Diagnostic software for predicting hard to detect abnormalities at individual level from MRI, CT and ultrasound images

LEAD INVENTOR: Michael L. Lipton, M.D., Ph.D.

DIAGNOSTIC SOFTWARE

BACKGROUND/UNMET NEED

MRI and CT imaging methods generate troves of information on organ structure and function. However, techniques to use this information in a quantitative manner and at the individual patient level for clinical decision making is still lacking.

SOLUTION

To overcome these limitations, researchers at the Albert Einstein College of Medicine have developed a novel, simple, inexpensive statistical method for post-acquisition image processing, quantitation, and analysis for clinical use. The software compares images from the patient to that of a control group and provides a readout to the clinicians, generating a holistic map of the areas of abnormalities detected in a patient.

Led by Dr. Michael Lipton, the Einstein team successfully validated the software in a clinical setting on patients (n = 34) with mild traumatic brain injury against control subjects (n =30) to identify white matter abnormalities namely, traumatic axonal injury (TAI). Significantly, the analysis revealed previously undetected abnormalities unique to each patient. The study further revealed inter-individual differences in TAI that were particularly dependent on the biomechanical aspect of each injury. In separate study, the group further demonstrated the statistical rigor and superiority of the method over others in unbiased assessment of subject specific abnormalities. Though these proof-of-concept studies were as tested on images obtained from MRI, the team envisions that the same can be expanded to other modalities (like CT, ultrasound) and to different organs across disease areas. The invention is well validated within clinical setting across large patient population and currently in routine use on patients. The software is fully functional and can be generalized for implementation across multiple MRI platforms. Its output metrics makes it highly suitable for integration with AI and machine learning modules for harnessing its full potential.

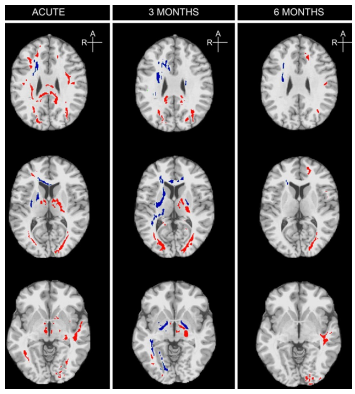

Figure: Fractional anisotropy (FA), a well-established hallmark of white matter abnormalities for mild traumatic brain injury was chosen as parameter for analysis. Each column shows abnormal regions detected within 2 weeks, at 3 and 6 months, of injury, respectively. Demonstrates an increasing number of abnormally high FA voxels (blue) at 3 months followed by a decrease at 6 months. The number of abnormally low FA voxels (red) decreases at 3 and 6 months in comparison to the initial assessment.

APPLICATIONS

- Diagnosis of organ, tissue abnormalities, pathologies at individual patient level
- Analysis of post-acquisition MRI, CT, ultrasound images for diagnosis and clinical decision making
- Evaluating neurodegeneration associated with Multiple sclerosis, Amyotrophic lateral sclerosis, Lyme disease
- Detecting concussions related abnormalities involved in contact sports

ADVANTAGES

- Simple and inexpensive
- Output metrics are amenable for integration with AI /machine learning tools
- Potential in aiding and interpreting MRI, CT and ultrasound images
- Potential to be implemented across MRI platforms as an additional scanner feature
- Potential to use the software as a fee for service business model

STAGE OF DEVELOPMENT

- Well validated under clinical setting
- Currently in routine clinical use
- Large, expanding, ready to use normative database of control and patients

RELEVANT LITERATURE

- Lipton et al., Brain Imaging and Behavior (2012)
- Dodd et al., Brain Imaging and Behav (2018)
- Strauss et al., Brain Imaging and Behav (2021)

INTELLECTUAL PROPERTY

Issued US Patents:

- 9,245,334

Office of Biotechnology and Business Development

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