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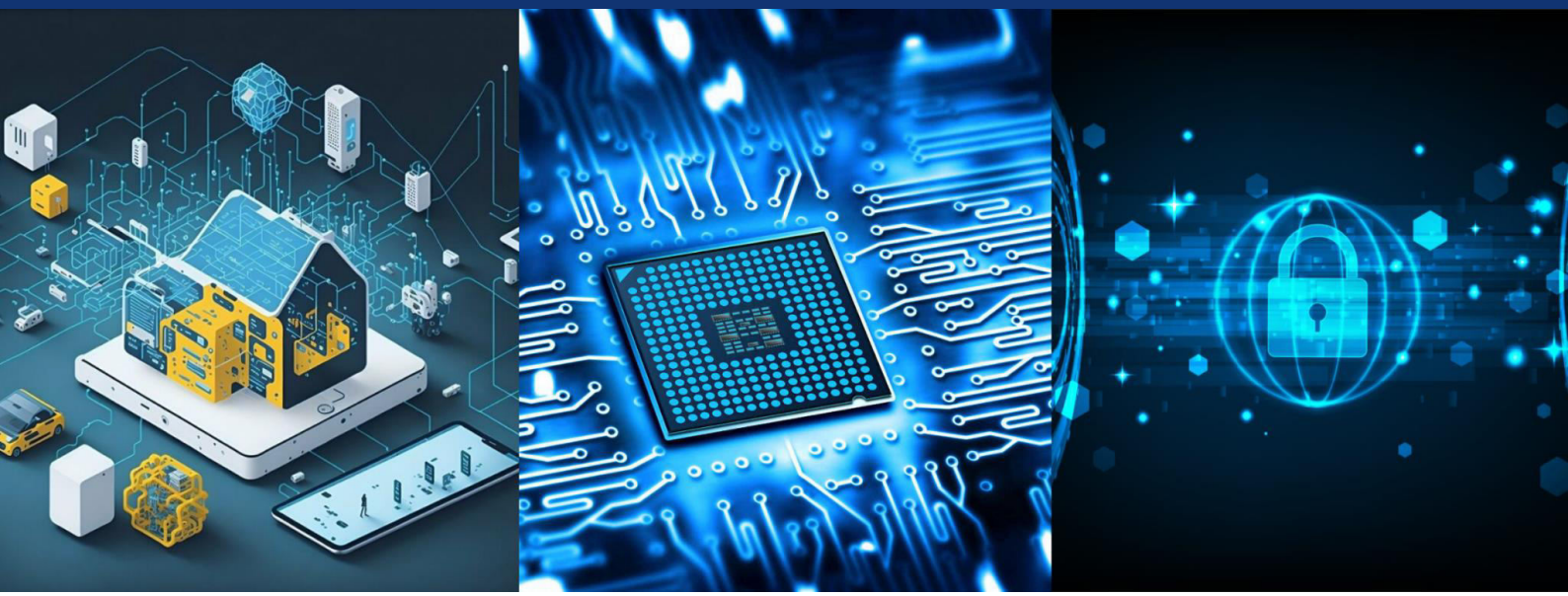

# International Journal of Innovative Research in Computer and Communication Engineering

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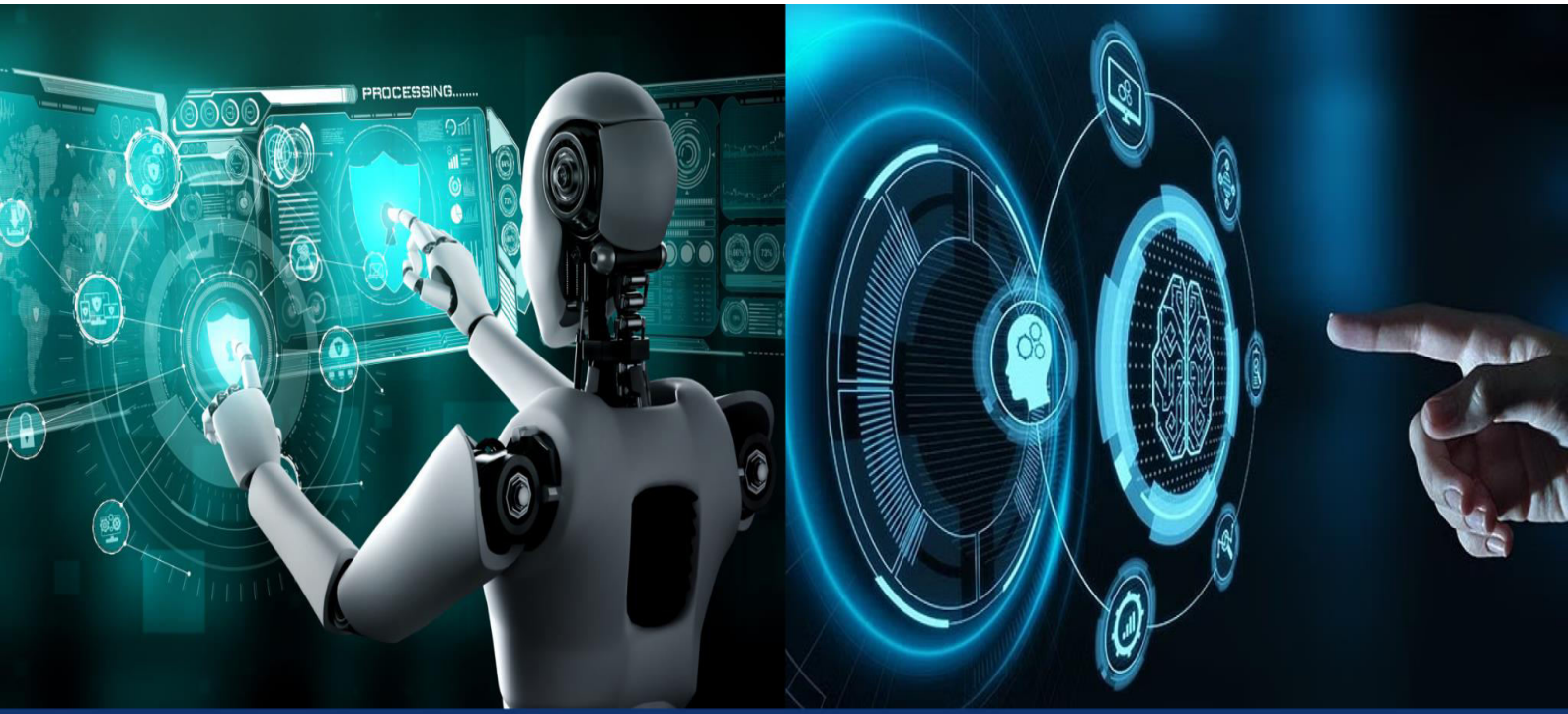


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# Diabetic Retinopathy Detection using Deep Learning

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**ABSTRACT:** Diabetic Retinopathy (DR) is a complication of diabetes that damages the retinal blood vessels and can lead to blindness if not detected early. Manual screening by ophthalmologists is time-consuming, so this study proposes an automatic detection system using a Convolutional Neural Network (CNN). The model classifies fundus images into different severity levels of DR, using a dataset from Kaggle. Preprocessing techniques were applied to improve accuracy. The proposed model was compared with a regression model and achieved better results with 88.1% accuracy. This work aims to develop a robust and reliable system for early detection of diabetic retinopathy.

**KEYWORDS:** Diabetic Retinopathy (DR), Convolutional Neural Network (CNN), Deep Learning, Automatic Detection

## I. INTRODUCTION

Diabetes is a common disease with increasing prevalence worldwide, leading to complications such as cardiovascular diseases, kidney failure, neural disorders, and diabetic retinopathy (DR). DR is a serious eye condition that can cause irreversible vision loss. People with a long history of diabetes, whether type 1 or type 2, are at higher risk of developing DR as they age. According to the WHO, DR is a significant global concern that demands urgent attention. In India, the situation is alarming, with only around 12,000 ophthalmologists available for 60 million diabetic patients. Many people remain unaware of their condition due to the asymptomatic nature of DR in its early stages. Early detection is critical to prevent severe complications. Traditional machine learning methods required manual feature extraction, which was tedious and less accurate. This led researchers to explore deep learning techniques. Convolutional Neural Networks (CNN) in deep learning have shown great success in medical image analysis and image classification, making them ideal for automatic DR detection.

## II. RELATED WORK

Previous methods for diabetic retinopathy (DR) detection used Machine Learning (ML) models like SVM and Random Forest with Local Binary Patterns (LBP) for feature extraction. However, these required manual feature selection and were ineffective on small datasets. Recent advancements in Deep Learning (DL), especially Convolutional Neural Networks (CNNs), have automated feature extraction and improved accuracy. Models like VGG16, ResNet, and Inception have shown better performance in DR classification. The proposed system employs CNNs for automatic classification into five severity stages, using preprocessing techniques like rescaling, grayscale conversion, flipping, and shear transformations. Early stopping prevents overfitting, and results are displayed via a user-friendly interface. Future improvements may include hybrid deep learning models, attention mechanisms, and AI-based telemedicine for better DR detection and accessibility.

## III. METHODOLOGY

**1.Data Source**:The dataset from **Kaggle's Diabetic Retinopathy Detection** contains **retinal images** captured under different conditions. Each subject has **two eye images** (left and right). Due to variations in cameras and models, the images have **noise**, requiring preprocessing. The severity of **Diabetic Retinopathy (DR)** is classified on a scale from **0 (No DR) to Proliferative DR (Severe stage)** for model training and testing.

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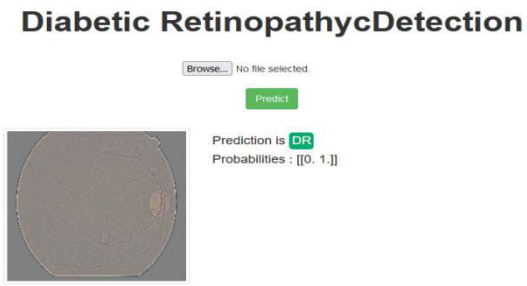
**2.Preprocessing:**The dataset images contained significant noise, requiring preprocessing to enhance their quality for analysis. The preprocessing steps included removing black borders and black corners to focus solely on the fundus region. The images were then resized to a standard dimension of 256×256 pixels to maintain uniformity. Finally, a Gaussian blur was applied to eliminate Gaussian noise, improving clarity and feature extraction for diabetic retinopathy detection. These preprocessing techniques ensured better image quality, leading to more accurate model predictions.

**3.Training:**The dataset was highly imbalanced, with most images classified as "No DR." To balance the data, augmentation was applied, generating 4,000 images per severity class. The preprocessed and augmented images were then used to train a CNN model on the Diabetic Retinopathy Detection dataset, improving classification accuracy.

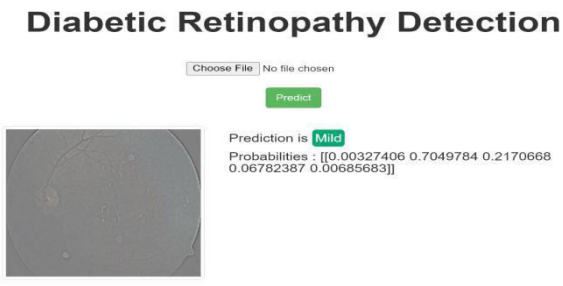
**4.Modelling:** A Convolutional Neural Network (CNN) model was used for training, with weights loaded without the last layer. The final layer was designed using Global Average Pooling 2D, a Dropout layer (0.5) to prevent overfitting, and an output layer with five nodes for classification. The Adam optimizer was used to adjust weights, and a sequential approach was followed to add and customize layers like convolutional, dropout, dense, and optimizers.

**5.Implementation:**For model training, Anaconda-Jupyter was used, while Anaconda-Spyder was utilized for deployment. The front-end development was done using the Sublime Text editor, with Python, HTML, CSS, and JavaScript as the primary programming languages. The Flask framework was used to build the web application for deploying the trained model.

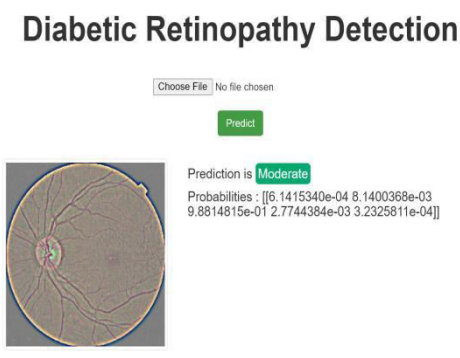
## IV. EXPERIMENTAL RESULT



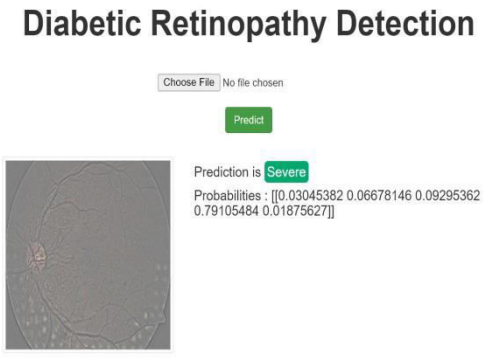

NO_DR DIABETIC RETINOPATHY DETECTION




MILD DIABETIC RETINOPATHY DETECTION




MODERATE DIABETIC RETINOPATHY DETECTION




SEVERE DIABETIC RETINOPATHY DETECTION

## V. CONCLUSION

The traditional method for detecting diabetic retinopathy (DR) is time-consuming, complex, and expensive. To address this, researchers have explored machine learning and deep learning techniques for automation. This study analyzed various automatic DR detection methods and proposed a deep learning-based approach using a CNN architecture with multiple deep layers for early diagnosis, improving accuracy and efficiency.

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