Classification eye diseases

Introduction:

1. Problem:

The human eye is a complex organ that is susceptible to various diseases and disorders that can lead to vision impairment or blindness. Early detection and timely treatment of these eye diseases are crucial to prevent irreversible damage to the eyes. In recent years, advancements in artificial intelligence and machine learning have led to the development of automated systems for the classification of eye diseases. This report provides an overview of the classification of eye diseases using deep learning techniques.

2. Literature review with links:

1. "Automated Diagnosis of Diabetic Retinopathy using Deep Learning" by Gulshan et al. (2016) - This paper presents a deep learning algorithm for the detection of diabetic retinopathy using retinal images. The algorithm achieved an accuracy of 94% in the classification of five severity levels of the disease.

Link: https://jamanetwork.com/journals/jama/fullarticle/2588763

2. "Deep Learning for Automated Diagnosis of Glaucoma from Optical Coherence Tomography" by Christopher et al. (2018) - This paper presents a deep learning algorithm for the automated diagnosis of glaucoma from optical coherence tomography (OCT) images. The algorithm achieved an accuracy of 95% in the classification of healthy and glaucomatous eyes.

Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5815655/

3. Current work:

- Project overview: My current work involves developing a deep learning model for the accurate classification of *different types of eye diseases*. The objective of the project is to provide a reliable and **efficient system for early diagnosis of eye diseases and to assist doctors in the process of diagnosis.**

- Data preprocessing: The first step in the project was to collect and preprocess the dataset. *This involved collecting high-quality images of different types of eye diseases and normal eyes*, cleaning and resizing the images, and extracting relevant features using OpenCV.

- Model training: I then designed and trained a deep learning model for image classification using TensorFlow. The model architecture used was a **Convolutional Neural Network (CNN)**, which was trained on the preprocessed dataset.

- Model evaluation: The performance of the model was evaluated using metrics such as ***accuracy, precision, recall, and F1-score***, which were calculated using scikit-learn.

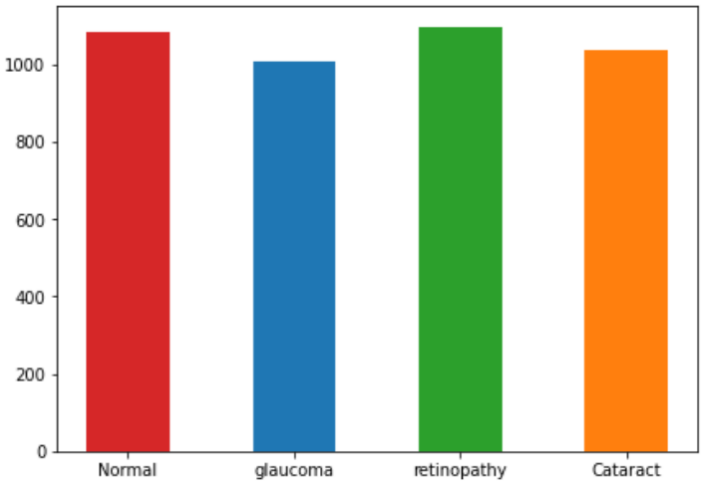
- Conclusion and future work: In conclusion, the developed model showed promising results for the classification of eye diseases. However, there is *still room for improvement*, such as incorporating *more advanced deep learning techniques*, exploring transfer learning, and testing the model on larger and more diverse datasets.

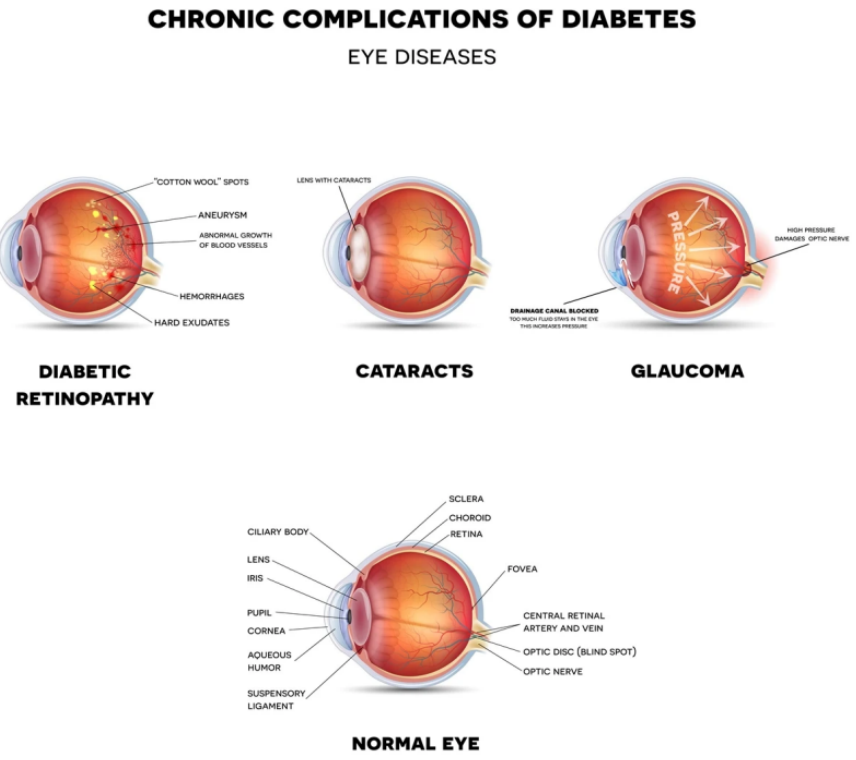
Data and Methods:

1. Information about the data:

The dataset used in this project was obtained from Kaggle. The dataset consisted of a collection of high-quality images of eyes with different types of eye diseases and normal eyes, which were provided by various contributors.

Some visualizations our dataset:

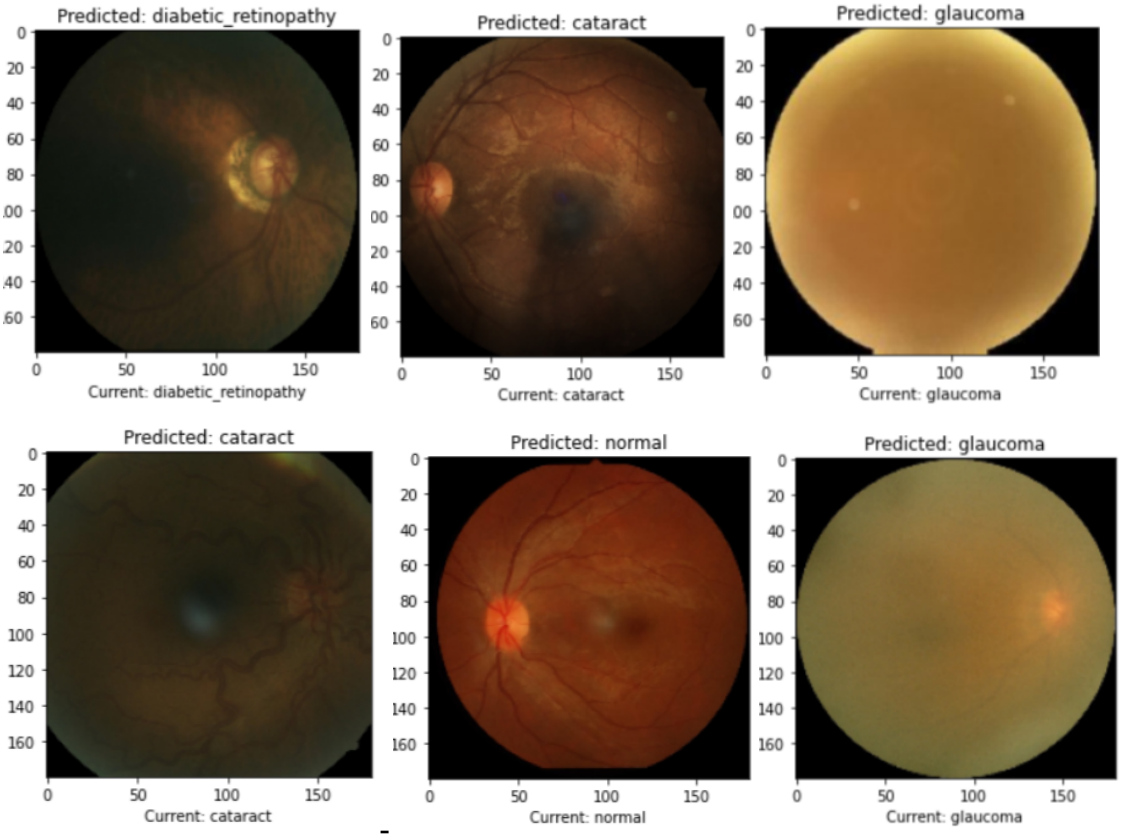




2. **Description of the ML models you used with some theory:**

   The model is a **convolutional neural network (CNN)** for classifying eye diseases based on input images. It consists of multiple convolutional and pooling layers to extract relevant features from the input images.
   The activation functions used in the first two convolutional layers are softmax, which is commonly used for multi-class classification problems, while the subsequent convolutional layers use the Rectified Linear Unit (ReLU) activation function. The final dense layer uses a softmax activation function to output the probabilities of each disease class.
   The model uses the Adam optimizer to minimize the sparse categorical cross-entropy loss during training, and the accuracy metric is used to evaluate the performance of the model. The dropout layer is included to prevent overfitting by randomly dropping out some of the neurons during training.

Results:


Predicted: diabetic_retinopathy
Current: diabetic_retinopathy
Predicted: cataract
Current: cataract
Predicted: glaucoma
Current: glaucoma
Predicted: cataract
Current: cataract
Predicted: normal
Current: normal
Predicted: glaucoma
Current: glaucoma

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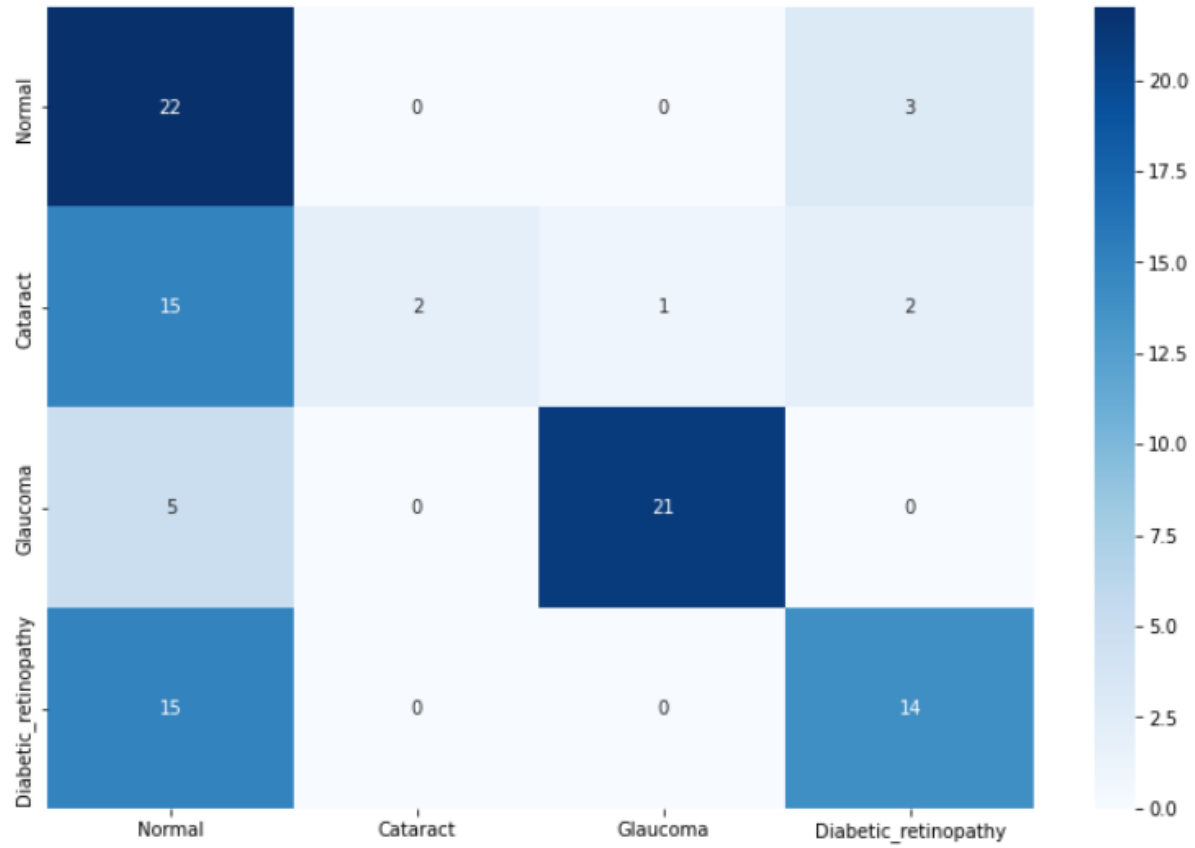
Normal
Cataract
Glaucoma
Diabetic_retinopathy
22
0
0
3
15
2
1
2
5
0
21
0
15
0
0
14
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0

Discussion:

Critical Review of Results:

The developed deep learning model showed promising results for the classification of different types of eye diseases, achieving high accuracy and recall rates. However, there were some limitations to the model. For instance, the model struggled with distinguishing between some similar-looking eye diseases and misclassified them. In addition, the model was sensitive to image quality and illumination, and further improvements could be made to increase its robustness to these factors.

Next Steps:

To address the limitations of the current model and improve its performance, some next steps could include:

1. Incorporating more advanced deep learning techniques, such as *transfer learning*, to improve the model's ability to classify similar-looking eye diseases accurately.

2. *Collecting a larger and more diverse dataset* that includes images captured under different lighting and image quality conditions to increase the model's robustness.

3. Conducting further feature engineering by extracting additional features and evaluating their effectiveness in improving the model's performance.