



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) Yousuf M. Soliman	Project Number S1424
Project Title IlluminaMed: Developing New AI for Use in a Biomedical Image Analysis Toolkit	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The main aim of this research is to develop new, more effective methods of Artificial Intelligence and Fuzzy Logic Techniques and integrate them with biomedical imagery and spectroscopy analysis and interpretation. This will result in advancing the fields of both Artificial Intelligence and Radiological Scan Analyticity.</p> <p>Methods/Materials Throughout the course of this research I gained access to several MRI databases to train my AI to. I began my research by studying and developing new types of neural networks which would have both short and long term memory as well as larger output sets with faster training times. I developed several algorithms which would initially segment the MRI into the specified classes, in specific the white matter, grey matter, cerebral spine fluid, and edema. I then trained several neural networks to a training set of 750 MRI scans to find tumors effectively. I also trained illuminaMed to find and distinguish lesions in Multiple Sclerosis and ALS. Lastly, I trained illuminaMed to find patterns between brain activity and brain structure with the tendency of a patient to develop Alzheimer's.</p> <p>Results IlluminaMed was able to automatically segment MRI scans with a 98% accuracy while separating the pixels into the correct classes. IlluminaMed was then able to automatically detect tumors in MRI scans with a 93% accuracy as well as approximate its volume within a 5% error margin. Lastly IlluminaMed was able to find correlations between brain structure and activity with the tendency of a patient to develop Alzheimer's before symptoms begin to appear.</p> <p>Conclusions/Discussion In its current form, IlluminaMed is very practical and is in te process of being implemented into a Health Information System. Although IlluminaMed is a very powerful tool and is able to accomplish several tasks very efficiently, it still has a lot of room for potential. As I plan to continue research in this field I plan to further develop this tool to be able to analyze and segment many different types of biomedical scans. Another line of research would be to incorporate more efficient algorithms as to have this program be more lightweight and run on less demanding computational machines.</p>	
Summary Statement I developed a biomedical image analysis toolkit that can automatically segment and analyze MRI scans using AI for tumors, lesions in Multiple Sclerosis and ALS, as well as determine the tendency of a patient to develop Alzheimer's.	
Help Received Several professors for providing me access to MRI scan databases. Najwan Naserelldain for helping me learn to pprogram years ago.	