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Design and Apparatus for Quantification of the Mapping of the Sensory Areas of the Brain

Medical imaging is an important tool for diagnosis and customizing treatment of patients with various ailments. Functional MRIs (fMRIs) for the brain have been advanced greatly, enabling imaging to create detailed maps that show a spatial organization of neuronal responses to different stimuli. However, these current practices are qualitative and lack the ability to provide quantitative data using the sensory maps created. Doctors need quantifiable scores in making diagnoses and prognoses, so this mapping has been limited mostly to experimental settings. Therefore, it is necessary to develop a tool to completely quantify sensory maps of the brain so that this imaging can be effective in clinical settings as a diagnostic tool.

Researchers at Arizona State University have developed a tool that can quantify sensory maps of the human brain. The system utilizes various techniques in analysis of the MRI brain image. Conformal geometry, which is the study of angle-preserving transformations (movements) on a space, is used. In addition, the analysis uses developments in differential geometry, which is an application of differential calculus to geometric contexts, to consider the intrinsic surface structure of the brain.

The mathematical models created using these proven techniques then enable the conversion of three-dimensional data into a two-dimensional map that can be easily stored and provided to patients. This enables direct comparison over time and between individuals using quantitative, no longer qualitative, data. Diagnoses and prognoses are then more reliable and consistent using quantitative data as their justification.

Potential Applications

- Medical imaging systems
- Radiology centers
- Surgery centers
- Rehabilitation services

Benefits and Advantages

- Quantifiable: Uses proven mathematical models to analyze sensory maps and create quantifiable scores
- Accurate: Eliminates issues with distortion encountered in previous attempts to map sensory cortices
- Integrated: Can function as standalone imaging device or be easily incorporated into current imaging devices