Kanna: A Deep Learning Approach for Screening Amblyopia Using Facial Images

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Amblyopia is the most frequent vision disorder in children leading to permanent visual impairment. Prevalence of amblyopia varies from 1.1%-5% in various studies. Early detection through a complete eye exam for Amblyopia Risk Factors (ARF) - refractive errors, alignment of the eyes and any other structural changes - is critical because there is a window for successful treatment. Various photoscreeners and autorefractors have been used to screen children for amblyopia but they are limited by cost and efficacy. Since most ARF can be detected by a visual exam, we looked to develop a simple photograph-based solution that would help detect amblyogenicity, combining principles of photoscreening and Deep Learning. Deep Learning and Image Processing algorithms were used to segment images of the face taken in ambient and low light surroundings to obtain necessary features. Normalized risks were formulated using sigmoidal models for each of the ARF to create a risk dashboard. A clinical validation was conducted with a sample of 658 children (5% level of significance and 3% error limit of detection) with a mean age of 8.86 years (range 2 to 15 years). The algorithm had an overall accuracy of 81.00%, with a sensitivity of 89.55% and specificity of 78.81%. We were able to demonstrate that deep learning and image processing analysis of low light and ambient light images acquired from a smartphone are extremely useful in screening for ARF in children and young adults for referral to doctors for further diagnosis and treatment.

Awards Won:

Third Award of $1,000

American Statistical Association: Certificate of Honorable Mention