International Journal of Nursing and Medical Science 2026:15(02), 33-38

IJNMS ISSN: 2454-6674

INTERNATIONAL JOURNAL OF NURSING AND MEDICAL SCIENCE

PANACEA INTERNATIONAL JOURNAL PRL PUBLISHER

Original Research Article Volume 15 Issue 02 March - April 2026

DEVELOPMENT OF A PROGRAM FOR DETECTING EYE DISEASES USING ARTIFICIAL INTELLIGENCE METHODS

Sabirova S.K., Rahimova F.B., Bakhtiyorova Sh.M.

Urgench State Medical Institute

Annotatsiya. Ushbu maqolada sun'iy intellekt (sun'iy intellekt) va mashinaviy o'qitish texnologiyalari asosida ko'z kasalliklarini erta aniqlashga mo'ljallangan dasturiy yechim ishlab chiqildi. Model sifatida chuqur o'rganishga asoslangan konvolyutsion neyron tarmoqlari qo'llanildi. Natijada ko'z kasalliklarini aniqlash aniqligi sezilarli darajada oshdi, diagnostika jarayonini avtomatlashtirish va oftalmologik amaliyot samaradorligini kuchaytirish imkoniyati yaratildi.

Аннотатция. В статье разработано программное решение для раннего выявления заболеваний глаз с использованием технологий искусственного интеллекта и машинного обучения. В качестве модели использовались сверточные нейронные сети, основанные на технологиях глубокого обучения. Полученные результаты показали значительное повышение точности диагностики и возможность автоматизации офтальмологических процессов.

Abstract. This article presents a software solution designed for early detection of eye diseases using artificial intelligence and machine learning technologies. Convolutional neural networks based on deep learning were utilized as the primary model. The proposed system demonstrates significantly improved diagnostic accuracy and enables automation of ophthalmic examination workflows.

Kalit so'zlar: sun'iy intellekt, mashinaviy o'qitish, chuqur o'rganish, ko'z kasalliklari, tibbiy diagnostika, neyron tarmoq, retinal tasvirlar.

Ключевые слова: искусственный интеллект, машинное обучение, глубокое обучение, заболевания глаз, медицинская диагностика, нейронная сеть, изображения сетчатки.

Keywords: artificial intelligence, machine learning, deep learning, eye diseases, medical diagnostics, neural network, retinal images.

Introduction. In recent years, the rapid development of information technologies has made it possible to fundamentally modernize the diagnostic process in almost all fields of medicine, including ophthalmology. Early detection of eye diseases and timely diagnosis are among the most important tasks of modern healthcare. Diseases such as diabetic retinopathy, glaucoma, and age-related macular degeneration are among the leading causes of vision loss worldwide. Failure to detect these diseases at an early stage may result in irreversible deterioration of vision. According to the World Health Organization, more than half of all blind patients worldwide fall into a category whose condition could have been treated or slowed down if detected early.

Traditional diagnostic procedures often rely heavily on the experience and expertise of ophthalmology specialists. This human factor increases the probability of errors, leads to differences in interpretation, and makes it difficult to quickly analyze large volumes of medical images. In addition, the shortage of ophthalmologists in remote regions makes timely preventive screening more challenging. From this perspective, integrating artificial intelligence technologies into diagnostic processes is emerging as an effective solution that ensures high accuracy, speed, and consistency.

Today, deep learning methods—especially convolutional neural networks (CNNs)—achieve the best results in recognizing and classifying medical images. These models are capable of identifying complex structures in fundus images, detecting microscopic pathological changes, and automatically assessing disease severity. Leading research centers around the world have developed AI models that can diagnose diabetic retinopathy with 90–97% accuracy, demonstrating the strong potential of this approach.

The relevance of this study is rooted in the need to improve early diagnostic systems for eye diseases in our country as well, to automate preventive screening, and to enhance the quality of medical services. Software developed using artificial intelligence can:

• help detect eye diseases at an early stage,

• assist specialists in the diagnostic process,

• quickly process large volumes of medical images,

• and enable high-quality medical services in remote areas.

Therefore, this work presents the development, training, evaluation, and practical implementation of an AI-based model for diagnosing eye diseases from images. Numerous studies have shown that deep learning models such as CNN, ResNet, VGG16, and EfficientNet achieve high effectiveness in medical image classification. Projects like Google Health and DeepMind have already produced major practical solutions in detecting eye diseases using AI.

In this research, open datasets such as EyePACS and MESSIDOR were used. Among various architectures tested, the EfficientNet-B0 model demonstrated the best performance. The training process was carried out using the TensorFlow library for 50 epochs.

The model achieved the following classification accuracies: diabetic retinopathy — 95.2%, glaucoma — 90.6%, and macular degeneration — 92.3%.

These results show that artificial intelligence has significant potential for identifying eye diseases and is promising for use in real clinical practice. Further improvements to the model are planned.

Research Methodology. In this research, the process of developing an AI-based model and software for detecting eye diseases was systematically planned. The overall workflow included: preparing the dataset, preprocessing the images, selecting and training the neural network model, determining evaluation metrics, and designing the user interface.

To train the model, publicly available fundus image datasets were used, including:

• EyePACS — a large dataset of diabetic retinopathy images;

• MESSIDOR — images labeled by disease severity;

• RIM-ONE — a dataset related to glaucoma diagnosis.

The dataset was expanded to a sufficient size to ensure model stability. All images were labeled by experts according to disease type and severity.

Before training, the images underwent preprocessing aimed at standardization and quality improvement:

• Image resizing — all images were converted to 256×256 or 512×512 pixels;

• Noise reduction — Gaussian blur or median filtering;

• Brightness and contrast normalization — using CLAHE;

• Data augmentation, including:

– rotation,

– zooming,

– slight shifting,

– shearing.

These steps reduced the risk of overfitting and improved generalization.

Since detecting eye diseases involves analyzing complex visual patterns, the following deep learning architectures were tested:

• basic CNN (for initial experiments),

• ResNet50 (with residual connections),

• EfficientNet-B0/B1 (optimized architectures with high classification performance).

EfficientNet-B0 achieved the highest accuracy and was selected as the main model.

Training parameters:

• Training set: 70%

• Validation set: 10%

• Test set: 20%

• Optimizer: Adam

• Learning rate: 0.0001

• Loss function: Categorical Cross-Entropy

• Number of epochs: 50–80

• Batch size: 16 or 32

To prevent overtraining and reduce unnecessary computation, EarlyStopping and ReduceLROnPlateau were applied.

Model performance was evaluated using:

• Accuracy,

• Precision,

• Recall (sensitivity),

• F1-score,

• Confusion Matrix.

These metrics made it possible to assess the model's readiness for practical clinical use.

Software Implementation

A software interface working on the trained AI model was developed to demonstrate practical applicability.

• Backend: Python (Flask)

• AI model: TensorFlow / Keras

• Frontend: HTML/CSS or PyQt (for desktop version)

Conclusion. In this study, an AI-based model and software were developed to detect eye diseases using deep learning techniques. Detecting eye diseases from fundus images is one of the most important areas in modern medicine, especially considering that late diagnosis of diabetic retinopathy, glaucoma, and macular degeneration significantly increases the risk of vision loss.

Based on datasets such as EyePACS, MESSIDOR, and RIM-ONE, a large training set was built. Preprocessing and augmentation improved the model's stability and accuracy. Using the EfficientNet-B0 architecture, the model achieved high performance: over 95% accuracy for diabetic retinopathy and more than 90% for glaucoma and macular degeneration.

A practical software interface was also created, capable of accepting a fundus image and automatically estimating the likelihood of disease, offering clear benefits as a decision-support tool for ophthalmologists and for screening in remote areas.

Overall, the findings demonstrate that integrating AI technologies into ophthalmic diagnostics can significantly improve early detection efficiency, speed up the diagnostic process, reduce human error, and enhance healthcare quality. Future work should focus on further model improvements, expanding the dataset, and developing real-time mobile or cloud-based platforms.

REFERENCES

1. Gulshan V., Peng L., Coram M., et al. Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs. JAMA, 2016.
2. Ting D.S.W., Cheung C.Y.-L., Lim G., et al. Deep learning in diagnosing diabetic retinopathy: a systematic review and meta-analysis. Nature Biomedical Engineering, 2019.
3. Abramoff M.D., Lavin P.T., Birch M., et al. Pivotal trial of an autonomous AI-based diagnostic system for diabetic retinopathy. npj Digital Medicine, 2018.
4. Tan M., Le Q. EfficientNet: Rethinking model scaling for convolutional neural networks. ICML, 2019.
5. Russakovsky O., Deng J., Su H., et al. ImageNet Large Scale Visual Recognition Challenge. International Journal of Computer Vision, 2015.
6. EyePACS Dataset. Diabetic Retinopathy Detection Dataset.
7. MESSIDOR Database. Methods to Evaluate Segmentation and Indexing Techniques in the Field of Retinal Ophthalmology.