# CALIFORNIA STATE SCIENCE FAIR
# 2015 PROJECT SUMMARY

**Name(s)**

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**Project Number**

**S1222**

**Project Title**

## Analysis of White Matter Hyperintensities on Brain Magnetic Resonance Imaging to Predict Walking / Gait Abnormalities

**Abstract**

**Objectives/Goals**

The purpose of this study is to examine measurements of White Matter Hyperintensities (WMH) and Cortical Atrophy derived from computer analysis of patient MRI#s, to be used for diagnosis in patients with Gait Abnormalities.

**Methods/Materials**

MRIs were collected for 29 patients; 15 of these patients exhibited an irregular gait and 14 were healthy volunteers (controls). These MRI scans were post-processed using software called FreeSurfer to provide quantitative measurements for regions of the brain. Gait Abnormal patients were tested using standardized testing protocols including MOCA, TUG, and Timed 25# Walking Tests. WMH were measured using MATLAB at the UCSD laboratory.

**Results**

To compare subjects, the W+G was divided by the intracranial volume to normalize the amount of atrophy for each subject. The results were then compared across subjects.

Pertinent results include:

1. As WMH increased, the volume of the left hemisphere of the brain tended to decrease. For each 1% change in WMH, an average of a 0.3% decrease in left hemisphere volume was observed.
2. Patients with Gait Abnormalities exhibited lower relative brain volumes. Patients with gait abnormalities exhibited about 14% greater cortical atrophy than healthy patients. The average cortical atrophy for healthy patient is about 0.35. vs. 0.4 for a gait abnormal patient.
3. The average Healthy Patient showed a much higher MOCA score than the average Gait Abnormal Patient. The average healthy patient MOCA score is 28.3 for a healthy patient and 25 for a gait abnormal patient.

**Conclusions/Discussion**

Pertinent conclusions include:

1. Using FreeSurfer and MATLAB, occurrences of White Matter Hyperintensities and Cortical Atrophy can be more accurately identified and measured
2. Measurements of White Matter Hyperintensity and Cortical Atrophy employed in this study show promise as a diagnostic tool for Gait Abnormality Disorders
3. Recommendations for further study

a. A larger sample group

b. Examine other cortical regions for further correlation

**Summary Statement**

This study provides initial confirmation of the viability of WMH and Cortical Atrophy measurements as tools to assist in the diagnosis of Gait Abnormalities.

**Help Received**

Dr. Fatta Nahab # Neuroscience Research Professor at the University of San Diego, California, for providing consultation and guidance throughout the entire project Dr. Shen Qian # Biomedical engineer at the University of San Diego, California, for providing consultation and guidance on data analysis, data