Computational Simulation of T1 Contrast in BOLD-fMRI Scans to Improve Analysis Potential

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Blood Oxygen Level Dependent Functional Magnetic Resonance Imaging (BOLD-fMRI) is a type of MRI scanning technique that makes use of the change in magnetization between oxygen-rich blood and oxygen-poor blood within tissue to create an image. Although it is considered a major breakthrough in MRI research, BOLD-fMRI scans are known to have lower spatiotemporal resolution in comparison to their necessarily contrast agent-using counterparts. In this experiment, the role of kernels or convolution matrices in drawing useful information out of an image, which will be a BOLD-fMRI scan from an actual patient, was investigated. The BOLD scan will be altered to display better contrast, such as that which is apparent in a T1 MRI. The purpose of doing this task programmatically would be to show white matter/cortical regions in the brain more clearly with the moving deoxygenated blood currents in the brain, something that BOLD-fMRI tests can already map, but will return lower resolution for. With this incentive, the contrast which is not apparent in most fMRI scans, due to the nature in which they are formed, can be digitally enhanced. There were multiple photo alteration methods coded, each creating a different filter for the viewer. The combination filter implemented each method on a 40/40/20 weight, a mixture that provided the greatest distinction/clarity of white matter. Pending doctor evaluation, another Java program was coded to compare the pixel ratios of the original and altered scan on the combination filter for a numerical comparison; an approximated 23% quality increase was yielded from this program. Even a slight quality increase allows the program to be a success, since the image provided better in-vivo insights than before to both patients and specialists.

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