



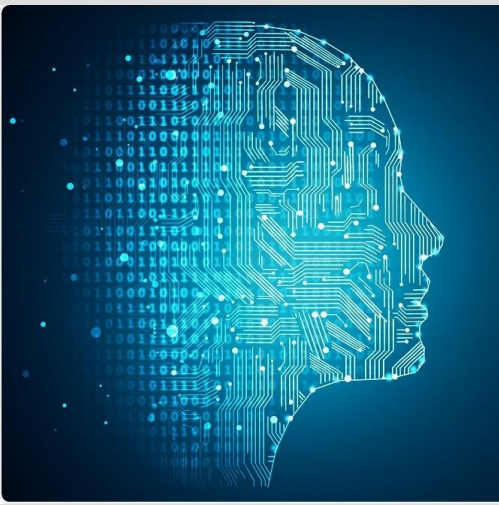
ROUNDTABLE DISCUSSIONS 2017

Enabling Artificial Intelligence (AI) in Telemedicine Screening



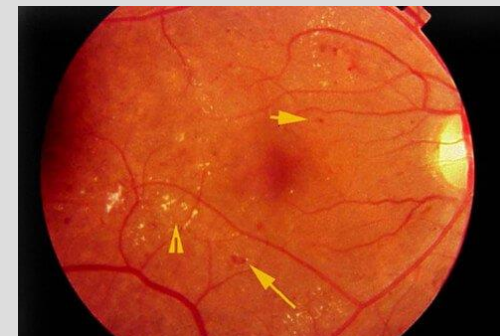
APTOS

ASIA PACIFIC TELE-OPHTHALMOLOGY SOCIETY



SCREENING & DIAGNOSIS DR FUNDUS IMAGES

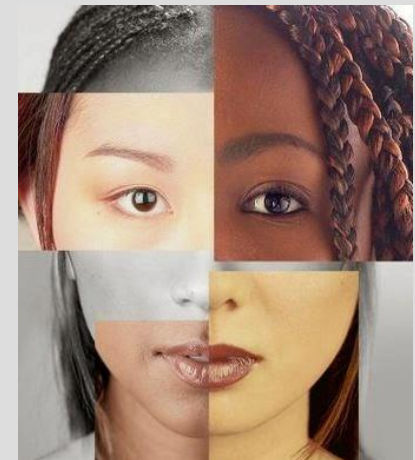
- Current DR Reading Center Standard: Ophthalmic Technician Graders Certified by Online Course
 - Qualified if score 80% grading accuracy on test images
- Deep Learning algorithms can now accomplish same task within a minute with over 90% accuracy for referable disease
- With a projected increase in the diabetic screening population, AI-hybrid or AI-alone graders will screen / diagnose a high volume of fundus images in a short period of time



HUMAN GRADING VARIATION VS STANDARDIZATION



- Subjective human graders – Everyone believes they are the gold standard and data sets often lack longitudinal or pre and post treatment data
- Barriers for regulatory approval → Lack of an agreed upon common reference standard to assess AI performance
 - APTOS aspires to create a consensus grading definition gold standard for training AI algorithms
- A standard set of unique images within a secure data portal should be devised to compare various AI algorithm performance
 - How to establish benchmarks for diagnosis or future predictions?



BARRIER 2: MULTIMODALITY & LONGITUDINAL DATA COLLECTION

- Progression over time = reference standard for many diseases
 - Diagnosis may be difficult when the disease is asymptomatic and slow
- AI is often trained with cross-sectional single-time point image with or without other multimodal data
 - Better ground truth accuracy if include multimodal data mimicking real life decision making
 - AI will perform better with more data, how can APTOS help with this?
- APTOS aims to establish a reference gold standard database of images
 - Provide a reliable window for detecting clinically relevant DR, similar to regulatory agencies for longitudinal changes



BARRIER 3: THE UNSEEN



- AI currently learns from human labelling, but can AI detect something that has not been seen before?
 - Yes, but there is a problem when multiple disease co-exist
 - If new features found, need to determine by research if this is associative or causative
- Like fundus photos, can a larger data set of OCT images be made available?
 - Everyone can contribute scans that have been validated by experts
 - All potential algorithms could be compared for reference without ownership issues – how can this be achieved?

AI AS A TREATMENT TOOL?

- Multiple tests to diagnose a disease and the progression of decisions to go from one test to another often involves the human mind in conjunction with patient wishes, adding to the difficulty in automating a complex decision-making process
- While AI can be a quick solution to dichotomic answers of a set threshold, what to do next still needs human input
- Thus AI can start the evaluation such as deciding when to refer, how to prioritize cases, or make an initial diagnosis which may need further follow-up
- Algorithms can help standardize human variance



UPTAKE OF AI

- Like any new technology, there will be variance of adoption by physicians
- Market penetration of AI is expected to rise as with other specialties
- Right now, AI grading is not reimbursed as much as human grading. Business models around price of equipment and software cost have not been worked out
- Advocacy through quality research and publications is of particular importance to lobby for government support
- Success stories in AU: system moved towards diagnosis and referrals by optometrists in addition to GPs and is now moving towards AI for tasks that ophthalmologists do not have time to do
 - AI will take up more and more mundane repetitive tasks that do not need human interventions

BUSINESS MODELS

- A viable model is to run AI in a clinical setting with supporting staff for referrals
- More patients can be screened with cheaper equipment, but there is a natural tension between the number of patients who need screening and the amount of income one can generate from screening
- To grow a business, one has to find a niche where a high volume of images has to be seen
- What AI aims to achieve is to share the workload of the physicians who are already too busy with seeing normal patients and annual check-ups
- Case Study: Average wait time at UC Berkeley is 3 years upon successful identification of diseases. A scalable way to redistribute workload within a closed system of healthcare providers

DEPLOYING AI

- Deploying AI in screening is aimed to reduce the burden on overworked service providers and to increase work for those who do not have see enough patients (redistribution)
- Ways to deploy AI: bundled with camera, in the cloud, or software as a service (SaaS)
 - Pre-loaded or internet connection (updateable)
 - APTOS advocates for the cloud model for compliance issues so that the images can stay on the device and be sent via network simultaneously
 - Cloud has the advantages of being scalable and updated in real time
- Goals:
 1. Reasonably-priced AI read of images every patient can afford (low cost high value second opinion)
 2. Service providers can ultimately rely less on government reimbursement?
 3. Quality patient care (less time at computer) since tests are “pre-read”