A Bayesian approach to joint modeling of matrix-valued imaging data and treatment outcome]{A Bayesian Approach to Joint Modeling of Matrix-valued Imaging Data and Treatment Outcome with Applications to Depression Studies

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Abstract: In this talk, we propose a unified Bayesian joint modeling framework for studying association between a binary treatment outcome and a baseline matrix-valued predictor. Specifically, a joint modeling approach relating an outcome to a matrix-valued predictor through a probabilistic formulation of multilinear principal component analysis (MPCA) is developed.

This framework establishes a theoretical relationship between the outcome and the matrix-valued predictor although the predictor is not explicitly expressed in the model.

Simulation studies are provided showing that the proposed method is superior or competitive to other methods, such as a two-stage approach and a classical principal component regression (PCR) in terms of both prediction accuracy and estimation of association; its advantage is most notable when the sample size is small and the dimensionality in the imaging covariate is large.

Finally, our proposed joint modeling approach is shown to be a very promising tool in an application exploring the association between baseline EEG data and a favorable response to treatment in a depression treatment study by achieving a substantial improvement in prediction accuracy in comparison to competing methods.