MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

COLLOQUIUM

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Denoising Large Neuro-Image MRI Data Using Spatial Random Effect Model

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10:20 AM - 11:10 AM
Refreshments 10:00 AM
C405 Wells Hall

Abstract

Spatial smoothing in Magnetic Resonance image (MRI) involves applying a filter to remove high frequency information and consequently improve signal-to-noise ratio that can greatly aid neurosurgeons in pre-surgical planning stages of tumor resection. This immensely reduce the time spent on Electrical stimulation mapping(ESM) prior to surgery. MRI's three-dimensional data provides voxel intensities with complex spatial relationship. The standard de facto spatial smoothing method, Gaussian Kernel smoothing, is but satisfactory since a uniform smoothing is done for the whole brain. Secondly, the kernel smoothing technique assumes normality for the voxel intensity, but numerous literature indicates that voxel intensities for MRI data approximately follows a Rician distribution. This leads to a blurring effect when the kernel smoother is applied to MRI data at various band widths.

A reduced rank spatial model in the Bayesian framework with spherical basis function at specified knots locations with different spatial resolutions is developed. Knots locations are equidistant but with careful consideration of the anatomical structure of the brain which mimics a half sphere. The data used is a public sourced MRI data of an adult male with brain tumor or lesion to the left region of his brain. This model structure aids in attaining a relatively manageable covariance structure in a computational sense.

The proposed method demonstrates an improvement in the automated spatial smoothing process for the Brainix MRI data. This work could be beneficial to the brain surgeon in that it significantly reduces the time spent probing via ESM as region boundary blurring is avoided.

Note: This work was done with substantial consultation with Dr. Rajib Paul (UNCC), my Advisor and Dr. Casey Jelsema (WVU)

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