digiTAC: An Automated and Inexpensive Solution for Visual Acuity Testing in Preverbal Children Using Deep Convolutional Neural Networks

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WHO estimates that around 12 million children (2-5% children worldwide) suffer from amblyopia - the most common visual impairment among children. Neurocognitive development is dependent on proper eye-neural connections established during infancy and this development is sometimes arrested due to treatable refractive error conditions. An inexpensive, easily usable system is required to detect visual acuity complications and allow early intervention to prevent further damage like vision impairment and blindness. digiTAC is a software-only application that digitizes the proven and accepted Gold Standard Teller Acuity Card method for testing visual acuity among preverbal children. Unlike other digital visual acuity testing solutions, digiTAC is the first fully automated solution that doesn't require any special hardware, internet, or an expert for testing. Independence from special hardware was achieved by using a Deep Convolutional Neural Network trained to predict visual fixation on a laptop screen using an ordinary webcam to capture video frames. digiTAC was approved for clinical trials at the All India Institute of Medical Sciences, Delhi. In stage one of the trials, visual acuity testing was done on 36 children (72 monocular tests) up to 10 years of age with a focus on slightly older children with both digiTAC and manual Teller Acuity Cards. These methods showed an excellent correlation with a Spearman's rho of 0.789 and Cronbach's alpha of 0.902 for the focus group. This successfully proves that digiTAC provides comparable results to the manual testing method in the focus group. It advances state of the art because no prior study is available to objectively evaluate vision by digital Teller Acuity Cards. It paves the way for stage two of the trial which is in progress.

Awards Won:

Third Award of $1,000

University of Arizona: Tuition Scholarship Award