Blindness Detection

CS 584 – Machine Learning

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Project Proposal

Problem and Proposed Solution

Diabetic retinopathy is one of the most common causes of blindness in people who have diabetes. Diabetic retinopathy screening is a dilated exam that can identify the risk and level of someone developing this disease. However, in some rural areas, this exam can be expensive or difficult to conduct due to the location.

Instead of having highly-trained doctors review the retina scan images and make a decision whether the patient has diabetic retinopathy, if yes, what is its severity, the goal of this project is to build a machine learning model using various techniques to speed up this process.

The APTOS 2019 Blindness Detection dataset available on kaggle will be used for this project. This real-word dataset consists of retina images from multiple clinics (3662 training images and 1928 testing images). Each training image has a label belonging to 1 of 5 classes depending on the severity, where label 0 indicates No Diabetic Retinopathy and label 4 indicates Proliferative Diabetic Retinopathy.

Related Work/Literature Review

[1] Lam C, Yi D, Guo M, Lindsey T. Automated Detection of Diabetic Retinopathy using Deep Learning. AMIA Jt Summits Transl Sci Proc. 2018 May 18;2017:147-155. PMID: 29888061; PMCID: PMC5961805.

[2] Sreng, S.; Maneerat, N.; Hamamoto, K.; Panjaphongse, R. Automated Diabetic Retinopathy Screening System Using Hybrid Simulated Annealing and Ensemble Bagging Classifier. Appl. Sci. 2018, 8, 1198. https://doi.org/10.3390/app8071198.
[3] Ting DSW, Cheung CY, Lim G, Tan GSW, Quang ND, Gan A, Hamzah H, Garcia-Franco R, San Yeo IY, Lee SY, Wong EYM, Sabanayagam C, Baskaran M, Ibrahim F, Tan NC, Finkelstein EA, Lamoureux EL, Wong IY, Bressler NM, Sivaprasad S, Varma R, Jonas JB, He MG, Cheng CY, Cheung GCM, Aung T, Hsu W, Lee ML, Wong TY. Development and Validation of a Deep Learning System for Diabetic Retinopathy and Related Eye Diseases Using Retinal Images From Multiethnic Populations With Diabetes. JAMA. 2017 Dec 12;318(22):2211-2223. doi: 10.1001/jama.2017.18152. PMID: 29234807; PMCID: PMC5820739.

[4] Ramachandran, N., Hong, S.C., Sime, M.J. and Wilson, G.A. (2018), Diabetic retinopathy screening using deep neural network. Clin. Experiment. Ophthalmol., 46: 412-416. https://doi.org/10.1111/ceo.13056.

[5] Ismael, H. R., Abdulazeez, A. M., & Hasan, D. A. (2021). Detection of Diabetic Retinopathy Based on Convolutional Neural Networks: A Review. Asian Journal of Research in Computer Science, 8(3), 1–15. https://doi.org/10.9734/ajrcos/2021/v8i330200.

Project Milestones

- We plan to understand the dataset using various visualization techniques.
- Our plan is to research various machine learning and deep learning models that are applicable to the problem.
- Post this, we plan to implement various techniques/algorithms to our problem statement such as logistic regression, decision trees, Convolutional Neural Networks (CNN), Random forest as an Ensemble Classifier. We plan to use Principal Component Analysis (PCA) and K-means for dimensionality reduction and initially clustering raw data to get an idea about the dataset.
- If time permits, compare the performance of our custom models to pre-existing models such as VGG and ResNet through the process of Transfer Learning.

References

Dataset:
https://www.kaggle.com/competitions/aptos2019-blindness-detection/data