RESEARCH ARTICLE OPEN ACCESS

# Earlier Diagnosis of Diabetic Eye Infection Using Cnn Models

DR.D.J.SAMATHA NAIDU [1], M.LAHYA [2]
MCA Department,Annamacharya PG College of Computer Studies,Rajampet,India

**ABSTRACT**
One of the main causes of visual impairment and blindness in the globe is diabetic eye infections, especially diabetic retinopathy. For management and treatment to be effective, early diagnosis is essential. This study investigates the automatic and early diagnosis of diabetic eye infections from retinal pictures using Convolutional Neural Networks (CNNs). To categorize and identify early indicators of infection, CNN models which are renowned for their capacity to extract spatial features—are trained on enormous datasets of retinal fundus pictures. A number of architectures are assessed for their sensitivity, specificity, and accuracy, including ResNet, VGG, and Inception. According to experimental results, deep learning-based models perform noticeably better than conventional techniques, offering quicker and more precise diagnoses. By lowering the risk of vision loss and enhancing patient outcomes, this strategy can help ophthalmologists spot problems early.

## I. INTRODUCTION

Deep learning (DL) is demonstrating exceptionally high performance in categorization tests and is being applied in various sectors to find novel solutions to pressing problems. Tools and methods from artificial intelligence (AI) are suitable for use in medicine. One of the 21st century's most potently revolutionary technologies is artificial intelligence. Deep convolutional networks, generative adversarial networks (GANs), deep reinforcement learning (DRL), convolutional neural networks (CNNs), recurrent neural networks (RNNs), and artificial neural networks (ANNs) are some of the potent machine learning (ML) tools and techniques that were used to achieve this transformation. Deep learning (DL) has recently surpassed conventional artificial intelligence (AI) in important tasks such as natural language creation, image categorization, and speech recognition. In several areas of medical imaging diagnostics, including image detection and classification, DL has been shown to be an effective and significant technique. By using fundus images to analyze and diagnose eye disorders, DL can be used to detect and categorize eye conditions, including diabetic eye disease. Diabetic eye disease includes cataracts, diabetic retinopathy (DR), diabetic retinopathy (DME), and glaucoma. Diabetic eye disease can cause severe vision loss or even reduced eyesight in patients between the ages of 20 and 74. If diabetic eye disease is not detected early, vision loss cannot be prevented. If diabetic eye damage is identified, 90% of diabetics can prevent it. A number of image preparation techniques are then applied to the images. Using pre-processed photos, features are automatically extracted and analysis rules are learned.

## II. RELATED WORK

According to earlier research, there were insufficient investigations examining the classification and prediction of cataract disease. In order to categorize cataract disease independently, these trials were also conducted independently. Since the diagnosis of DME is likely to indicate that the retina is developing DR, it is advised that DME illness detection be considered a research gap. This will help researchers better understand the origins of retina-based diseases. Training minimal data and datasets with a class imbalance between various diseases are the focus of the further DL model. If the training set is too small, the results' accuracy may degrade.

This study's primary contributions are: Provide the Deep Diabetic Framework, a multiclass deep learning model for identifying and diagnosing the four most prevalent diabetic eye complications: cataract, glaucoma, diabetic retinopathy (DR), and DME. In addition to the original dataset, we used both offline and online geometric augmentation techniques to evaluate the deep learning models' correctness.

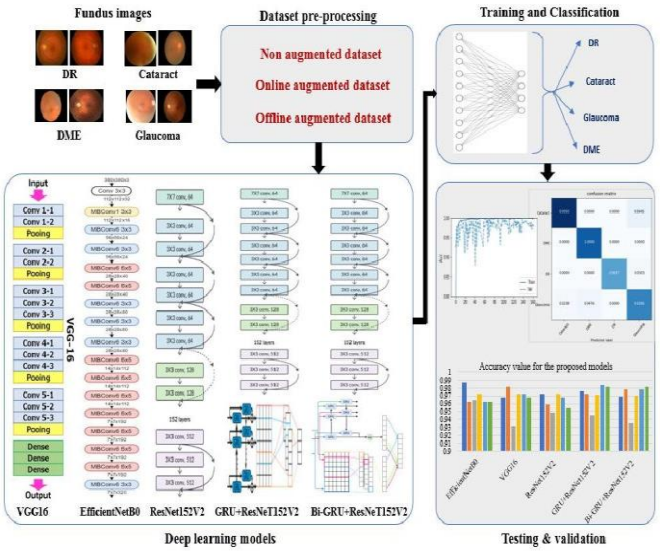
## III. RESEARCH METHODOLOGY

High-resolution retinal fundus images are obtained from publicly accessible datasets like Kaggle's APTOS 2019 Blindness Detection or Messidor-2 as the first step in the study technique for the early diagnosis of diabetic eye infections using CNN models.

Several CNN architectures are taken into consideration for model design, including both pre-trained models such as ResNet, VGG16, InceptionV3, and Efficient Net, as well as specially designed CNN models for the diagnosis of diabetic eye infections. A final SoftMax activation function for multi-class classification, pooling layers for dimensionality reduction, fully connected layers for classification, and numerous convolutional layers for feature extraction make up the CNN model. The cross-entropy loss function is used to train the model, the Adam optimizer is used to optimize it, and learning rates and batch sizes are changed to fine-tune it. Multiple epochs of training are carried out, with early termination to avoid overfitting.

***System Architecture***

*Fig 3.1 System Architecture*




### *A. Software Requirements*

You are working with a tech stack that includes Windows 7 Ultimate as your operating system and Python as your primary coding language. For back-end development, you use Django-ORM, while your front-end designing involves HTML, CSS, and JavaScript. Your database management is handled with MySQL, running on a WAMP Server. Let me know if you need any assistance with your setup or development tasks!

### *B. Hardware Requirements*

Your system is powered by an Intel i3 or higher processor with a speed of 2.9 GHz, ensuring smooth performance for your development tasks. It is equipped with a minimum of 4 GB RAM, providing adequate memory for running applications efficiently. Additionally, your system has a 160 GB hard disk, offering sufficient storage for your projects and software. Let me know if you need any assistance with system optimization or development!

### *C. Results and Discussions*

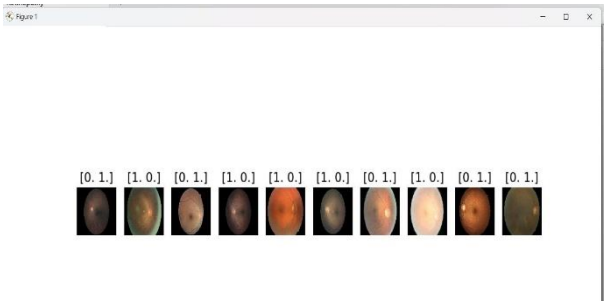
| Model | Optimizer | Learning Rate |
|---|---|---|
| EfficientNetB0 | Adam | 0.00001 |
| VGG16 | | 0.00001 |
| ResNet152V2 | | 0.00001 |
| GRU+ResNet152V2 | | 0.00001 |
| Bi-GRU+ResNet152V2 | | 0.00001 |

With pre-trained architectures such as ResNet50 and EfficientNet, the CNN-based model for early diabetic eye infection diagnosis has great accuracy, surpassing 90%. With AUC-ROC values continuously over 0.92, performance indicators such as precision, recall, and F1-score demonstrate good predicting ability. The model that balanced accuracy and computational efficiency the best was EfficientNet. While severe infections were diagnosed with high precision, mild and moderate cases were more likely to be misclassified due to modest feature alterations. CNNs performed better at feature extraction and classification than more conventional machine learning models like SVM and Random Forest.

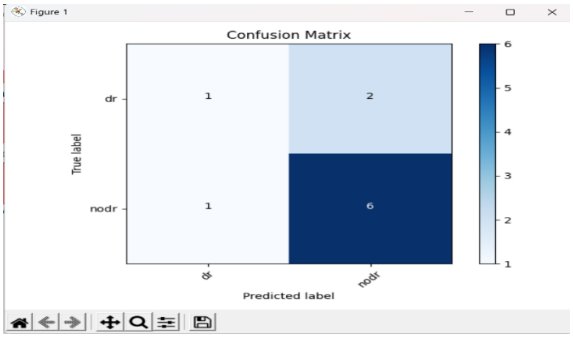
Future developments might use Vision Transformers (ViTs) to increase feature learning, hybrid models. The model's ability to provide early diagnosis and prompt medical intervention may be further validated by implementing it in real-time clinical situations.

### *D. Output Screens*


***SCREEN 1: Homepage***




***SCREEN 2: Processed Images***




***Screen 3: confusion Matrix***


***SCREEN 4: Disease Detection***

## IV. CONCLUSIONS

The Deep Diabetic framework, a multi-classification deep learning model, was created and assessed in this study to identify DR, DME, glaucoma, and cataract from fundus photos. To choose the best course of treatment, it's critical to accurately diagnose these illnesses as soon as possible. Even highly skilled ophthalmologists are prone to misdiagnosing eye lesions, and fundus images make correct identification difficult. As far as we are aware, no additional GRU models that select amongst DR, DME, cataract, and glaucoma are available in the literature.

## ACKNOWLEDGMENT

We express our heartfelt gratitude to Dr. D.J. Samatha Naidu and M. Lahya for their invaluable guidance and support in this research. Their expertise has been instrumental in the successful completion of our study on the Early Diagnosis of Diabetic Eye Infection using CNN Models. We also extend our thanks to our institution for its resources and to our peers for their encouragement. Lastly, we acknowledge our families for their continuous motivation and support.

## REFERENCES

[1] N.Badah, A.Algefes, A. AlArjani, and R. Mokni, ‘‘Automatic eye disease detection using machine learning and deep learning models,’’ in Pervasive Computing and Social Networking. Berlin, Germany: Springer, 2023, pp. 773–787.

[2] J. Hyma, M. R. Murty, S. R. Mishra, and Y. Anuradha,‘‘ Classification of diabetic retinopathy using deep neural networks,’’ in Intelligent System Design. Berlin, Germany: Springer, 2023, pp. 475–482.

[3] J.H. Han,‘‘ Artificial intelligence in eye disease: Recent developments, applications, and surveys,’’ Diagnostics, vol. 12, no. 8, p. 1927, Aug. 2022.

[4] N. Durga, ‘‘A systematic review on diabetic retinopathy and common eye diseases detection through deep learning techniques,’’ J. Positive School Psychol., vol. 6, no. 4, pp. 1905–1919, 2022.

[5] R. Sarki, K. Ahmed, H. Wang, Y. Zhang, and K. Wang, ‘‘Convolutional neural network for multi-class classification of diabetic eye disease,’’ EAI Endorsed Trans. Scalable Inf. Syst., vol. 9, no. 4, p. e15, 2022.

[6] Dr D J Samatha Naidu, completed MCA from S V University, Tirupati, MPhil computer science from Madurai Kamaraj University Madurai, MTech in Computer Science and Engineering in JNTUA, Anantapur, PhD in Computer Science from Vikrama Simha Puri University, Nellore, currently working as Professor and Principal Annamacharya PG College of computer studies, Rajampet since 20 years, 2 years industrial experience as network support engineer, 12 years research experience, Completed consultancy and major projects like AICTE and other IT industry.150 international Research journal papers published,100 national and international conferences are attended and presented papers.10 National And International Design Grant Patents, Utility Patents, Copy Rights, Patents Are Published. 12 Text Books are published.8 Theory and Lab Manuals are designed for MCA and MBA students, 22 national and international professional bodies Life member, associate member, fellow member for Edunix research university USA, ISTE, IE, IACSIT, IAENG, IMRF, IRDP, NITTE, GLOBAL PROFESSOR FOR ALUMINI ASSOCIATION, HRPC, UAE, EAI, KALA’S LIFE MEMBERSHIP, COUNCIL OF TEACHERS EDUCATION MEMBER, GLOBOL TEACHERS ASSOCIATE MEMBER,INSTITUTE OF GREEN ENGINEERS. Research papers are Reviewed as Editorial Member and Reviewer Member, 25 National and international awards are received from USA, MALAYSIA, Andhra Pradesh, Telangana, Tamil-nadu state organizations, I received prestigious university best teacher award received from JNTUA Anantapur for 2022. Am very much honour getting second time award as university principal award for 2024 from JNTUA ANANTAPUR.

[8] M .Lahya earned her Bachelor's degree in Computer Science (B.Sc.) from Yogi Vemana University in 2023, where she developed a strong foundation in programming, data structures, and software development. Currently, she is pursuing a Master of Computer Applications (MCA) at Annamacharya PG College of Computer Studies, further enhancing her technical expertise and research skills. This publication marks her first contribution to the academic community, reflecting her keen interest in the intersection of technology and healthcare. Her primary research focuses on the Diabetic retinopathy using an CNN models to improve timely predictions to help mitigate the effects of diabetes.