



2020 LEAD Capstone Poster Session

Using Artificial Intelligence to Improve Glaucoma Care

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Abstract

- **Objective:**

- To collaborate with the UTSW MAIA laboratory on a project to use artificial intelligence to create a novel decision support model for glaucoma management

- **Project Plan:**

- Begin collaboration with MAIA lab with simple self-contained project using cross-sectional data and large numbers
- Transition to a number of projects that employ longitudinal data and potentially various AI algorithms, both supervised and unsupervised (e.g. deep learning)
- Ultimately create a decision support software to help improve clinical decision making in real time

- **Significance:**

- This has the potential to improve our ability to provide care to glaucoma patients, reduce under- and over-treatment, all while using the many data points already available to us.



Objectives

- To collaborate with the UTSW MAIA laboratory on a project to use artificial intelligence to create a novel decision support model for glaucoma management



Background Information

- Decision making in glaucoma management can be extremely complex.
- Sources of complexity include:
 - 1) variability in disease characteristics and aggressiveness;
 - 2) its asymptomatic nature often causing delayed diagnosis
 - 3) reliance on subjective and error-prone testing
 - 4) limited ability to correlate structural and functional loss
 - 5) unpredictable procedural intervention that can carry high risks, including vision loss, and may have limited duration of efficacy.
- It is often very difficult to project someone's trajectory: will they eventually lose vision from glaucoma? In the next 10 years? 20 years? 30 years? Do they even have glaucoma? How likely is it they will develop glaucoma? How do we interpret borderline findings?



Background Information

- Currently, most of these challenges are navigated by individual practitioner's experience and intuition as well as informed by knowledge gleaned from landmark glaucoma studies in the literature. Still, it can be extremely difficult to process the very large number of variables, some of which can be unreliable and fluctuating, such as visual field testing.
- Artificial intelligence has been employed in the field of glaucoma in multitude of ways to help identify early glaucomatous changes.¹⁻⁷ For example, a deep learning algorithm has been used to identify patients with glaucoma as a screening tool, using only fundus photographs¹. Similarly, Bizios² et al used two separate machine learning methodologies (artificial neural network and support vector machines) to train AI algorithms to classify OCT RNFL images as healthy versus glaucomatous. Both methods reportedly were able to accurately classify healthy subjects as healthy. A hybrid deep learning algorithm was used by Muhammad³ et al to differentiate healthy eyes from glaucomatous eyes using a single OCT photo per eye, with accuracy reported to 93.1%.



Specific Aims

- To begin a series of projects that apply artificial intelligence to glaucoma evaluation and management
- To eventually create a meaningful novel decision support program to better navigate the uncertainties of glaucoma care



Project Plan

- Begin collaboration with MAIA lab with simple self-contained project using cross-sectional data and large sample size
- Transition to several projects that employ longitudinal data and potentially various AI algorithms, both supervised and unsupervised (e.g. deep learning)
- Ultimately create a decision support software to help improve clinical decision making in real time



Application of What You Learned at LEAD

- Communicating my vision in a way that garners enthusiasm and cooperation from those critical to the project



Proposed Budget

- No additional funds needed currently beyond existing departmental personnel



Innovation and Significance

- Artificial intelligence carries to the potential to impact myriad facets of modern society by leveraging computational ability beyond what we are capable. Ophthalmology and the field of glaucoma have many potential areas where this could be of benefit.
- Many projects have begun to look at potential uses of AI in ophthalmology and glaucoma, including its use to improve effective screening in resource- or expertise-limited settings.
- This has the potential to improve our ability to provide care to glaucoma patients, reduce under- and over-treatment, all while using the many data points already available to us.



References

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