COSE474-2024F: Final Project Proposal
"Ocular Disease Image Classification"

Michael van Huet

1. Introduction

With the rapid advancement of technology across various sectors, one of the most promising areas for innovation is the healthcare industry. Often, what may initially appear as a benign discovery could actually have more serious implications, potentially evading detection during a healthcare professional's examination. Therefore, leveraging technology to assist in the diagnosis of medical conditions could prove invaluable. This report will explore how image classification techniques can be employed to identify ocular diseases in patients, highlighting the potential benefits of integrating deep learning into medical diagnostics.

2. Problem definition & challenges

The goal of this project is to develop an image classification system for ocular diseases using photos of a patients left and right eye with an accuracy that can be useful for health professionals. There are many hurdles associated with this task that will need to be kept in mind when creating this deep learning model. Perhaps the most obvious challenge is the model needs to be generalised to patients of various ages and ethnicity's as although the eyes do not change much throughout a persons lifespan, there can still be differences that must be accounted for. Another challenge this model will face is the complexity of ocular diseases. Symptoms for the same disease will not be identical for every occurrence as there may be differences in positioning, colour, size and many other factors. Additionally, many diseases can even look very similar so it is important that the model is trained using various strategies to combat this problem.

3. Related Works

The Inception model, particularly Inception V3, has been applied to various medical imaging tasks. A study by Pacheco et al. (2020) demonstrated the use of Inception V3 for detecting glaucoma from optical coherence tomography (OCT) images. Their results indicated that the model could effectively differentiate between healthy and glaucomatous eyes, showcasing the versatility of the Inception architecture in medical applications.

Another Related article ”Ocular Disease Detection with Deep Learning (Fine-Grained Image Categorization) Applied to Ocular B-Scan Ultrasound Images" explores the use of deep learning techniques for the classification of ocular diseases based on B-scan ultrasound images. The authors employ fine-grained image categorization methods to enhance the accuracy of disease detection, focusing on the unique characteristics of ocular structures that can be identified in ultrasound images. (Ye et al., 2024)

4. Datasets

The Dataset that will be used for this project is the Ocular Disease Recognition set from Kaggle which includes a photo of the left and right eye fundus of 5000 patients. images like these are relatively simple to take which makes it practical to develop the system with. Annotations were labeled by trained human readers with quality control management. They classify patient into eight labels including: Normal (N), Diabetes (D), Glaucoma (G), Cataract (C), Age related Macular Degeneration (A), Hypertension (H), Pathological Myopia (M), Other diseases/abnormalities (O)

5. State-of-the-art methods and baselines

Recent advancements in deep learning have significantly impacted the field of ocular disease detection. Notably, convolutional neural networks (CNNs) have become the standard approach due to their ability to extract complex features from retinal images. Among the most recognized models is Inception V3, which has been effectively utilized for glaucoma detection. Pacheco et al. (2020) demonstrated that their implementation of Inception V3 achieved an accuracy of 92% in identifying glaucoma in fundus images, showcasing the model's effectiveness in handling various ocular conditions.

References

Pacheco, R. J., Azevedo, M. N., and Sanches, P. Glaucoma detection using deep learning and inception v3. In *Proceedings of the 2020 IEEE International Conference on Image Processing (ICIP)*, pp. 1992–1996. IEEE, 2020. doi: 10.1109/ICIP40778.2020.9191374.

Ye, X., He, S., Dan, R., Yang, S., Xv, J., Lu, Y., Wu, B., Zhou, C., Xu, H., Yu, J., Xie, W., Wang, Y., and Shen, L. Ocular disease detection with deep learning (fine-grained image categorization) applied to ocular b-scan ultrasound images. *Ophthalmology and Therapy*, 13(10): 2645–2659, 2024. ISSN 2193-8245, 2193-6528. doi: 10.1007/s40123-024-01009-7.

(Pacheco et al., 2020) (Ye et al., 2024)