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Maximin and maximin efficient designs for functional MRI experiments

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Abstract

Functional magnetic resonance imaging (fMRI) is considered one of the leading technologies for studying human brain activity in response to mental stimuli. Well planned experimental designs for fMRI are crucially important. They help researchers to collect informative data to successfully achieve valid and precise statistical inference about the inner workings of our brains. Existing studies on fMRI designs are primarily based on linear models, in which a known shape of the hemodynamic response function (HRF) is assumed. However, the HRF shape is usually uncertain and can vary across brain regions. To address this issue, we consider, at the design stage, a nonlinear model allowing for a wide spectrum of feasible HRF shapes, and propose efficient approaches for obtaining both maximin and maximin efficient designs that are relatively efficient across a class of possible HRF shapes. We present some theoretical results that help to reduce the space of the unknown model parameters and demonstrate that good designs can be obtained over a restricted subclass of fMRI designs. The obtained designs are compared with designs that are widely used in practice.

Biography

Ming-Hung Kao has completed his Ph.D in year 2009 from the University of Georgia. He is currently an assistant professor in the School of Mathematical & Statistical Sciences at Arizona State University.