

A functional mixed model for scalar on function regression with application to a functional MRI study

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Abstract: Motivated by a functional magnetic resonance imaging (fMRI) study, we propose a new functional mixed model for scalar on function regression. The model extends the standard scalar on function regression for repeated outcomes by incorporating subject-specific random functional effects. Using functional principal component analysis, the new model can be reformulated as a mixed effects model and thus easily fit. A test is also proposed to assess the existence of the subject-specific random functional effects. We evaluate the performance of the model and test via a simulation study, as well as on data from the motivating fMRI study of thermal pain. The data application indicates significant subject-specific effects of the human brain hemodynamics related to pain and provides insights on how the effects might differ across subjects.