IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, November 2026
Impact Factor: 8.2

Machine Learning-Based Detection of Diabetic Retinopathy in Female Patients Aged 30–50 Years

Shaikh Hafsa Munaf[1] and Kiran D. Tikar[2]
[2]Assistant Professor, Department of Computer Applications,
Sadhu Vaswani Institute of Management Studies for Girls, Pune, India
hafsa.shaikh@svims-pune.edu.in[1] ,kirantikar@svims-pune.edu.in[2]

Abstract : *Diabetic Retinopathy (DR) is an eye disease that can cause vision damage and blindness if it is not detected at initial stages. This study proposes a deep learning-based approach for predicting Diabetic Retinopathy from retinal fundus images, only focusing on female patients aged 30–50 years. The ODIR-5K dataset was used as the source of retinal images. After filtering the dataset according to gender and age a final dataset of 202 patients and 404 fundus images was considered, consisting of 103 DR patients and 99 No-DR patients. A deep learning model called EfficientNetB0 was used to classify the retinal images. The data was divided into training and testing sets at the patient level. The model achieved 56.10% accuracy, 56.82% precision, 59.52% sensitivity, 52.50% specificity, 58.14% F1-score, and 55.00% ROC-AUC.*

An interactive dashboard was also developed to demonstrate the model's predictions using the selected images. The results show that deep learning can be used for retinal image analysis. The model needs further improvement and testing with larger datasets before it can be considered for real-world medical use.

Key Words: Diabetic Retinopathy, Deep Learning, EfficientNetB0, ODIR-5K, Fundus Images, Machine Learning, Eye Disease Detection.

1. INTRODUCTION

Diabetes is a common health disease that can also affect eyes. One of the major eye-related complications of diabetes is Diabetic Retinopathy (DR). It occurs when high blood sugar levels damage the small blood vessels in the retina of eye. If it is not detected and cured at an early stage, it can lead to vision problems and, in severe cases, vision loss.

Traditionally, retinal images are examined by medical experts to identify signs of the disease. However, manually checking a large number of retinal images takes time and also require experienced specialists. Because of this, Machine Learning and Deep Learning techniques are increasingly being studied for easy analysis of retinal images.

In this research, a Deep Learning-based approach is used to detect Diabetic Retinopathy from retinal fundus images of female patients aged 30–50 years. The ODIR-5K dataset is used for the study. After filtering the dataset according to age, gender, and diagnosis, 202 patients with 404 retinal images were selected. The images are divided into two categories: Diabetic Retinopathy (DR) and No Diabetic Retinopathy (No DR). For classification, the EfficientNetB0 deep learning model is used. An interactive dashboard was also developed to demonstrate the model's predictions using the selected research images.

II. LITERATURE REVIEW

Many researchers have studied the use of Machine Learning and Deep Learning for detecting Diabetic Retinopathy from retinal fundus images. Earlier studies used traditional machine learning methods by extracting features such as blood vessels and retinal lesions. Later, Convolutional Neural Networks (CNNs) became popular because they can automatically learn important features from retinal images.

Copyright to IJARSCT
www.ijarsct.co.in
DOI: 10.48175/IJARSCT-40513

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 1, November 2026 Impact Factor: 8.2

Different deep learning models such as ResNet, Inception, MobileNet, and EfficientNet have been used for Diabetic Retinopathy detection. Researchers have also used datasets such as ODIR-5K, EyePACS to train these models. These studies show that deep learning can be useful for analysis and classification of retinal images.

However, most existing studies consider general patient groups and do not specifically focus on female patients aged 30–50 years. Therefore, this research focuses on this specific group using the ODIR-5K dataset and the EfficientNetB0 model to classify retinal images into Diabetic Retinopathy and No Diabetic Retinopathy categories.

III. RESEARCH GAP

Most existing studies on Diabetic Retinopathy use general patient groups and large datasets. Very few studies focus specifically on female patients aged 30–50 years. Different deep learning models have been used for DR detection, but their performance can vary depending on the dataset and patient group. There is also limited research using a specifically filtered group from the ODIR-5K dataset. Therefore, this study focuses on female patients aged 30–50 years and uses EfficientNetB0 to classify retinal images into DR and No DR.

IV. METHODOLOGY

The methodology consists of the following main steps: Dataset collection, data filtering, image preprocessing, patient-level data splitting, data augmentation, EfficientNetB0 model training and fine-tuning, model evaluation, and prediction. Finally, an interactive dashboard was developed to demonstrate the model results using the selected retinal images.

The proposed methodology begins with the ODIR-5K dataset, which is preprocessed and filtered to select female patients aged 30–50 years. Based on the diagnostic information, patients are classified into Diabetic Retinopathy (DR) and No Diabetic Retinopathy (No DR) categories. After filtering, 202 patients with 404 fundus images are selected. The dataset is then divided at the patient level into training and testing sets, with 161 patients (322 images) used for training and 41 patients (82 images) used for testing. The fundus images are resized to 224 × 224 pixels, followed by data augmentation to improve model generalization. An EfficientNetB0 transfer-learning model is then trained and fine-tuned for DR classification. The model performance is evaluated using Accuracy, Precision, Recall (Sensitivity), F1-score, Specificity, and ROC-AUC. Finally, the trained model is used to classify uploaded fundus images as DR or No DR, and an interactive dashboard is developed to provide the prediction and confidence score to the user.

V. DATASET

The ODIR-5K (Ocular Disease Intelligent Recognition) dataset was used for this research. It contains patient information, fundus photographs of both eyes, and diagnostic information. The official dataset describes 5,000 patient cases with left- and right-eye images and diagnostic labels.

For this study, the dataset was filtered according to:

- Gender: Female
- Age: 30–50 years
- Diagnosis: DR or No DR

However, total number of patients was 202 from those: DR Patients are 103 and no DR Patients are 99. Total number of images are 404.

VI. DATA PREPROCESSING

The following preprocessing steps were performed:

- Data Filtering- The dataset was filtered according to gender, age, and diagnosis.
- DR and No DR Selection- Only patients with a clear DR or No DR label were selected.
- Image Selection- Both left- and right-eye fundus images were used when available.
- Image Resizing- All images were resized to 224 × 224 pixels so that they could be provided as input to

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, November 2026
Impact Factor: 8.2

EfficientNetB0.

- Data augmentation was used during training. It included: Horizontal flipping, small image rotation, small image zoom

These techniques help the model learn from slightly different versions of the training images.

VII. MACHINE LEARNING MODELS

EfficientNetB0 was selected as the main deep learning model. EfficientNet was introduced by Tan and Le and uses a compound scaling approach that balances network depth, width, and image resolution.

VIII. ALGORITHM

The algorithm starts by loading the ODIR-5K dataset and filtering it to select female patients aged 30–50 years. The selected patients are classified into Diabetic Retinopathy (DR) and No Diabetic Retinopathy (No DR) categories, and their corresponding fundus images are prepared. The images are resized to 224 × 224 pixels and the patients are divided into training and testing groups at the patient level. Data augmentation is then applied to the training images. Next, the EfficientNetB0 transfer-learning model is loaded and trained using the training dataset, followed by fine-tuning of selected layers. The trained model is tested on the testing dataset, and its performance is evaluated using Accuracy, Precision, Recall, F1-score, Specificity, and ROC-AUC. Finally, the model predicts whether a given fundus image indicates DR or No DR, and the prediction and confidence score are displayed through the interactive dashboard.

IX. MODEL EVALUATION

The model was evaluated using the following measures:

Accuracy: It shows the overall percentage of correctly classified images.

Accuracy = (TP + TN) / (TP + TN + FP + FN)

Precision: Precision shows how many images predicted as DR were actually DR.

Precision = TP / (TP + FP)

Sensitivity: shows how many actual DR cases were correctly detected.

Sensitivity = TP / (TP + FN)

Specificity: shows how many No DR cases were correctly identified.

Specificity = TN / (TN + FP)

F1-Score: combines precision and recall.

F1 = 2 × (Precision × Recall) / (Precision + Recall)

ROC-AUC: measures how well the model separates DR and No DR cases.

X. FINDINGS AND RESULTS

After training and fine-tuning the EfficientNetB0 model, the model was tested on 82 images from 41 patients.

Model Performance

metric	Result
Accuracy	56.10%
Precision	56.82%
Sensitivity / Recall	59.52%
Specificity	52.50%
F1-Score	58.14%
ROC-AUC	65.00%

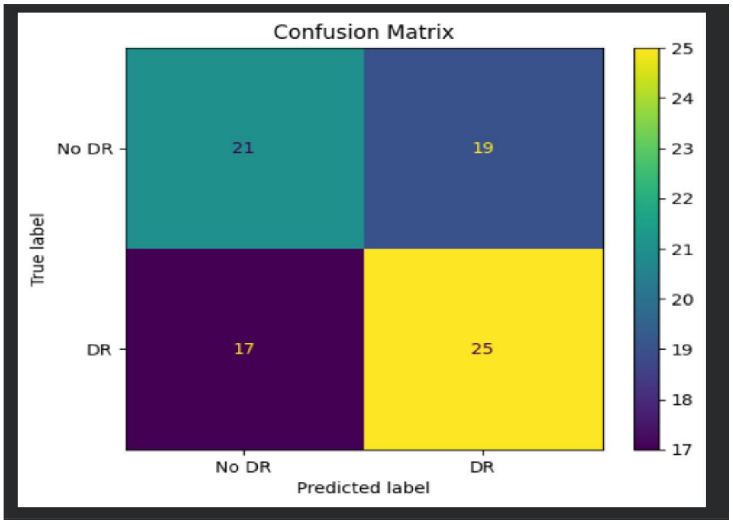
IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, November 2026
Impact Factor: 8.2

The confusion matrix was:

	Predicted No DR	Predicted DR
Actual No DR	21	19
Actual DR	17	25

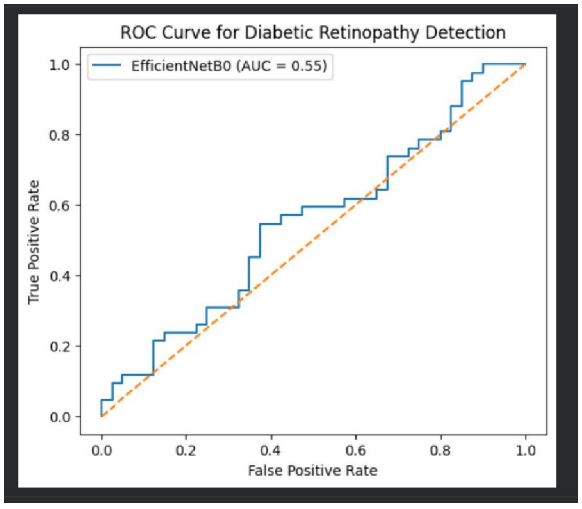
The model correctly identified 21 No DR images and 25 DR images. It incorrectly classified 19 No DR images as DR and 17 DR images as No DR.

Confusion matrix of the EfficientNetB0 model:



ROC curve of the EfficientNetB0 model

The ROC curve represents the classification performance of the EfficientNetB0 model at different classification thresholds. The model achieved an ROC-AUC of 0.55, indicating limited discrimination between DR and No DR classes in the testing data.



IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, November 2026
Impact Factor: 8.2

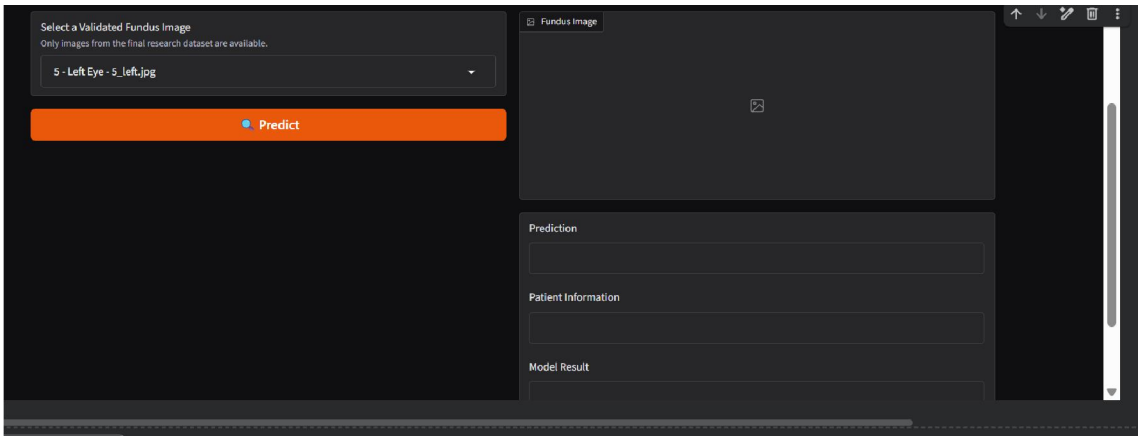
XI. MAJOR FINDINGS

The main findings of the research are:

- EfficientNetB0 was successfully trained for binary Diabetic Retinopathy classification.
- The model achieved 56.10% accuracy.
- The model achieved 56.82% precision.
- Sensitivity was 59.52%, while specificity was 52.50%.
- The model achieved an F1-score of 58.14%.
- The model achieved a ROC-AUC of 0.55.
- The confusion matrix showed 21 correctly classified No DR images and 25 correctly classified DR images.
- An interactive dashboard was developed to demonstrate the model predictions using the selected retinal images.
- The results indicate that the model requires further improvement and testing with larger datasets before practical medical use.

XIII. DASHBOARD / SYSTEM IMPLEMENTATION

An interactive dashboard was developed to demonstrate the practical implementation of the proposed Diabetic Retinopathy detection system. The dashboard allows the user to select a validated retinal fundus image from the study dataset and view the model prediction. It displays the selected fundus image, patient information, predicted class, and model probability. The dashboard provides a simple interface for demonstrating the working of the EfficientNetB0 model.



XIII. LIMITATIONS

This study has some limitations. The final dataset contains only 202 patients and 404 retinal fundus images, which is relatively small for training a deep learning model. The study focuses only on female patients aged 30–50 years, so the results cannot be directly generalized to other age groups or male patients. The model was evaluated using images from the same dataset, and no external dataset was used for validation. The current model performance also indicates that further improvement is required. Therefore, the proposed system should be considered a research prototype and not a clinically validated diagnostic system.

XIV. CONCLUSION

This study presented a deep learning-based approach for detecting Diabetic Retinopathy in female patients aged 30–50 years using retinal fundus images from the ODIR-5K dataset. After filtering the dataset, 202 patients and 404 fundus images were selected for the study. EfficientNetB0 was used for binary classification of DR and No DR images. The

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, November 2026
Impact Factor: 8.2

model achieved 56.10% accuracy, 56.82% precision, 59.52% sensitivity, 52.50% specificity, 58.14% F1-score, and 55.00% ROC-AUC. An interactive dashboard was also developed to demonstrate the model predictions. The results show the potential of deep learning for retinal image analysis, while the current performance indicates the need for larger datasets, further model improvement, and external validation before practical medical use.

REFERENCES

1. Tan, M., & Le, Q. V. (2019). EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks. Proceedings of the 36th International Conference on Machine Learning (ICML).
2. Gulshan, V., Peng, L., Coram, M., et al. (2016). Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs. JAMA, 316(22), 2402–2410.
3. Gargeya, R., & Leng, T. (2017). Automated Identification of Diabetic Retinopathy Using Deep Learning. Ophthalmology, 124(7), 962–969.
4. Arora, L., Singh, S. K., Kumar, S., et al. (2024). Ensemble deep learning and EfficientNet for accurate diagnosis of diabetic retinopathy. Scientific Reports, 14, 30554.
5. ODIR-5K Dataset. Ocular Disease Intelligent Recognition (ODIR-5K) dataset.