



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 2, February 2025

An Effective Method of Diabetic Retinopathy Diagnosis to Mitigate Blindness Risk

K.Yoka Muthu Nivethitha, X.M.Binisha, S.I.Padma, Dr.R.S.Ganesh

PG Student, Department of ECE, PET Engineering College, Vallioor, Tamil Nadu, India

Assistant Professor, Department of ECE, PET Engineering College, Vallioor, Tamil Nadu, India

Associate Professor, Department of ECE, PET Engineering College, Vallioor, Tamil Nadu, India

Associate Professor, Department of ECE, PET Engineering College, Vallioor, Tamil Nadu, India

ABSTRACT: This project proposes an effective method of diabetic retinopathy diagnosis to mitigate blindness risk. The proposed method begins with the input of retinal images, which undergo preprocessing using an adaptive Gaussian filter to enhance image quality and reduce noise. Subsequently, K-means segmentation is employed to isolate regions of interest, facilitating more accurate feature extraction. The Multiscale Gray Level Co-occurrence Matrix (GLCM) technique is then utilized for feature extraction, capturing intricate patterns within the segmented images. Finally, the extracted features are classified using the Attention-DCNN model, which emphasizes critical areas in the images, improving prediction accuracy. This project is implemented by using python language.

KEYWORDS: Diabetic retinopathy; Blindness risk; k-means;GLCM.

I. INTRODUCTION

Python is a high-level, interpreted programming language known for its simplicity, readability, and versatility. Created by Guido van Rossum and first released in 1991, Python emphasizes code readability with its clean syntax, which uses indentation to define code blocks. This design philosophy makes it easy to learn and use, even for beginners. Python supports multiple programming paradigms, including object-oriented, procedural, and functional programming, making it suitable for a wide range of applications. One of Python's standout features is its extensive standard library, which provides modules and functions for handling file I/O, data manipulation, mathematics, web development, and more. Additionally, Python has a vibrant ecosystem of third-party libraries, such as NumPy, pandas, TensorFlow, and Flask, which extend its capabilities to areas like scientific computing, machine learning, and web development. Python is platform-independent, meaning code written in Python can run on various operating systems without modification, provided the necessary interpreter is installed.

Its dynamic typing and garbage collection mechanisms streamline development by reducing the need for manual memory management. Python is widely used in industries such as web development, data analysis, artificial intelligence, automation, and game development. Its simplicity and power have made it a favorite in education, as it's often the first language taught in programming courses. Python's open-source nature allows developers to contribute to its development, ensuring that it evolves to meet the changing needs of the programming community. Python's interactive interpreter and built-in support for scripting enable rapid prototyping and iterative development. This feature, combined with its support for testing and debugging, enhances productivity. Despite its simplicity, Python is highly powerful and can handle complex applications, from small scripts to large enterprise systems. Python's ease of use, flexibility, and vast library support make it a go-to language for developers, researchers, and educators worldwide. Its community-driven growth ensures it remains at the forefront of technological innovation.

II. DIABETIC RETINOPATHY DETECTION

Diabetic retinopathy (DR) is a leading cause of blindness worldwide, particularly among individuals with diabetes. As the prevalence of diabetes continues to rise, the urgency for effective screening and early diagnosis of DR has never been more critical. The disease often progresses without noticeable symptoms until significant vision loss occurs, making regular eye examinations essential for at-risk populations. Unfortunately, access to trained ophthalmologists and advanced diagnostic tools is limited, especially in rural and underserved areas. To overcome these issues, this

project proposes revolutionizing diabetic retinopathy diagnosis through attention-DCNN for blindness prevention. This work highlights the need for innovative solutions that enhance the efficiency and accuracy of DR detection. Leveraging advancements in technology, particularly artificial intelligence, offers promising avenues for transforming how diabetic retinopathy is diagnosed. By integrating intelligent systems into routine eye care to facilitate timely interventions that are crucial for preventing vision impairment. The implementation of such systems not only aids in early detection but also alleviates the burden on healthcare resources. As it explores the potential of these technologies, it is essential to consider their impact on patient outcomes and overall public health. This process shift towards automated screening represents a significant step forward in combating the threat of blindness associated with diabetic retinopathy.

III. PROPOSED METHODOLOGY

Robust Diabetic Retinopathy Classification using approximate Bayesian neural networks (BNNs) & Uncertainty estimated using expected conditional risk based QWK-Risk uncertainty measure. In this work classifying a Wide Range of Diabetic Retinopathy Images based on a Lightweight Robust Deep Learning Model. This process introduces a novel approach called Data Preprocessing for the real-time diagnosis of Retinal Disease within a hospital environment. The “PRE U-net” is introduced as a novel approach for a fully automated fovea centralizes detection, addressing the localization as a pixel-wise regression task. In this method to detect diabetic retinopathy using a convolutional neural network (CNN) model and Inceptionv3 and Resnet50 are used for the feature extraction of diabetic fundus images. This paper proposes a hybrid retinal image enhancement algorithm for diabetic retinopathy diagnostic using deep learning model for early detection of DR. The methodology used in this process deep learning algorithms, particularly Convolutional Neural Networks (CNNs). This process introduces the optimal values for the contrast enhancement of retinal fundus images using intelligent evolution algorithms. The methodology used in this process involves the development of an engineering platform that integrates both hardware and software utilities. The proposed SPORG-RBVS technique involves different stages of pre-processing such as grayscale conversion. Reliable and Energy-Efficient Diabetic Retinopathy Screening Using Memristor-Based Neural Networks & pseudo-binary classification technique for classification. In this work using an Transformer Model with Multiple Instance Learning (TMIL) is proposed for DR classification on high-resolution fundus retinal images.

IV. SIMULATION RESULTS

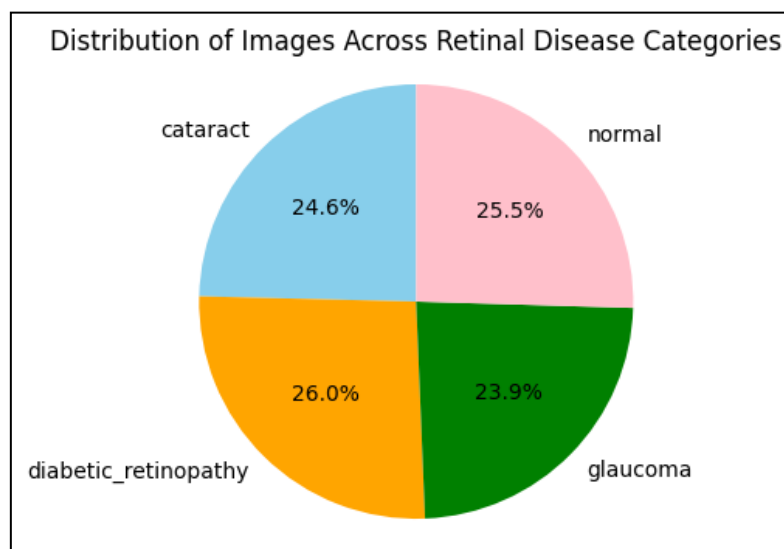


Fig 1 Distribution of images across Retinal Disease Categories

Figure 1 represent that the distribution of images across different retinal disease categories. The largest category is normal eyes, accounting for 25.5% of the images. Cataract is the second largest category at 24.6%, followed by diabetic retinopathy at 26.0% and glaucoma at 23.9%. This indicates that the dataset covers a range of common retinal conditions, with a relatively even distribution across the major disease types.

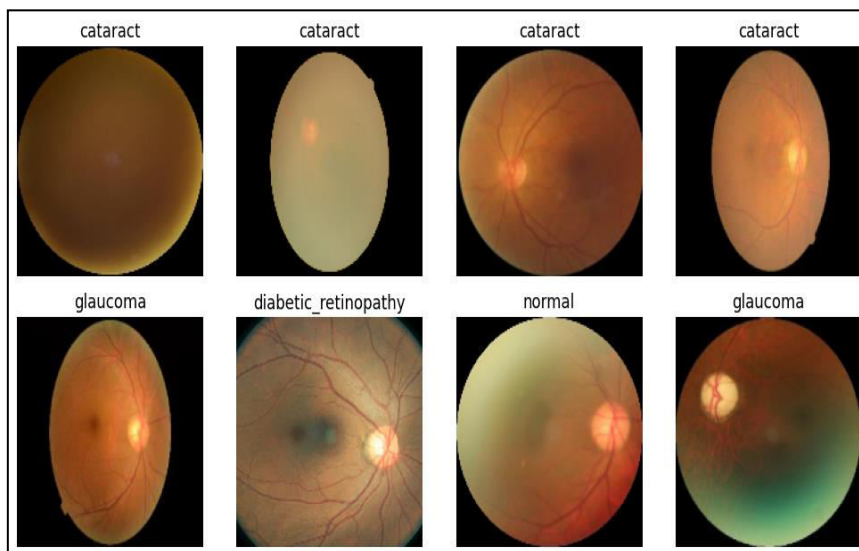


Fig 2 Input Dataset

Figure 2 illustrates that Input Dataset. The image shows a collection of retinal images representing different eye conditions. There are four images for each of the four categories: cataract, glaucoma, diabetic retinopathy, and normal. The retinal images vary in appearance, with differences in color, texture, and the presence of abnormalities depending on the specific eye condition.

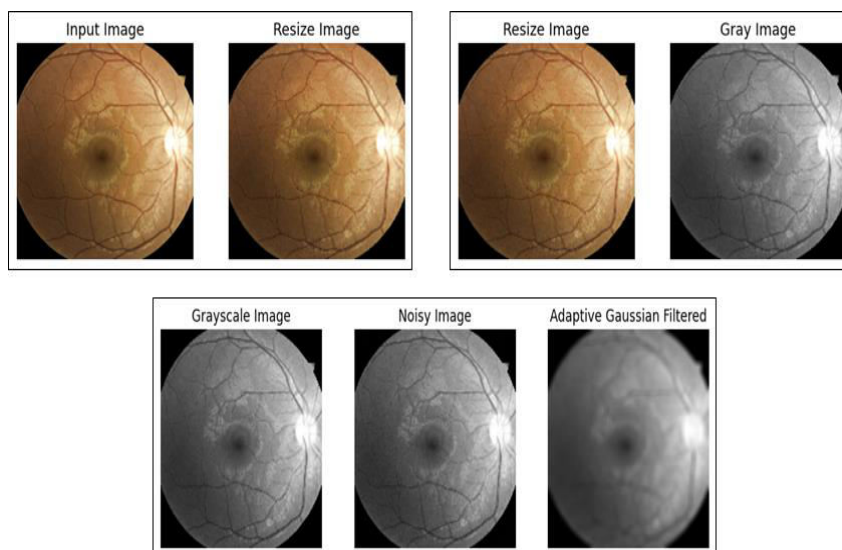


Fig 3 Preprocessing

Figure 3 represents that preprocessing. The input image is resized, converted to grayscale, and then processed with a noisy filter and an adaptive Gaussian filter. The resulting images demonstrate how different image processing techniques can affect the appearance and quality of the retinal image, which could be relevant for tasks such as image enhancement or segmentation.

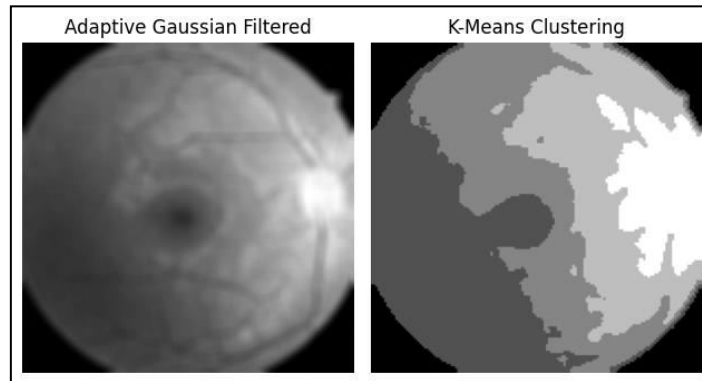


Fig 4 Segmentation

Figure 4 shows that the image on the left shows a retinal image that has been processed using an adaptive Gaussian filter, which can help enhance features and reduce noise. The image on the right demonstrates the application of K-Means clustering, a common unsupervised machine learning technique, to the retinal image data. This clustering approach could be used to group similar retinal patterns or identify distinct regions of interest within the image.

Multiscale GLCM Properties:

Contrast:

```
[[0. 0. 0. 0.]  
 [0. 0. 0. 0.]  
 [0. 0. 0. 0.]]
```

Correlation:

```
[[1. 1. 1. 1.]  
 [1. 1. 1. 1.]  
 [1. 1. 1. 1.]]
```

Energy:

```
[[1. 1. 1. 1.]  
 [1. 1. 1. 1.]  
 [1. 1. 1. 1.]]
```

Homogeneity:

```
[[1. 1. 1. 1.]  
 [1. 1. 1. 1.]  
 [1. 1. 1. 1.]]
```

Fig 5 Feature extraction

Figure 5 illustrates that the image displays a table of multiscale GLCM (Gray-Level Co-occurrence Matrix) properties, including Contrast, Correlation, Energy, and Homogeneity, for a set of retinal images. These GLCM properties are commonly used in image analysis and feature extraction tasks, such as texture analysis, which could be relevant for automated detection or classification of retinal conditions.

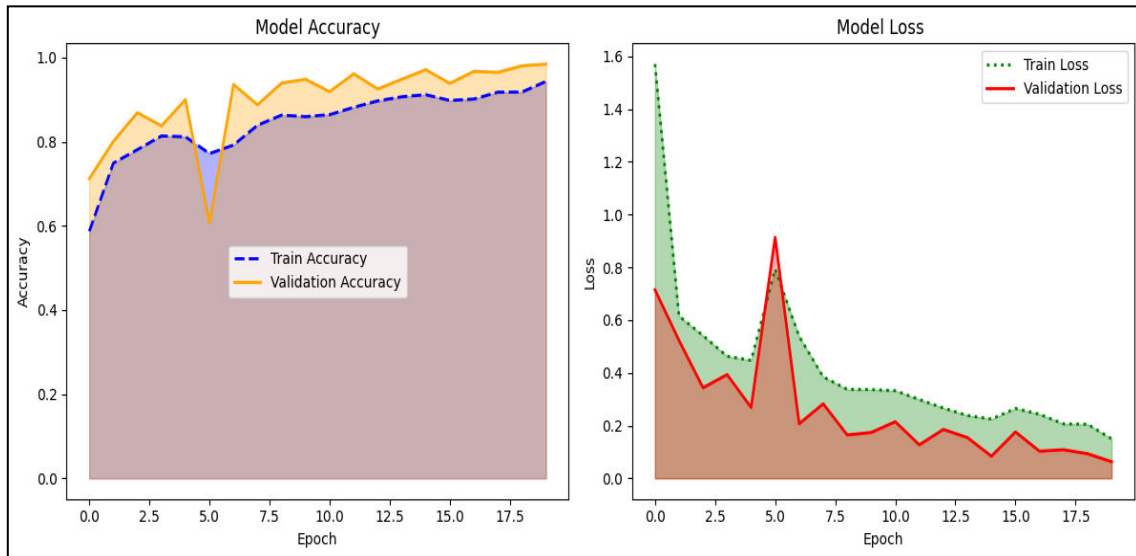


Fig 6 Model Accuracy and Model Loss

Figure 6 shows that the image shows the model accuracy and loss during the training and validation process over multiple epochs. The accuracy plot indicates that the model achieves high and stable training and validation accuracy as the training progresses. The loss plot shows a decreasing trend for both the training and validation loss, suggesting the model is learning effectively and avoiding overfitting.

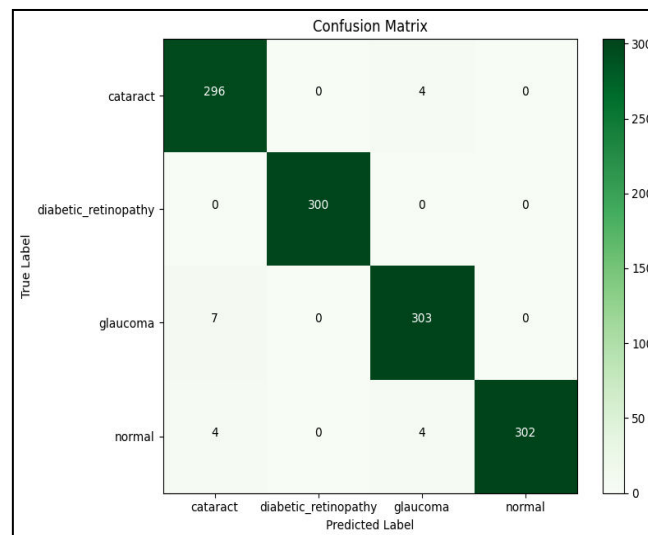


Fig 7 Confusion matrix

Figure 7 shows a confusion matrix, which is a table that summarizes the performance of a classification model. The rows represent the true labels, while the columns represent the predicted labels. The values in the cells indicate the number of instances classified into each category. This confusion matrix provides a detailed breakdown of the model's performance across the different retinal disease categories, which can be used to identify areas for improvement or further investigation.

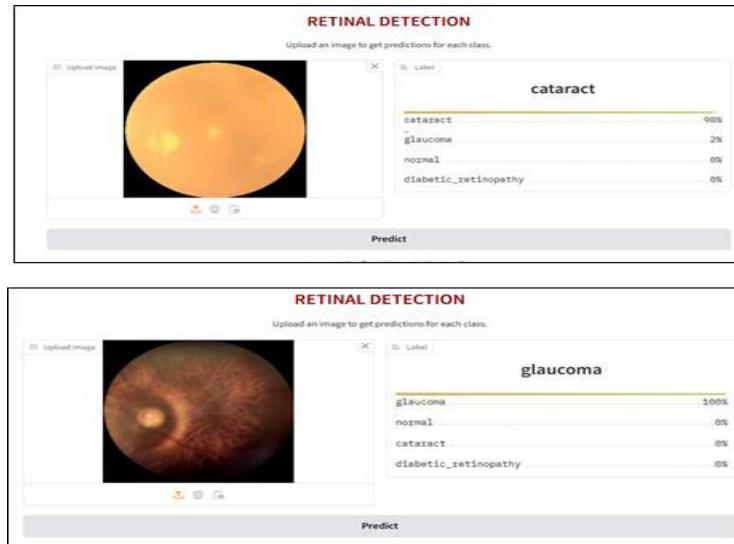


Fig 8 Predicted Output

Figure 8 predicted the image shows a web-based tool for retinal disease detection. It allows users to upload retinal images and presents the model's predictions for different eye conditions, such as cataract and glaucoma. The tool displays the input image along with the predicted disease labels and their corresponding probabilities.

V. CONCLUSION

The proposed Attention-DCNN-based framework for diabetic retinopathy diagnosis represents a significant advancement in medical imaging analysis and blindness prevention. By integrating advanced preprocessing techniques like adaptive Gaussian filtering and K-means segmentation, the method ensures optimal image quality and precise region isolation. The use of Multiscale GLCM further enhances feature extraction, capturing critical details necessary for accurate diagnosis. The incorporation of the Attention-DCNN model enables the system to focus on crucial areas within the retinal images, improving classification accuracy and reducing diagnostic errors. The proposed method not only offers a robust solution for early detection but also provides a reliable tool. Experimental results validate the system's efficacy, showcasing superior detection rates and enhanced classification performance over traditional approaches. Implemented in Python, this comprehensive framework demonstrates the potential for real-world application, contributing to improved healthcare outcomes and the prevention of vision loss.

REFERENCES

1. M. D. Alahmadi, "Texture Attention Network for Diabetic Retinopathy Classification," in IEEE Access, vol. 10, pp. 55522-55532, 2022.
2. S. Ghouali et al., "Artificial Intelligence-Based Teleophthalmology Application for Diagnosis of Diabetics Retinopathy," in IEEE Open Journal of Engineering in Medicine and Biology, vol. 3, pp. 124-133, 2022.
3. H. Mustafa, S. F. Ali, M. Bilal and M. S. Hanif, "Multi-Stream Deep Neural Network for Diabetic Retinopathy Severity Classification Under a Boosting Framework," in IEEE Access, vol. 10, pp. 113172-113183, 2022.
4. J. Hu, H. Wang, L. Wang and Y. Lu, "Graph Adversarial Transfer Learning for Diabetic Retinopathy Classification," in IEEE Access, vol. 10, pp. 119071-119083, 2022.
5. J. Jaskari et al., "Uncertainty-Aware Deep Learning Methods for Robust Diabetic Retinopathy Classification," in IEEE Access, vol. 10, pp. 76669-76681, 2022.
6. S. H. Abbood, H. N. A. Hamed, M. S. M. Rahim, A. Rehman, T. Saba and S. A. Bahaj, "Hybrid Retinal Image Enhancement Algorithm for Diabetic Retinopathy Diagnostic Using Deep Learning Model," in IEEE Access, vol. 10, pp. 73079-73086, 2022.

7. B. N. Jagadesh, M. G. Karthik, D. Siri, S. K. K. Shareef, S. V. Mantena and R. Vatambeti, "Segmentation Using the IC2T Model and Classification of Diabetic Retinopathy Using the Rock Hyrax Swarm-Based Coordination Attention Mechanism," in IEEE Access, vol. 11, pp. 124441-124458, 2023.
8. W. Nazih, A. O. Aseeri, O. Y. Atallah and S. El-Sappagh, "Vision Transformer Model for Predicting the Severity of Diabetic Retinopathy in Fundus Photography-Based Retina Images," in IEEE Access, vol. 11, pp. 117546-117561, 2023.
9. W. K. Wong, F. H. Juwono and C. Apriono, "Diabetic Retinopathy Detection and Grading: A Transfer Learning Approach Using Simultaneous Parameter Optimization and Feature-Weighted ECOC Ensemble," in IEEE Access, vol. 11, pp. 83004-83016, 2023.
10. H. Naz et al., "Ensembled Deep Convolutional Generative Adversarial Network for Grading Imbalanced Diabetic Retinopathy Recognition," in IEEE Access, vol. 11, pp. 120554-120568, 2023.



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