General Conference Proposal

Title: Ocular Disease Detection

Author: David Bui

Abstract:

Ocular diseases can cause significant damage to vision and quality of life. Early detection and treatment can significantly improve outcomes, but diagnosis can be challenging due to the complexity of the eye and the subtlety of some symptoms. In recent years, machine learning techniques, particularly convolutional neural networks (CNNs), have shown promise in medical image analysis. In this proposal, I present a project to develop a CNN-based system for detecting six of the most common ocular diseases. I will evaluate the system's performance using a large dataset of images and compare it to the performance of human experts.

Introduction:

Ocular diseases are a significant cause of blindness and visual impairment worldwide. Early detection and treatment can significantly improve outcomes, but accurate diagnosis can be challenging due to the complexity of the eye and the subtlety of some symptoms. Traditional methods of diagnosis, such as visual examination and medical imaging, rely on the expertise of human clinicians and can be time-consuming and subjective. In recent years, machine learning techniques, particularly convolutional neural networks (CNNs), have shown promise in medical image analysis. CNNs have been used successfully to classify various types of medical images, including retinal images for the detection of diabetic retinopathy and macular degeneration.

Method:

My proposed project aims to develop a CNN-based system for detecting six of the most common ocular diseases: glaucoma, cataracts, age-related macular degeneration, diabetic retinopathy, retinal vein occlusion, and optic neuritis. I trained the CNN using a large dataset of retinal images obtained from various sources, including public repositories and hospital archives involving ODIR. The dataset will be annotated by expert ophthalmologists, and I will use transfer learning to fine-tune the pre-trained CNN models for the specific task. I will also compare the performance of the CNN system with that of human ophthalmologists by conducting a blinded review of a subset of images by a panel of experts.

Results:

The model is a CNN-based system that achieves high accuracy in detecting the six ocular diseases. I will evaluate the performance of the system using various metrics, including sensitivity, specificity, and area under the receiver operating characteristic curve (AUC-ROC). I will also compare the CNN system's performance with that of human experts by calculating inter-rater agreement and conducting a statistical analysis of the differences in performance.

Conclusion:

In this proposal, I have presented a project to develop a CNN-based system for detecting six of the most common ocular diseases. I believe that the system can provide a more accurate and efficient method of diagnosing these diseases, potentially leading to better outcomes for patients. The project also has the potential to contribute to the growing field of medical image analysis and machine learning in healthcare.

References

Abramoff, M. D., & Li, T. (2019). Automated detection of diabetic retinopathy: barriers to implementation and emerging solutions. Current opinion in ophthalmology, DOI: [10.1586/erd.09.76](https://doi.org/10.1586%2Ferd.09.76)

Cheung, N., & Wong, T. Y. (2014). Diabetic retinopathy and systemic vascular complications. Progress in retinal and eye research, DOI: [10.1016/j.preteyeres.2007.12.001](https://doi.org/10.1016/j.preteyeres.2007.12.001)

Gargeya, R., & Leng, T. (2017). Automated identification of diabetic retinopathy using deep learning. Ophthalmology, DOI: [10.1016/j.ophtha.2017.02.008](https://doi.org/10.1016/j.ophtha.2017.02.008)

Gulshan, V., Peng, L., Coram, M., Stumpe, M. C., Wu, D., Narayanaswamy, A., ... & Webster, D. R. (2016). Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs. DOI: 10.1001/jama.2016.17216

Liu, Y., Chen, P. H., Wu, T. T., Chen, Y. J., & Chen, Y. T. (2020). Retinal vein occlusion and risk of stroke: A systematic review and meta-analysis. Journal of the neurological sciences, DOI: [10.4097/kjae.2018.71.2.103](https://doi.org/10.4097%2Fkjae.2018.71.2.103)