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Method for Measuring Human Vision Cortical Magnification Factor

In human vision, varying amounts of neural resources are devoted to visual fields. Retinotopic mapping uses fMRI to give a projection of the visual field and its cortical representation in a subject. Cortical magnification factor (CMF) is a common measure of the ratio of the cortical areas devoted to each region of the visual field, to show visual acuity and cortex concentration. Often, blood oxygenation level dependent (BOLD) fMRI activation data is used to generate retinotopic maps, which are then used to estimate CMF. Unfortunately, because of low signal-to-noise ratios and spatial resolution, CMF can only be estimated, not accurately measured, as a function of retinal eccentricity.

Researchers at Arizona State University in collaboration with a researcher at NYU have developed a novel algorithm which can precisely measure and illustrate cortical magnification factors in the visual cortex. Using smoothing tools, topology correction tools, measurement tools and illustration tools, this algorithm enables solid CMF measurement with improved resolution to provide greater insights into human visual acuity. The measurements can be used to quantify CMF in the visual field and give an indication of visual disease. This algorithm was tested on the Human Connectome Project 7T fMRI dataset and produced great results.

This algorithm makes it possible to measure CMF on the whole 2D planar visual field for each individual patient and shed light on functional visual differences between healthy and unhealthy patients.

Potential Applications

- Measuring human vision cortical magnification factor
 - Detect or distinguish disease to make diagnoses or prognoses
 - Research into the human visual system
 - Provide insights into human visual acuity

Benefits and Advantages

- Removes topology violations
- Improves spatial resolution in retinotopic mapping
- Achieves a thorough description of human CMF in 2D planar visual field
- More accurate CMF measurements
 - On the whole visual field from structure MRI and fMRI scans
- Great illustration of CMF showing patient's visual acuity, asymmetries and change across individuals
- Helps in discovering more variation of acuity and preference in human visual cortex

For more information about this opportunity, please see

[Xiong et al - SPIE Medical Imaging - 2023](#)

For more information about the inventor(s) and their research, please see

[Dr. Wang's departmental webpage](#)