



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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Project Title Automated Feature Detection for Diagnosing Neurodegenerative Diseases	
Abstract Objectives/Goals The objective of this project was to determine if feature detection algorithms could identify neurodegenerative lesions in brain MRIs. Neurodegenerative lesions, including those found in patients diagnosed with Langerhans Cell Histiocytosis (LCH), are frequently missed through visual inspection of brain MRIs due to their low signal intensity. Furthermore, the detection process is difficult due to the high diversity of lesions and the similarity with normal tissue. By separating the brain into distinct regions, subtle changes in intensity between adjacent pixels in the image can be enhanced and used to identify lesions. Methods/Materials Brain MRI data were acquired from parents of patients that are members of a closed histiocytosis group on Facebook. A database of 107 reported cases of histiocytosis was compiled; of these, 27 separate brain MRIs were obtained from 13 patients. Two types of software were used to analyze the MRIs, including OsiriX for initial viewing and storage, and MATrix Laboratory (MATLAB) for feature/lesion identification and extraction. The algorithm that was developed was called Signal Characterization for Neurodegenerative Lesions (SCANL). Results Using SCANL, neurodegenerative lesions were detected in the cerebellum of 13 of the 14 MRIs previously identified by neuroradiologists, which is a 92.9% success rate. Furthermore, SCANL identified neurodegenerative lesions in an additional 3 patients (5 MRIs) from the Clean Scans group. Successful identification of lesions was independent of the magnetic field strength of the MRI machine and the size of the lesion, but dependent upon the intensity of the background cerebellum. Conclusions/Discussion SCANL was able to identify 92.9% of lesions previously found by neuroradiologists and lesions in an additional 5 MRIs from 3 patients who were previously told their scans were clean; 2 of these patients, after additional review by their oncologists, have now received independent verification of neurodegenerative changes. Based on these results, we recommend that doctors include SCANL (or feature detection algorithms) as part of the neuroradiology review of brain MRIs.	
Summary Statement We developed an automated feature detection algorithm to find neurodegenerative lesions in brain MRIs.	
Help Received My mother taught me how to code.	