IJIRMET ISSN (Online): 2456-0448
International Journal Of Innovative Research In Management, Engineering And Technology
Vol. 10, Issue 3, March 2025

Diabetic Retinopathy Disease Deduction Using Resnet-50 Algorithm

[1] Dr.D.Anitha, [2]Ms .J.Navadharshini, [3] Ms.S.K.Phaviyasri, [4] Ms.B.Saisaranya, [5]Ms.K.Babyka
[1] Associate Professor, [2] [3] [4] [5] Students,Department of Information Technology, Muthayammal Engineering College (Autonomous),Rasipuram 637408,TamilNadu,India

1assvanitha@gmail.com,2navadharshinij@gmail.com,3phaviyasri@gmail.com,4bsaisaranya2003@gmail.com,5babyka.k.it@gmail.com

Abstract: ***Diabetic retinopathy (DR) produces bleeding, exudation, and new blood vessel formation conditions. DR can damage the retinal blood vessels and cause vision loss or even blindness. If DR is detected early, ophthalmologists can use lasers to create tiny burns around the retinal tears to inhibit bleeding and prevent the formation of new blood vessels, in order to prevent deterioration of the disease. The rapid improvement of deep learning has made image recognition an effective technology; it can avoid misjudgments caused by different doctors' evaluations and help doctors to predict the condition quickly. The aim of this paper is to adopt visualization and preprocessing in the ResNet-50 model to improve module calibration, to enable the model to predict DR accurately.***

Keyword : Deep Learning, ResNet – 50 , Visualization

I. INTRODUCTION

Diabetic Retinopathy (Dr) Is A Progressive Eye Disease Caused By Damage To The Blood Vessels In The Retina Due To Prolonged Diabetes. It Is One Of The Primary Causes Of Blindness Worldwide. Traditional Dr Diagnosis Requires Ophthalmologists To Manually Inspect Retinal Images, Which Is Time-Consuming And Prone To Human Error. Artificial Intelligence (Ai) And Deep Learning Techniques Have Shown Significant Potential In Automating Medical Image Analysis. This Study Investigates The Use Of Resnet-50, A Deep Convolutional Neural Network, To Classify Retinal Images Into Different Dr Severity Levels, Improving Diagnostic Efficiency And Accuracy.

The Increasing Prevalence Of Diabetes Has Led To A Rise In Dr Cases, Making Early Detection More Critical Than Ever. Conventional Methods Rely On Fluorescein Angiography And Optical Coherence Tomography (Oct), Which Require Specialized Equipment And Expert Interpretation. Automated Deep Learning Models Offer A Scalable Alternative, Enabling Faster And More Accessible Screenings In Remote Areas. This Research Aims To Bridge The Gap Between Traditional Dr Diagnosis And Ai-Powered Automation.

II. TECHNIQUES OF DIABETIC EYE DISEASE DETECTION

Diabetic Eye Detection:

The Diabetic Eye Is A Well-Protected Part Of The Eye, Although It Is Externally Visible, Whose Unique Self-Generated Pattern Remains Stable Throughout Adult Life. These Key Factors Make The Diabetic Eye Suitable As A Biometric For Identifying Individuals.

Image Processing Frameworks Can Be Used For Unique Feature And Pattern Extraction, Along With Converting It Into The Biometric Template From The Digital Image Of The Eye, Which Can Later Be Stored In The Database. This Biometric Template Contains A Physical-Mathematical Representation Of The Unique Information Stored In The Diabetic Eye And Allows Comparisons To Be Made Between Models.

When A Client Prefers To Be Distinguished And Identified By A Diabetic Eye Recognition System, The Following Steps

Take Place:

- The Image Of The Eye Needs To Be Acquired And Photographed (Image Acquisition).
- A Template Is Generated For The Diabetic Eye Region For Biometric Identification.
- This Template Is Compared With Other Templates Stored In A Database Until Either A Matching Model Is Found Or No Match Is Detected.
- If A Match Is Recognized, The Client Is Declared Identified And Acknowledged.

- If No Match Is Recognized, The Client Remains Unidentified And Anonymous.

Dataset Collection:

Retinal Fundus Images Were Obtained From Publicly Available Datasets Such As Aptos And Messidor. These Datasets Contain Images Labeled According To Dr Severity, Including No Dr, Mild, Moderate, Severe, And Proliferative Dr.

Preprocessing: Image Enhancement Techniques, Including Contrast Adjustment, Noise Reduction, And Normalization, Were Applied To Improve Feature Extraction. Data Augmentation Methods Such As Rotation, Flipping, And Brightness Adjustments Were Employed To Increase Dataset Variability And Enhance Model Robustness.

Model Training:

1. The Resnet-50 Model Was Pre-Trained On The Imagenet Dataset And Fine-Tuned Using The Dr Dataset.
2. A Softmax Classifier Was Added To Categorize Dr Severity Levels.
3. The Model Was Trained Using The Adam Optimizer With An Adaptive Learning Rate To Improve Convergence.
4. Early Stopping And Dropout Regularization Techniques Were Applied To Prevent Overfitting.

Evaluation Metrics:

The Model Performance Was Assessed Using:

Accuracy: Measures Overall Model Performance.
Precision & Recall: Evaluates Sensitivity And Specificity.
F1-Score: Balances Precision And Recall.
Confusion Matrix & Roc Curve: Provides A Visual Representation Of Classification Performance.

3.Advantages Of Diabetic Eye Detection:

The Major Challenge Here Is To Achieve High Performance On A Mobile Platform Because Of Limitation Of Space, Power, And Cost Of The System.

- Diabetic Eye Resnet50 Is A Densely Connected Fully Convolutional Network That Proceeds In The Feed-Forward Fashion With Dense Features For Better Performance.
- This Connectivity Enhances The Capability Of The Network And Enables The Feature Reuse For Better Performance
- Biometrics In Both Physiological And Behavioral Forms Are Delivering An Efficient Platform For Security Metrics.
- We Would Optimize The Network Further And Reduce The Number Of Layers To Make It Memory-Efficient For Mobile And Handheld Devices With Reduced Parameters And Multiplications

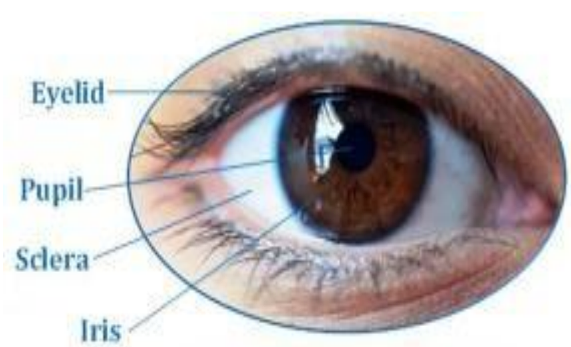

Fig: The Outer Structure Of Human Diabetic Eye

The Purpose Of This Project Will Be To Implement An Diabetic Eye Recogniton And Identification System Which Can Authenticate The Claimed Performance Of The Methodology. The Development Tool Used Will Be Python®, And Emphasis Will Be Only On The Software For Exhibiting Recognition, And Not Hardware For Capturing An Eye Image. Python® Provides An Excellent Rad(Rapid Application Development) Environment, With Its Image Processing Toolbox, And Highlevel Computing Techniques.

System Architecture:

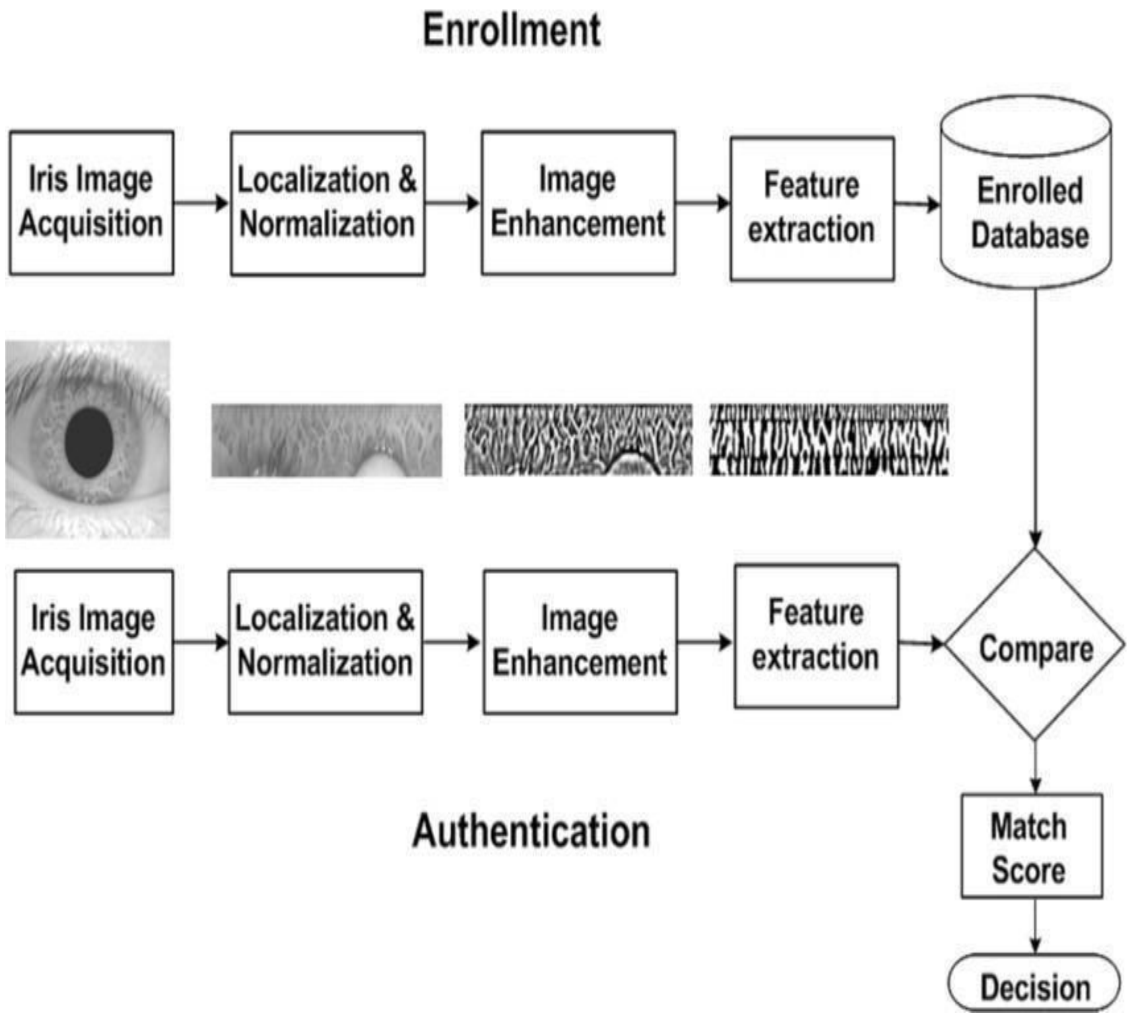

Fig 2.1 System Architecture

The System Architecture In The Image Represents A Biometric Iris Recognition System That Consists Of Two Main Phases: Enrollment And Authentication

1. Enrollment Phase (Storing Biometric Data)

This Phase Is Responsible For Capturing And Storing The Biometric Features Of An Individual For Future Authentication. The Steps Are:

Iris Image Acquisition: The System Captures An Image Of The Eye Using A Specialized Camera.

Localization & Normalization: The Iris Region Is Detected, Isolated, And Adjusted To A Standard Format To Compensate For Variations In Lighting, Distance, And Angle.

Image Enhancement: The Image Is Processed To Improve Quality, Removing Noise And Adjusting Contrast.

Feature Extraction: Unique Features Of The Iris (Such As Texture And Patterns) Are Extracted Using Algorithms.

Enrolled Database: The Extracted Features Are Stored In A Secure Database For Future Comparison.

2. Authentication Phase (Verification Of Identity)

In This Phase, A New Iris Image Is Compared With The Stored Data For Identity Verification. The Steps Are:

Iris Image Acquisition: A New Image Of The Eye Is Captured.

Localization & Normalization: The Iris Region Is Detected And Formatted Similarly To The Enrollment Phase.

Image Enhancement: The Image Is Processed To Improve Recognition Accuracy.

Feature Extraction: The System Extracts Key Features From The New Iris Image.

Comparison: The Extracted Features Are Compared Against The Stored Templates In The Database.
Match Score Calculation: The System Calculates A Match Score, Which Represents The Similarity Between The Input And Stored Data.
Decision: Based On The Match Score:
If A Match Is Found, The Identity Is Verified.
If No Match Is Found, Access Is Denied.

III. Proposed System:

Diabetic Retinopathy (Dr) Is A Leading Cause Of Blindness Among Adults, And Its Early Detection Is Essential For Preventing Irreversible Vision Loss. Manual Screening For Dr Is Time-Consuming, Requiring Highly Trained Professionals To Examine Retinal Images. Artificial Intelligence (Ai), Particularly Deep Learning (Dl) Models, Offers An Opportunity To Automate This Process, Enabling Faster And More Accurate Diagnosis.

Resnet-50 (Residual Network With 50 Layers) Is One Of The Most Successful Deep Learning Architectures Used For Image Classification Tasks. Its Deep Residual Structure Helps In Mitigating The Vanishing Gradient Problem, Making It Well-Suited For Training On Large-Scale Image Datasets Like Those Used For Dr Detection.

IV. RESULTS AND DISCUSSION:

The Resnet-50 Model Achieved High Accuracy In Dr Classification Compared To Traditional Diagnostic Approaches. The Confusion Matrix Analysis Showed Significant Improvement In Distinguishing Between Dr Severity Levels. Data Augmentation Techniques Helped Address Class Imbalance Issues. The Model's Performance Was Evaluated Across Multiple Test Sets, With An Emphasis On Its Generalization Capabilities. Comparative Studies With Other Architectures Confirmed The Effectiveness Of Resnet-50 In Medical Image Classification.
Despite Its Strong Performance, Some Challenges Remain. False Positives Were Observed In Cases Where Retinal Abnormalities Mimicked Dr Lesions. Additionally, Limited Dataset Diversity Impacted Model Generalization. Future Enhancements Include Integrating Explainable Ai (Xai) Techniques To Improve Model Interpretability And Confidence Estimation.

V. CONCLUSION:

This Study Proposed Two Approaches To Designing The Dr Grading System: A Standard Operation Procedure (Sop) For Preprocessing The Fundus Image, And A Revised Structure Of Resnet-50, Including An Adaptive Learning Rating To Adjust The Weight Of Layers, Regularization And Change The Structure Of Resnet-50, Which Was Selected For Its Suitable Features. It Is Worth Noting That The Purpose Of This Study Was Not To Design The Most Accurate Dr Screening Network, But To Demonstrate The Effect Of The Sop Of Dr And The Visualization Of The Revised Resnet-50 Model. The Results Provided An Insight To Revise The Structure Of Cnns Using The Visualization Tool.

References:

[1] Heath Grades, "Eye Cancer", Available: Http://Www.Healthgrades.Com/Conditions/Eye-Cancer.

[2] Richard D Grutzmacher, Thomas D Lindquist, Mark E Chittum, Ann H Bunt-Milam, And Robert E Kalina," Congenital Diabetic Eye Cysts". British Journal Of Ophthalmology, 1987, 71, P.P. 227-234h.

[3] Cancer Research Uk, Available: Http://Www.Cancerresearchuk.Org/About-Cancer/Type/Eyecancer/About/Types-Of-Eye-Cancer#Mel

[4] The Eye Cancer Foundation Eye Cancer Network Education And Support For Eye Diseases Patients And Their Families, Available: Http://Www.Eyecancer.Com/Conditions/34/Diabeticeyemelanoma

[5] Milesresearch,Available:Http://Www.Milesresearch.Com/Main/Links.Htm.

[6] Digital Image Processing, Available: Http://Www.Tutorialspoint.Com/Dip/Grayscale_To_Rgb_Conversio N.Html.

[7] James Church, Dr. Yixin Chen, And Dr. Stephen Rice, "A Spatial Median Filter For Noise Removal In Digital Images". Southeastcon, 2008. Ieee, P.P.618 – 623.