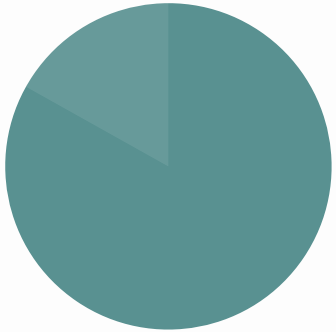
Screening of Common Retinal Diseases with Deep Learning



Presented by
Maryam Ghaffari

Outline

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  - Explore Data
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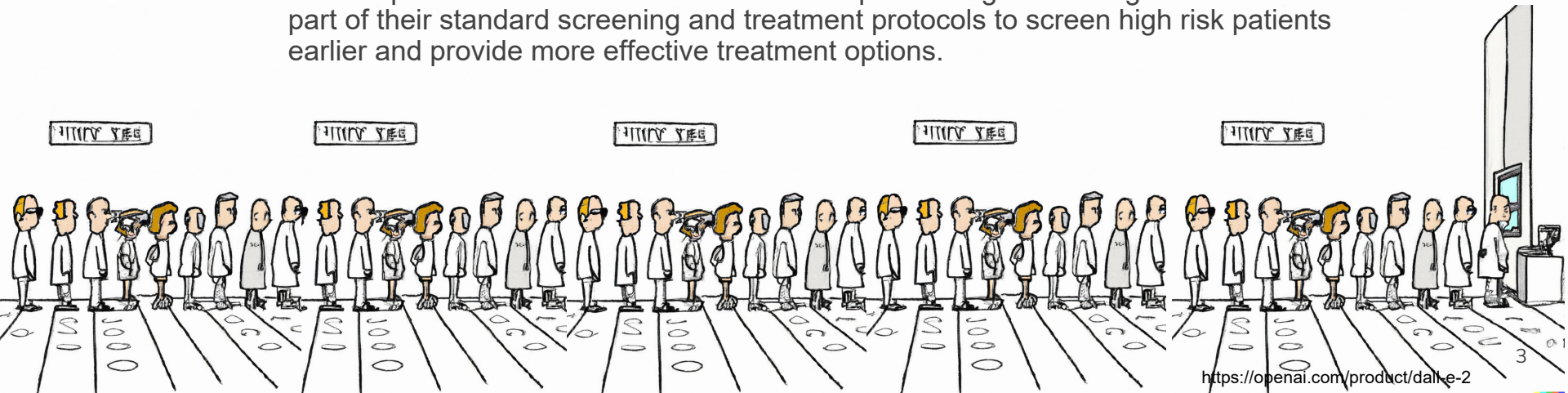
Problem Statement

- Farabi hospital is a comprehensive center of excellence in ophthalmology.
- More that 500 patients visiting Farabi Hospital daily. Shortage in specialists to screen the high risk patients decrease patient outcomes and increase healthcare costs.
- OCT imaging is a standard of care for guiding the diagnosis of retinal conditions.
- The hospital as a stakeholder interested in implementing the AI diagnostic tool as part of their standard screening and treatment protocols to screen high risk patients earlier and provide more effective treatment options.



https://openai.com/product/dall-e-2

Mission

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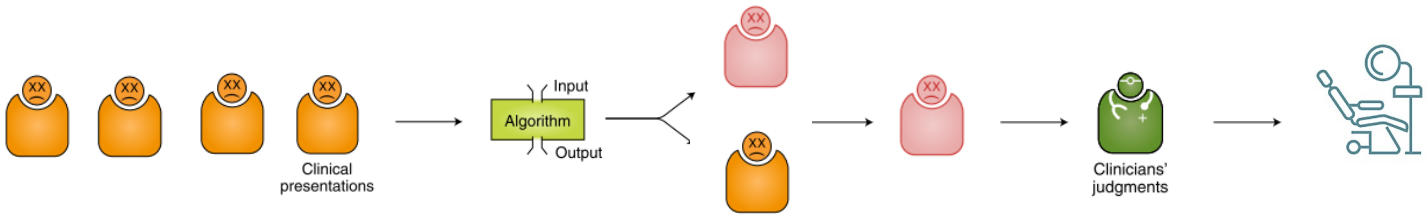
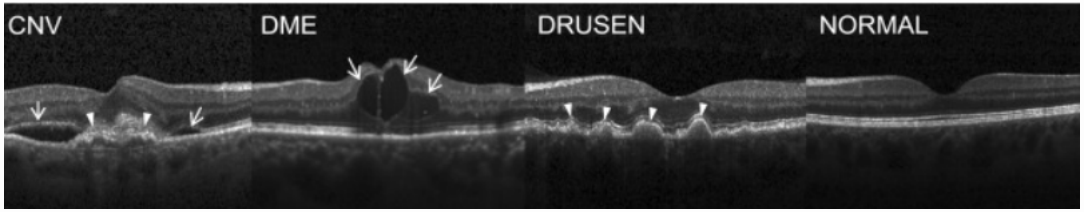
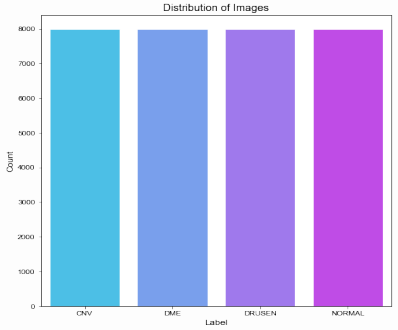
- Generate a Convolutional Neural Network (CNN) algorithm which detects high risk retinal conditions in OCT with high accuracy.
- Reveal potential indicators in the OCT in different diagnosis by highlighting regions recognized by the CNN to help ophthalmologists make more informed decisions regarding patient care, leading to better patient outcomes .



Methodology: Obtain & Scrub Data

- Data were collected in the University of California San Diego, Guangzhou Women and Children's Medical Center.
- There datasets include 33000 OCT images. The images are split into a training set (32000) and a testing set (1000) of independent patients. Images are labeled as and split into 4 directories: CNV, DME, DRUSEN, and NORMAL
- CNV and DME are generally considered more serious and require more aggressive treatment.

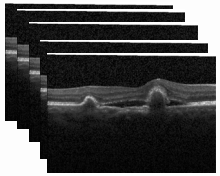


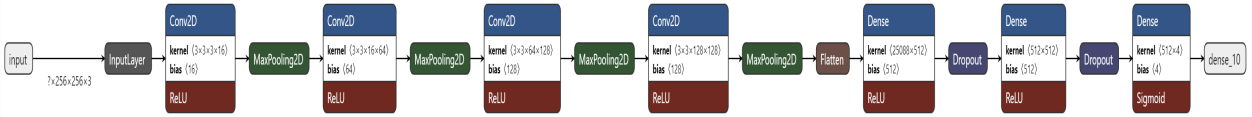


Kermany, Daniel S., et al. "Identifying medical diagnoses and treatable diseases by image-based deep learning." *cell* 172.5 (2018): 1122-1131.

Methodology : Model Data

Convolutional Neural Network (ConvNet/CNN)



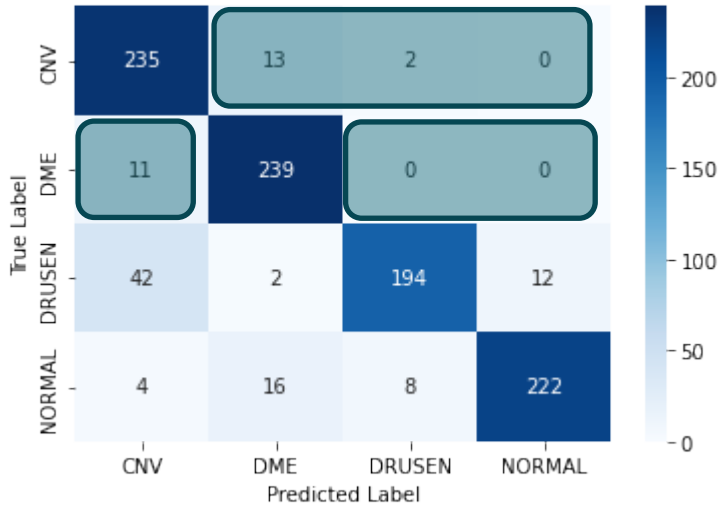


Output

CNV
DME
DRUSEN
NORMAL

Methodology : Model Interpretation

Confusion Matrix



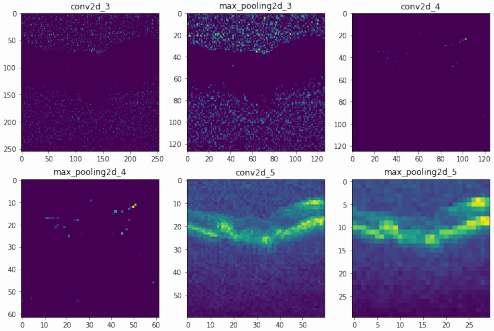
False Negative

↑ Recall = $\frac{\text{True Positives}}{\text{True Positives + False Negatives}}$ ↓

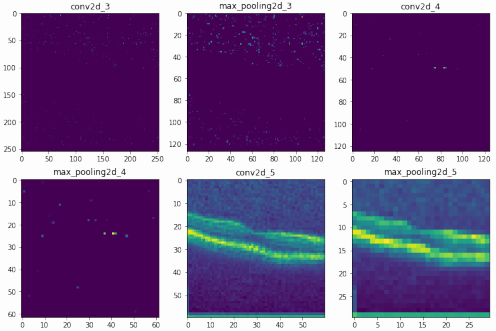
	recall
CNV	0.94
DME	0.96
DRUSEN	0.78
NORMAL	0.89

Feature Visualization

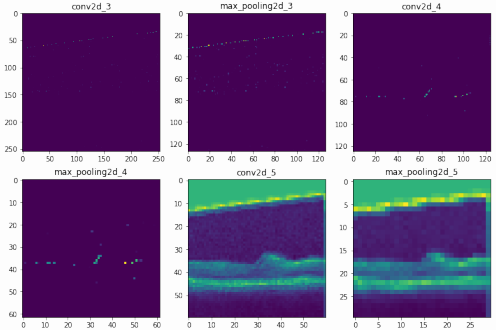
CNV



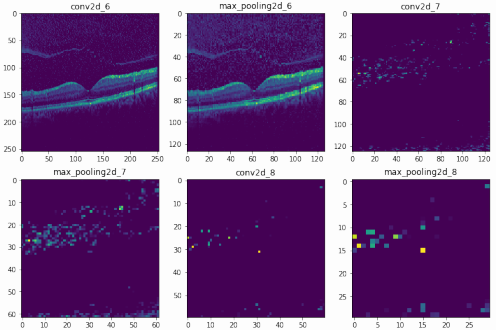
DRUSEN



DME



Normal



Conclusion & Recom mendation

Conclusion:

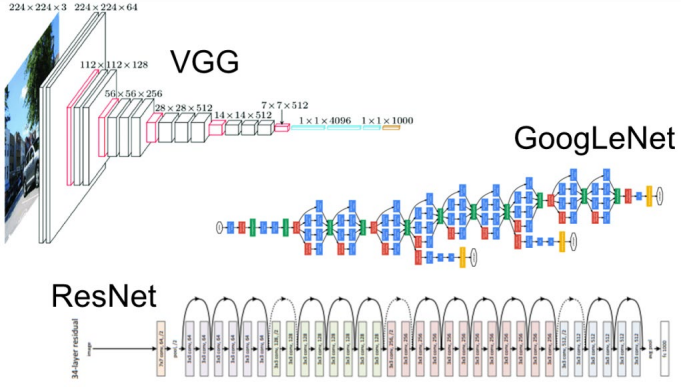
- The proposed model distinguish between four potential classes (CNV, DME, DRUSEN, and NORMAL) with a high accuracy rate of 0.89.
- The model achieved a recall of 0.94 and 0.96 for CNV and DME, respectively.
- Implementing deep learning-based diagnostic tools for screening and diagnosis of retinal diseases can significantly improve patient outcomes and reduce healthcare costs by enabling early detection and personalized treatment

Recommendation:

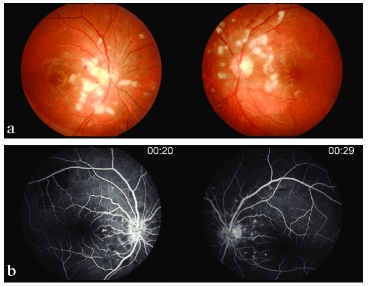
- Implementation of the developed CNN model in screening protocol
- Integration with existing protocols
- Ongoing monitoring and evaluation.

Future work

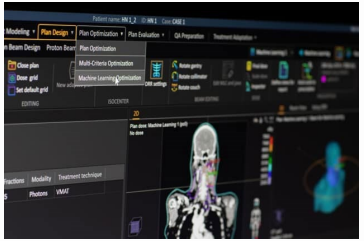
1. Exploration of different deep learning architectures and pretrained models



2. Incorporating other imaging modalities



3. Clinical validation



https://glassboxmedicine.com/2020/12/08/using-predefined-and-pretrained-cnns-in-pytorch-tutorial-with-code/
Ustaoğlu, Melih, et al. "Purtscher-like retinopathy associated with atypical hemolytic uremic syndrome.47.6 (2017): 348.
https://physicsworld.com/a/machine-learning-a-roadmap-for-clinical-validation/

Thank You!

Email: mar.ghaffari@gmail.com
GitHub: https://github.com/MarGhaf/Screening-of-Common-Retinal-Diseases-with-Deep-Learning