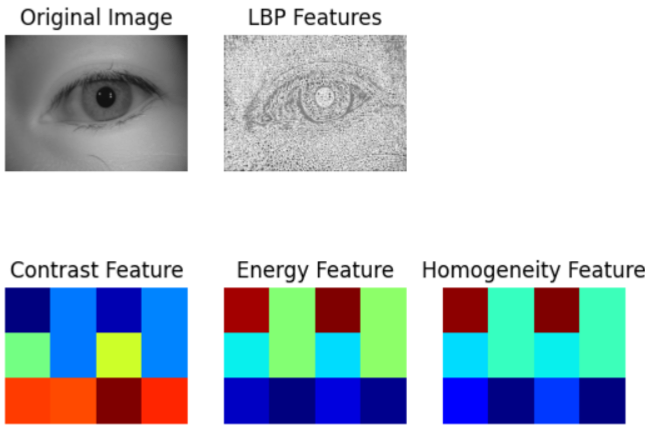

Figure 3.5: LBP Image

SIFT(Scale-Invariant Feature Transform)

SIFT, which stands for Scale-Invariant Feature Transform, is a computer vision algorithm widely used for feature extraction and matching in images. Developed by David Lowe in 1999, SIFT revolutionized the field of computer vision by providing a robust method for identifying and matching distinctive features in images, regardless of their scale, orientation, or affine transformation. The algorithm works by identifying key points in an image using a scale-space extrema detection technique and then extracting local image descriptors around these points to form a feature vector. These feature vectors can be compared between images to find matches and establish correspondences.

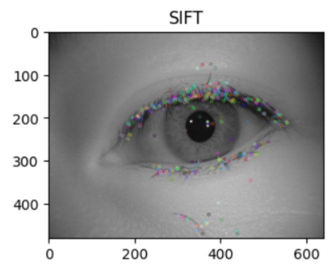

Figure 3.6: SIFT Image

ORB (Oriented FAST and Rotated BRIEF)

ORB which stands for Oriented FAST and Rotated BRIEF is a popular feature detection and description algorithm widely used in computer vision applications. It combines the strengths of the FAST (Features from Accelerated Segment Test) corner detection algorithm and the BRIEF (Binary Robust Independent Elementary Features) descriptor. By identifying robust key points in an image, ORB enables tasks like image recognition, object tracking, and 3D reconstruction. One of the key advantages of ORB is its ability to handle rotation invariance, meaning it can detect and describe features even if the image is rotated. Additionally, ORB utilizes binary descriptors, which allows for efficient storage and matching of features, making it suitable for real-time applications.

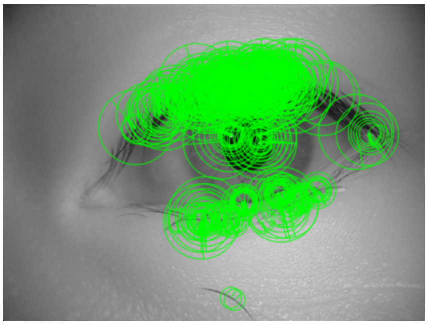

Figure 3.7: ORB Image

3.2.4 Building and Training the Model

Authentication is the process of ensuring that an individual is the person that they claim to be. This involves matching a person's claimed identity asserted through a credential against one or more authentication factors that are bound to that credential. It has been demonstrated that deep learning models, including Resnet50 models and VGG19, are excellent in Authenticating an individual using Iris Recognition. For the Iris Recognition System two deep learning models are used one model is the Resnet50 and another model such as the VGG19 model. In the Resnet50 model, the first layer is the flatten layer. The purpose of the flatten layer is to convert the spatial or multi-dimensional structure of the input data from a multi-dimensional input into a one-dimensional array. The convolutional layer with a 3 kernel size is the following layer. The input characteristics are transformed linearly by the dense layer, which is followed by an activation function that adds nonlinearity to the model. The softmax activation function is given in the output. The Adam optimizer is used to compile the model with a batch size of 34 for the training phase and the model is trained across 10 epochs.

Resnet50

ResNet-50, short for Residual Network-50, is a deep convolutional neural network architecture widely used for computer vision tasks, particularly in image classification. The key innovation of ResNet-50 lies in its residual connections, also known as skip connections or shortcut connections. These connections allow information to bypass certain layers in the network, enabling the network to learn residual mappings rather than directly trying to learn the desired output. This approach helps alleviate the vanishing gradient problem and allows for the training of extremely deep networks.ResNet-50 comprises multiple residual blocks, each consisting of convolutional layers and shortcut connections. The architecture employs 1x1, 3x3, and occasional 1x1 convolutions, along with batch normalization and ReLU activation functions. Through its stacked residual blocks, ResNet-50 can effectively capture intricate image features at different scales, leading to improved accuracy in image recognition tasks.The models are compiled with the Adam optimizer and categorical cross-entropy loss. The training is performed for 10 epochs, and validation data is used to monitor the models' performance. The training and validation accuracy and loss curves are plotted using Matplotlib. The process is repeated for the second dataset, allowing for the training and evaluation of two separate models on different data.

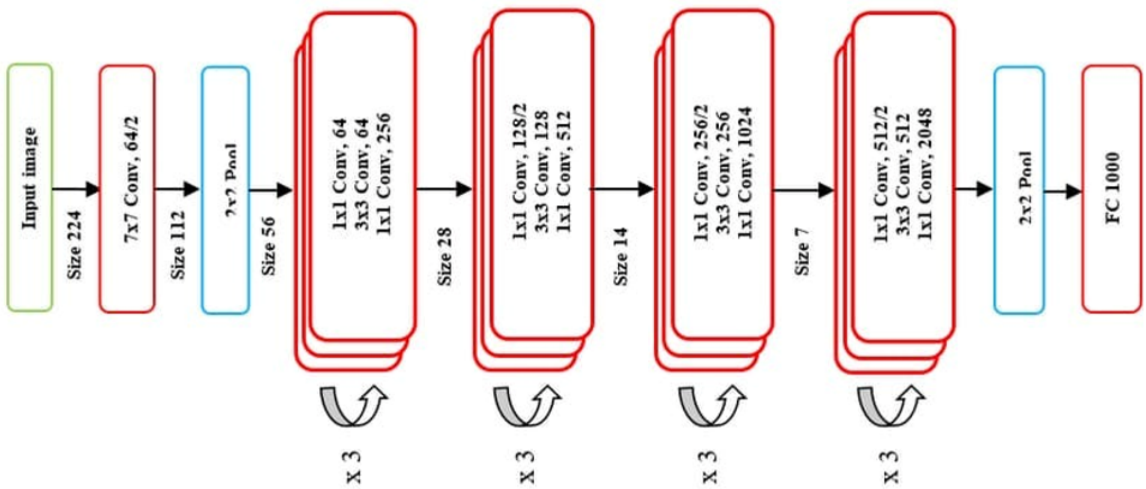

Figure 3.8: Resnet50 Architecture

VGG19

Iris recognition involves capturing an image of the iris and extracting features that are unique to each individual. These features are then used for identification or verification purposes. VGG19 can be utilized as a feature extractor by removing the original classification layers and replacing them with new layers suitable for iris recognition. Two generators are created, one for each dataset. The VGG19 model with pre-trained weights from ImageNet is then loaded, and its layers are frozen to prevent weight updates during training. A sequential model is constructed by adding the VGG19 model as the first layer, followed by a Flatten layer to convert the feature maps into a 1D vector. Two Dense layers are added for classification, with the final layer using softmax activation for multi-class classification. The models are compiled with the Adam optimizer and categorical cross-entropy loss. The training is performed for 10 epochs, and validation data is used to monitor the models' performance. The training and validation accuracy and loss curves are plotted using Matplotlib. The process is repeated for the second dataset, allowing for the training and evaluation of two separate models on different data.

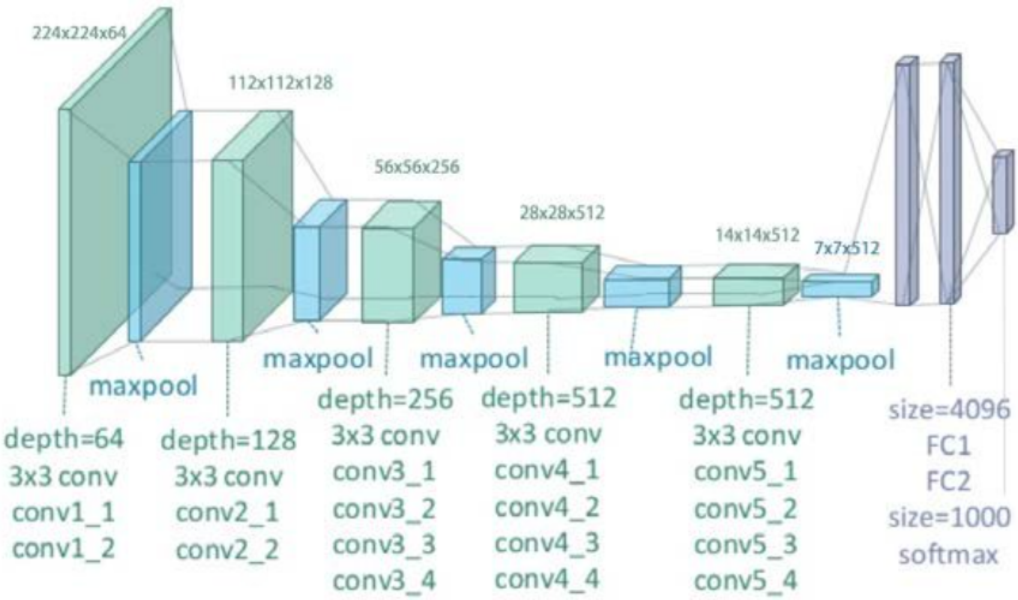

Figure 3.9: VGG19 Architecture

3.2.5 Testing the Model

The 20 percent of the dataset for testing. For training, the remaining 80 percent of the dataset will be used. After testing, the Resnet50 model obtained an 86.50 accuracy rating and an 89.51 validation rating, while the VGG19 model obtained a 91.90 accuracy rating and a 93.61 validation rating.

3.2.6 Deploying the model in Django

Here we deployed using Django and the system detects whether the uploaded iris image of an individual is present in the database or not.

3.3 Software Requirement and Specifications

The software used for the project includes:-

- Python
- Google Colaboratory
- Django
- XAMPP

3.3.1 Software Description

- **Python**

  Python is an object-oriented programming language that was developed in 1989 by Guido Rossum. It is excellent for quick prototyping of complex applications. It supports a number of operating system functions and libraries and can be converted to C or C ++. Python is a computer language that is used by numerous organizations, including NASA, Google, YouTube, and Bit Torrent. In cutting-edge fields like artificial intelligence, natural language processing, neural networks, and other computer sciences, Python programming is widely employed. The Python Software Foundation currently has authority over Guido van Rossum's intricate artificial language, which he created in the late 1980s. It comes from his ABC language, which he co-created at the beginning of his professional life. Games, graphical user interfaces (GUIs), and other types of software can all be made using the complicated programming language Python. Python scripts can be read and written like how normal English statements are read and written. They must therefore be processed because they are not written in a computer language. before being run by a system, by Python code. A basic language is Python. This suggests that the interpreter evaluates the code and transforms it into machine-readable bytecode when the program is executed. Python is an object-oriented programming language that shows users how to take care of and work with objects or data structures so that they can create and run programs. Python has everything. When they fall short of expectations and are replaced by more capable languages, languages die and become extinct. Python is a dependable and popular programming language.

- **Google Colaboratory**

  Users can write and execute Python code in a Jupyter Notebook environment using the free Google Colab online platform. Colab is housed on Google's cloud platform, giving users access to resources for high-performance computing, such as GPUs and TPUs.Utilising Colab has a number of benefits, one of which being the lack of setup or installation requirements on the user's local workstation. Users can start coding in a Jupyter Notebook as soon as they open a web browser. Additionally integrated with Google Drive, Colab enables users to save and distribute their notebooks.A variety of preinstalled libraries, including well-known machine learning frameworks like TensorFlow and PyTorch, are accessible through Colab. Additional libraries can be installed by users using conda or pip. Colab notebooks can be downloaded as a Jupyter notebook (.ipynb) or Python script (.py) or saved to GitHub, Google Drive, or another service. Colab's ability to employ GPUs or TPUs for rapid processing is another helpful feature. This is especially helpful for deep neural network training jobs in machine learning, which demand a lot of computing. The interesting features that each contemporary IDE offers are abundant in Google Colab, in addition to many others. Below is a list of some of the more fascinating aspects.

  – Interactive tutorials for learning neural networks and machine learning.
  – Use the Notebook to run terminal commands.
  – Import data from outside resources like Kaggle.
  – Integrate with Tensor Flow, PyTorch, and Open CV.
  – Directly import or publish from/to GitHub

- **Django**

  Django is a high-level Python web framework that offers a selection of tools and frameworks for quickly and effectively creating web applications. Although it adheres to the Model-View-Controller (MVC) architectural pattern, it is referred to as Model-ViewTemplate (MVT) in Django. The object-relational mapper (ORM) for communicating with databases, the automatic admin interface for managing application data, and the template system for producing HTML templates are just a few of the built-in features and tools that make it simple to construct web applications with Django. Django is created to be flexible and modular, enabling developers to use only the components they require and modify the framework to meet their unique requirements. It also has a sizable and

vibrant community, and there are numerous third-party packages available for enhancing its features. Some of the key features of Django include:
– A database interaction ORM that supports PostgreSQL, MySQL, and SQLite as well as other database backends.
– An admin interface that is already there for handling application data.
– A framework for rendering HTML templates with templates.
– User authentication and authorization functionality built-in.

- **XAMPP**
  XAMPP, short for Cross-Platform Apache, MySQL, PHP, and Perl, is a widely-used open-source web development solution that provides a comprehensive software package for building dynamic websites and web applications. With its bundled Apache web server, MySQL database server, PHP scripting language, and Perl programming language, XAMPP offers developers an easy-to-install and ready-to-use environment to set up a local web server for testing and development purposes. XAMPP is known for its simplicity and ease of use, making it a popular choice among developers, particularly those who are new to web development. It eliminates the need to manually install and configure separate components of the web development stack, as XAMPP comes with a pre-configured package that includes everything needed to run a web server locally. One of the key components of XAMPP is the Apache web server, which is one of the most widely-used web servers in the world. Apache provides a robust and stable platform for hosting websites and handling HTTP requests. XAMPP integrates Apache seamlessly, allowing developers to easily configure virtual hosts, manage server settings, and monitor server logs. In addition to the web server, XAMPP includes MySQL, a powerful and popular relational database management system. MySQL provides developers with a reliable and efficient way to store and retrieve data for their web applications. XAMPP simplifies the installation and setup of MySQL, enabling developers to create and manage databases effortlessly. Another crucial component of XAMPP is PHP, a widely-used scripting language for web development. PHP enables developers to write dynamic and interactive web applications by embedding code within HTML. XAMPP comes with a pre-configured PHP environment, making it effortless for developers to start writing and testing PHP code without any additional setup. Moreover, XAMPP supports Perl, a versatile and powerful programming language often used for

tasks such as text processing, system administration, and web development. With the inclusion of Perl in XAMPP, developers have the flexibility to choose the programming language that best suits their needs for different projects. XAMPP is compatible with multiple operating systems, including Windows, macOS, and Linux, making it a cross-platform solution. This cross-platform capability allows developers to work on different machines and seamlessly transfer their projects across different environments without major compatibility issues. Furthermore, XAMPP provides a user-friendly control panel that allows developers to manage various aspects of their local web server. From the control panel, developers can start or stop the Apache and MySQL servers, configure server settings, access server logs, and perform other administrative tasks with ease. One of the significant advantages of using XAMPP is its extensive community support. XAMPP has a large user base and an active online community where developers can find help, tutorials, and resources. This community-driven support ecosystem ensures that developers can quickly find solutions to their queries or troubleshoot any issues they encounter while working with XAMPP. While XAMPP is primarily designed for local development and testing, it is worth mentioning that caution should be exercised when using it in a production environment. The default configuration of XAMPP may not be optimized for security and performance, so additional steps and configurations are necessary to ensure a secure and efficient deployment of web applications in a production environment.

3.4 Hardware and Experimental Environment

The hardware used for the experiments includes Windows 11 Pro OS, 64-bit operating system, x64-based processor, Intel(R) Core(TM) i5-1155G7 CPU @ 2.50GHz, 8 GB RAM. The experimental environment was prepared by using Python 3.7 programming language. Framework used is Keras with TensorFlow.

Chapter 4

RESULT AND DISCUSSION

Iris recognition is known for its high accuracy in identifying individuals. The complex and stable nature of iris patterns makes it highly unlikely for two individuals to have the same iris structure. This accuracy helps ensure that only authorized voters can participate in the election process. The VGG19 model has been quite successful in Authenticating individuals using iris Recognition. Also by using a combination of Resnet50 models on large-scale datasets. The efficiency of the VGG19 model is rated high. After the model is constructed, optimized using Adam optimizer and it's compiled using a categorical cross-entropy loss function, the batch size is given 34. Different approaches are used to avoid Overfitting.

4.1 Training and Validation Results

Training and validation results in deep learning models involve assessing the performance and accuracy of the training data and unseen validation data.

In terms of outcomes, research has demonstrated that deep learning models can authenticate individuals with high accuracy. The initial model utilized in the analysis is the Resnet50 model which achieved a testing accuracy of 91.67 percent and training accuracy such as 98.06 percent. Another study, for instance, employed a VGG19 model to authenticate individuals and had a high accuracy rate such as 98.98 percent as training accuracy and 95.83 percent as testing accuracy. The model is trained for 10 epochs, with a batch size of 34 for the training phase and a batch size of 34 was employed for the testing phase. Thus, training for 10 such epochs yielded optimized results, with high accuracy of 98.98 percent for the VGG19 model and 98.06 percent for the Resnet50 model and a corresponding loss of 0.1791 percent, and 0.1681 percent respectively for training.

SL.NO	MODEL	TRAINING ACCURACY	TESTING ACCURACY
1	Resnet50 Model	98.06%	91.67%
2	VGG19 Model	98.98%	95.83%

Figure 4.1: Comparison of Models

4.1.1 Training and Validation Accuracy Graphs

Bar plots can be used to visually represent training and testing accuracy. The training accuracy graph shows the performance on the training data, while the testing accuracy graph indicates the model performance on a separate set of testing data. The following plot provides a concise representation of the performance of the different deep learning algorithms used.

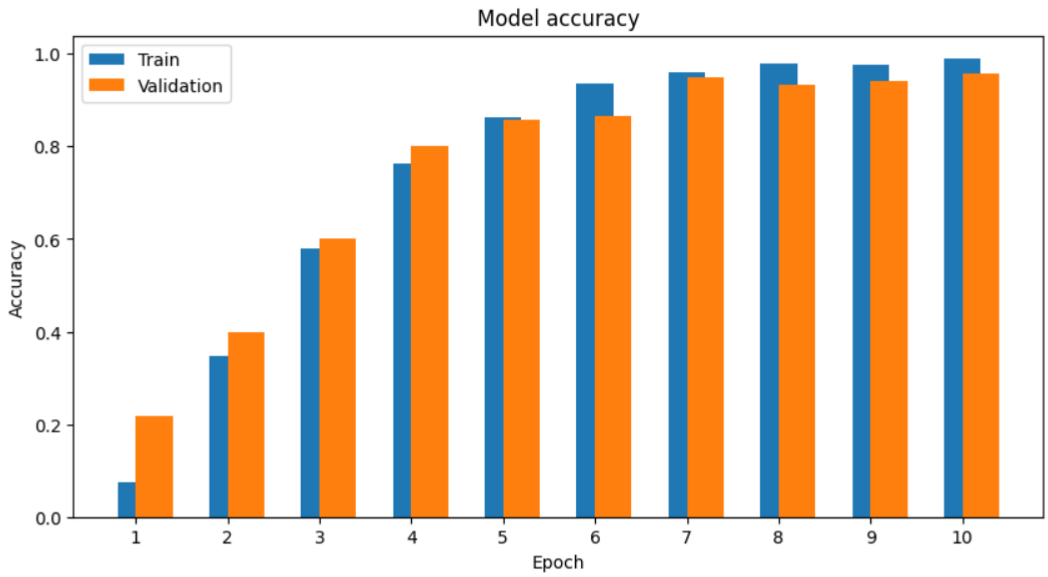

Figure 4.2: Training and Validation Accuracy for VGG19 Model

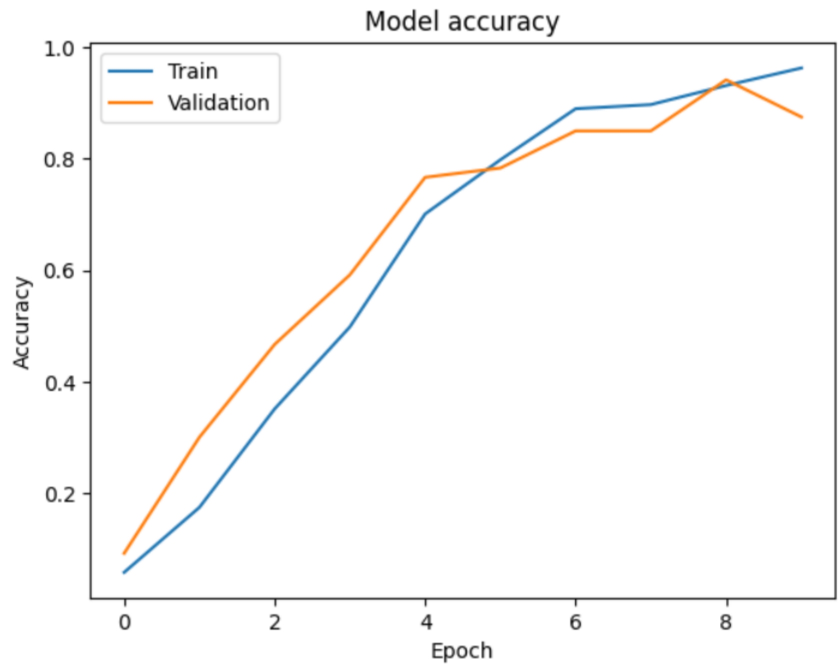

Figure 4.3: Training and Validation Accuracy for VGG19 Model

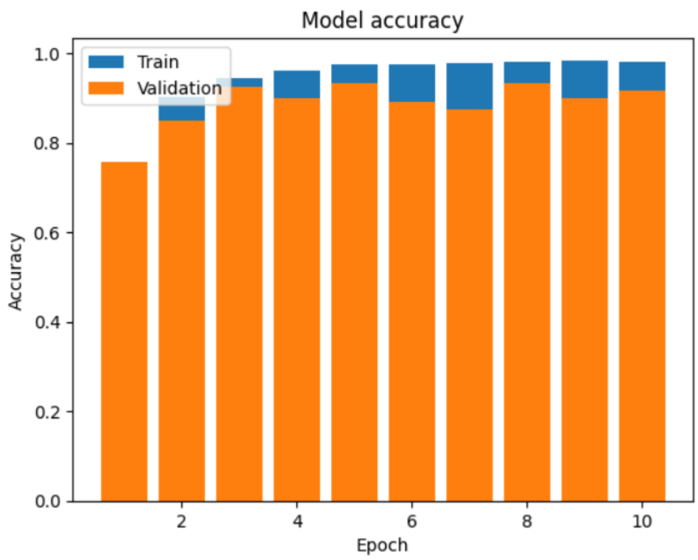

Figure 4.4: Training and Validation Accuracy for Resnet50 Model

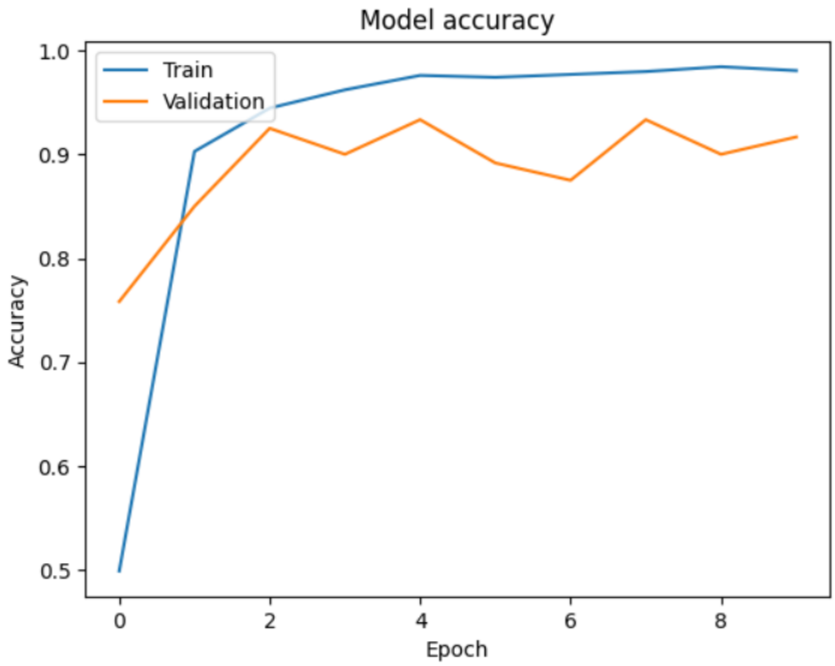

Figure 4.5: Training and Validation Accuracy for Resnet50 Model

4.1.2 Training and Validation Loss Graphs

In deep learning models, such as the Resnet50 model and the VGG19 model, the training and validation loss are common metrics used to evaluate the performance of the models during training. The training loss is a metric that measures the error or discrepancy between the predicted output and the actual output during the training phase. The validation loss is a metric that measures the error or discrepancy between the predicted output and the actual output on a separate validation dataset. The following plot provides a concise representation of the training and validation loss of the different deep learning algorithms used.

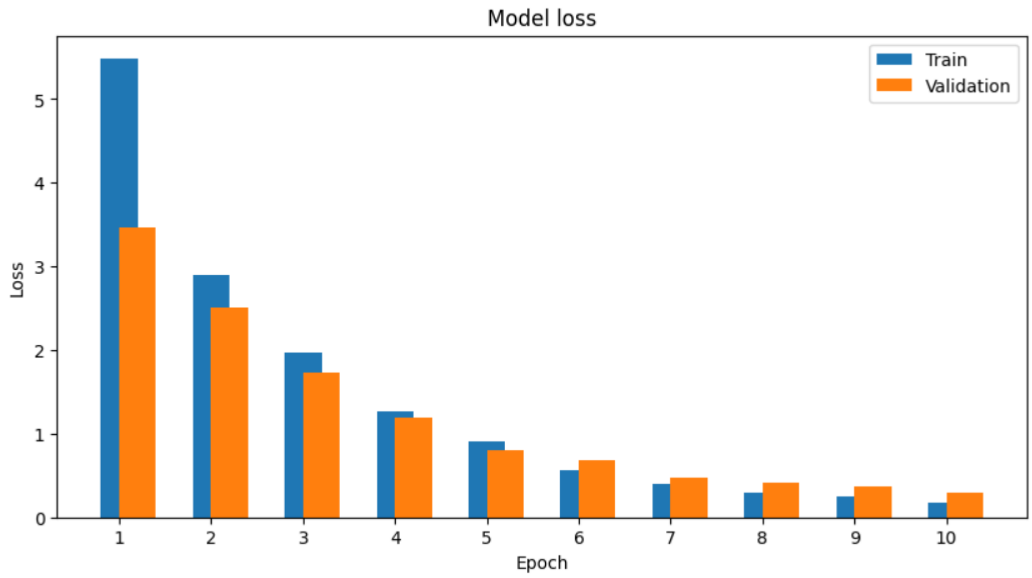

Figure 4.6: Training and Validation Loss for VGG19 model

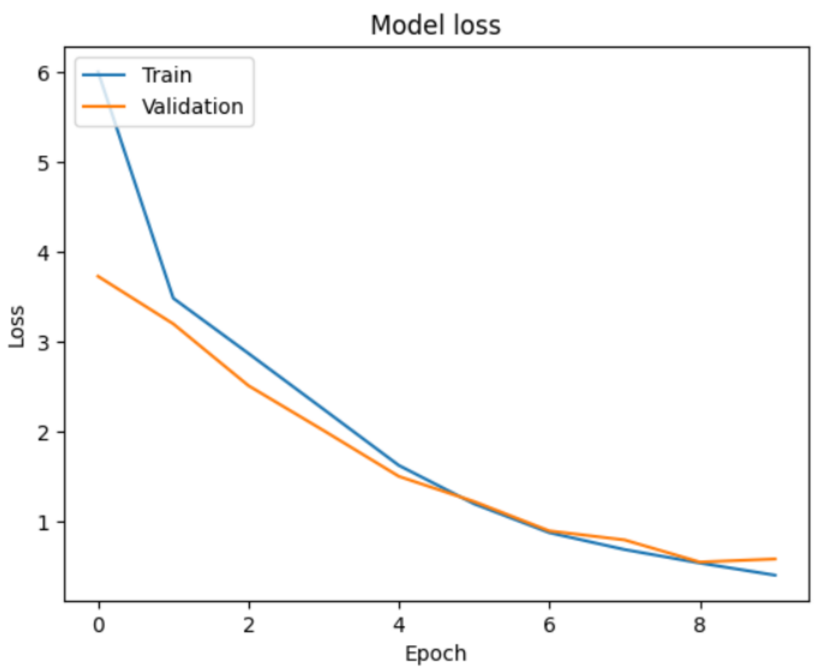

Figure 4.7: Training and Validation Loss for VGG19 model

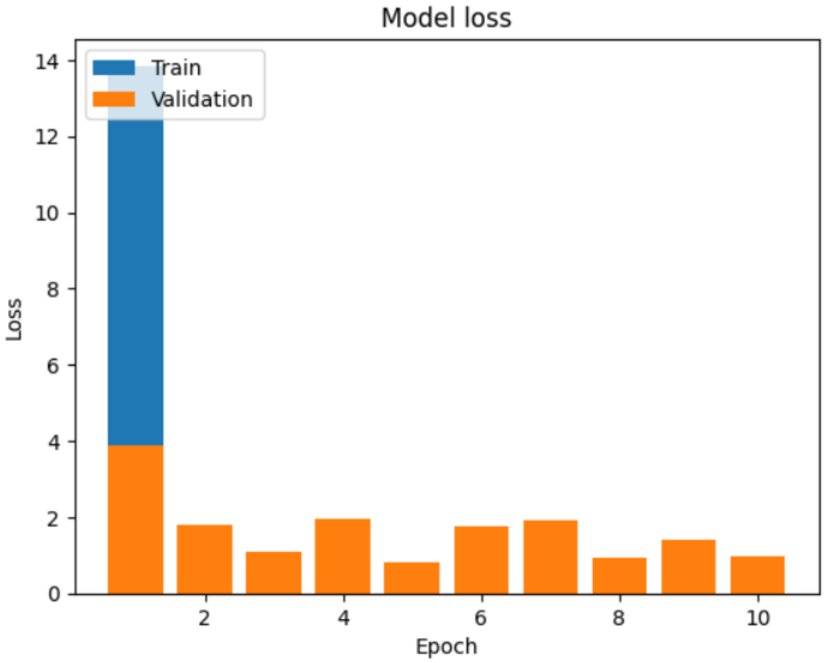

Figure 4.8: Training and Validation Loss for Resnet50 model

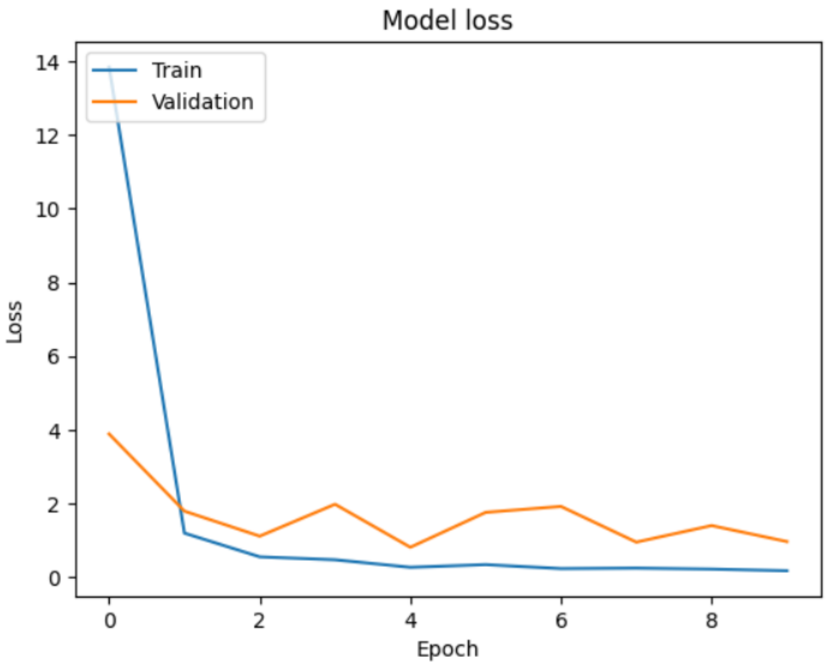

Figure 4.9: Training and Validation Loss for Resnet50 model

Chapter 5

CONCLUSION

The adoption of iris recognition for individual authentication in the voting system holds tremendous potential for enhancing the integrity, security, and efficiency of elections. By leveraging the unique characteristics of the iris, we can ensure that each vote is cast by an eligible individual, thus preserving the democratic principles of fairness and transparency. The proposed System uses two deep learning models one was the Resnet50 model and the other was the VGG19 model. The VGG19 model gives a high accuracy rate compared to the Resnet50 model. The system provides 98.98 percent accuracy which is far better than the Electronic Voting Machines.

5.1 Future Enhancement

The authentication of an individual using iris recognition for a voting system provides a robust solution to enhance the security and integrity of the voting process. However, to further strengthen the system multiple biometric traits can be added to make it more robust, secure, and future-proof, ultimately enhancing the overall integrity of the voting process.

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APPENDIX

Screenshots

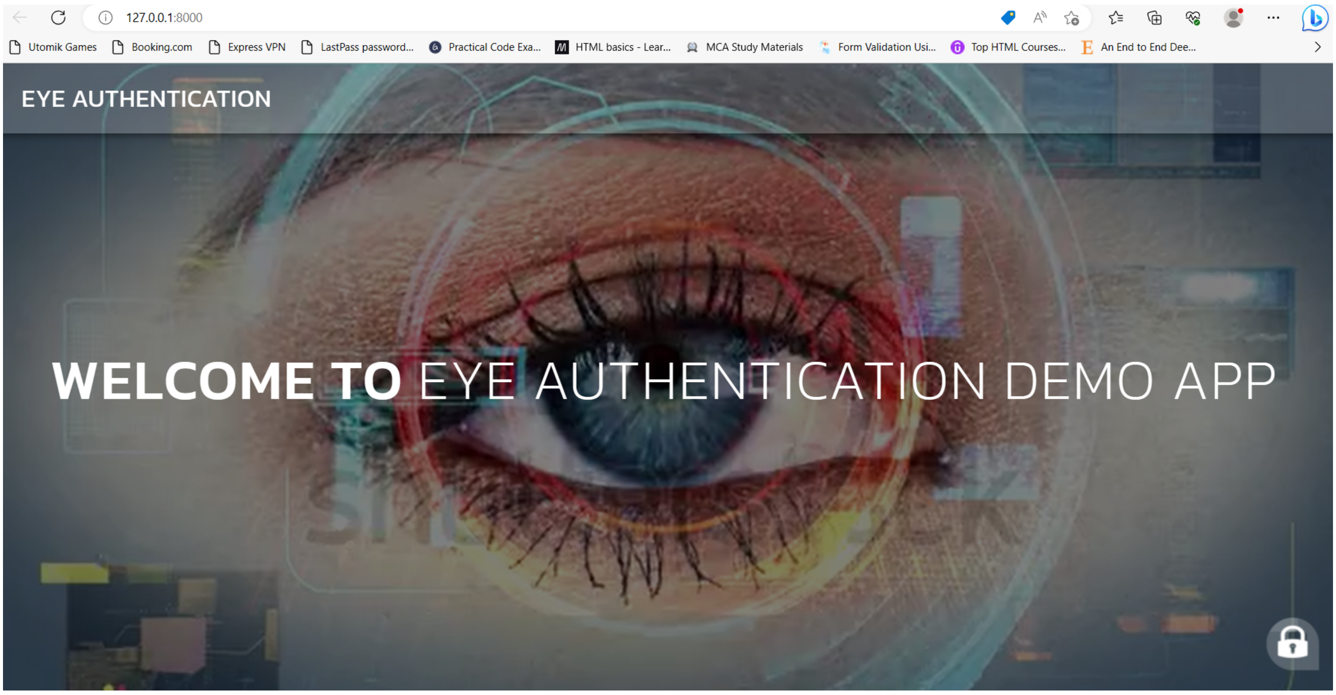

Figure A.1: Home Page

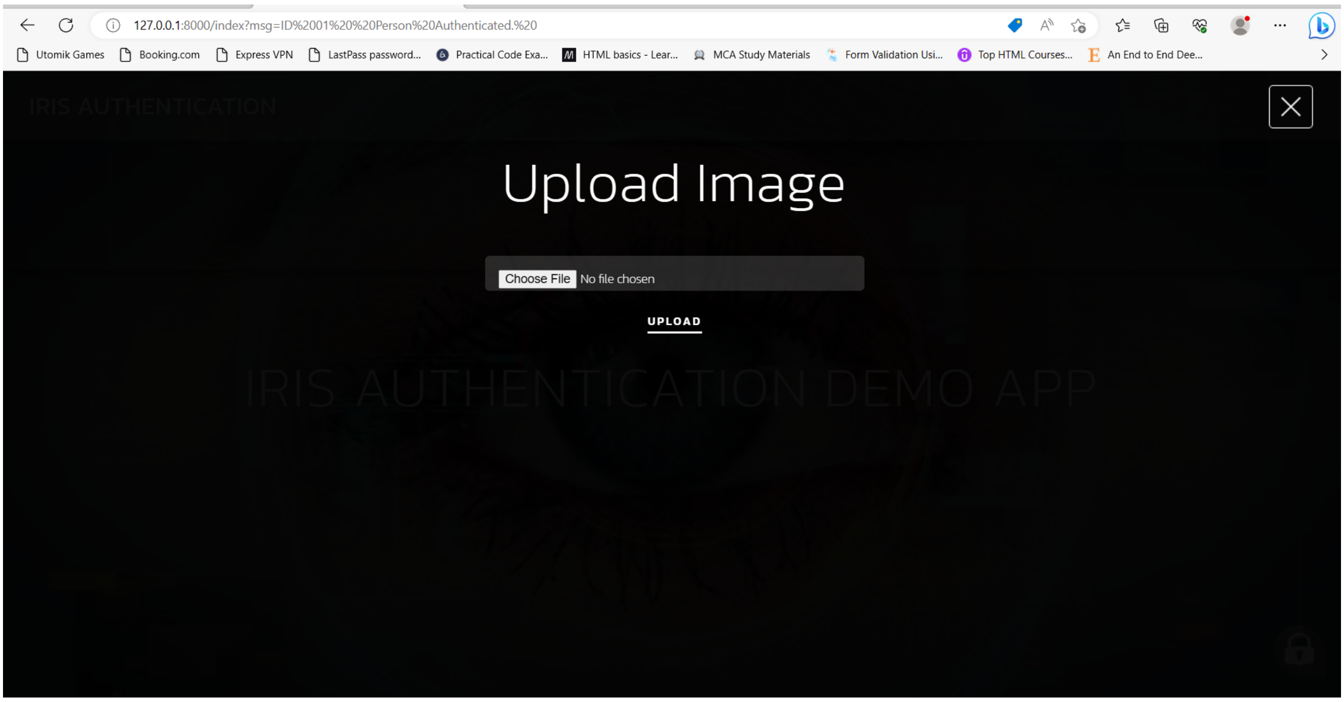

Figure A.2: Upload Image page

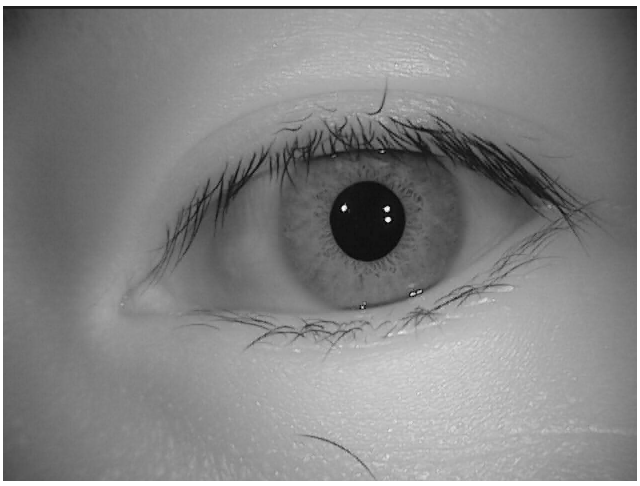

Figure A.3: Image to upload

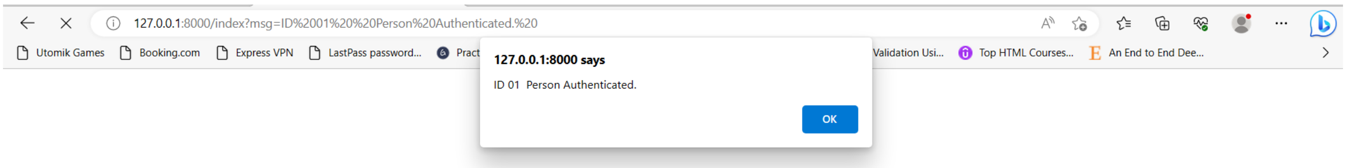

Figure A.4: Authentication Result

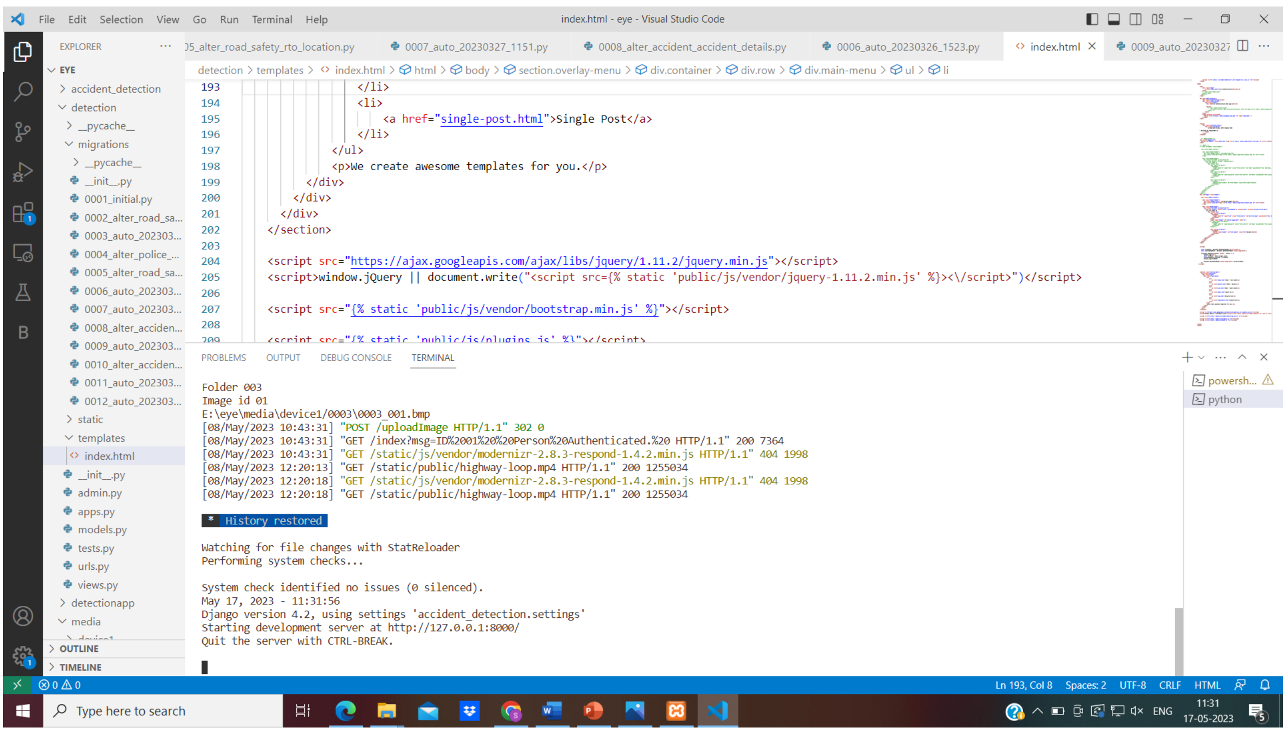

Figure A.5: VS code

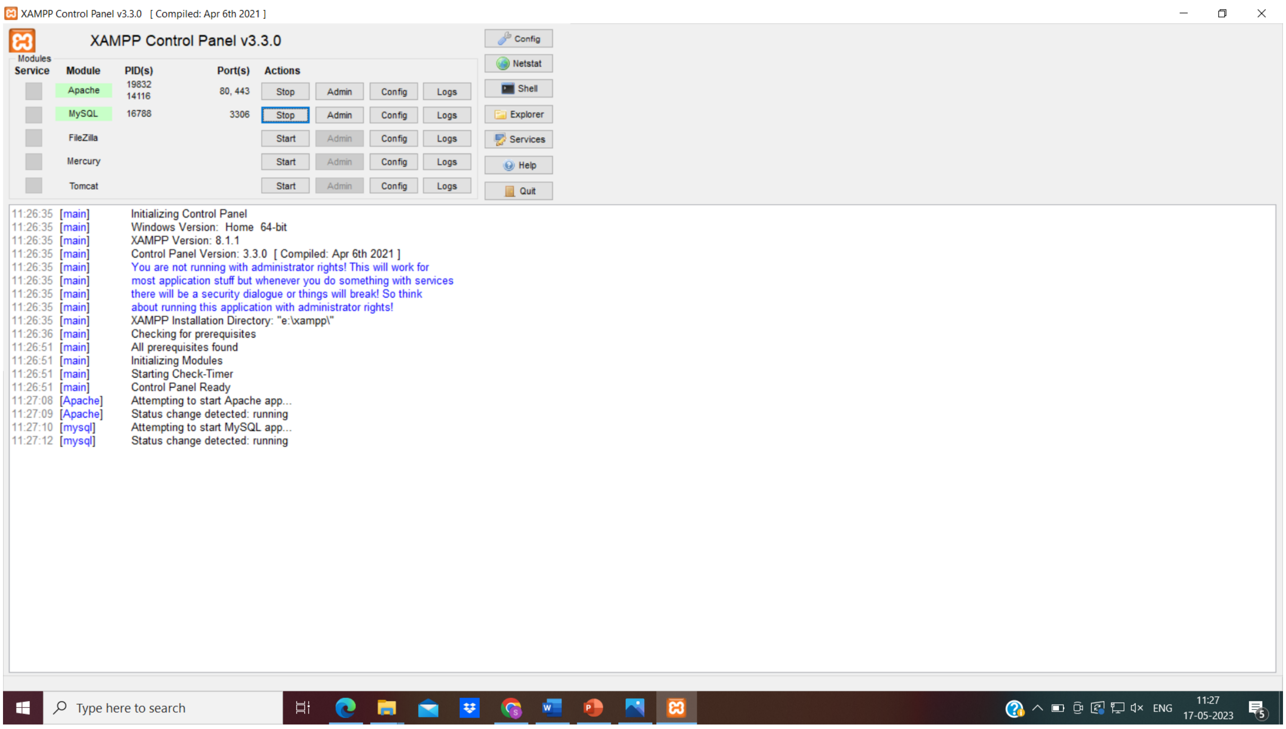

Figure A.6: XAMPP