

Long-Range Trends and Short-Range Dependencies in Response Time Data

Dr. Mario Peruggia

Department of Statistics

The Ohio State University

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Classroom D, Advanced Technology Center,

2021 Lakeshore Drive, New Orleans

Abstract

Human response time data are widely used in cognitive psychology to evaluate theories of mental processing. Typically, the data constitute the times taken by a subject to react to a succession of stimuli under varying experimental conditions. A careful analysis of these data must distinguish and account for both local dependencies and overall trends. Local dependencies might be directly related to the mental process generating the response times. For example, a subject might perceive that her last few responses were slow and try to compensate by speeding up the next few ones or vice versa. Local dependencies might also be due to sudden distractions or attention gathering events. Overall trends might be due to learning, i.e. the fact that, over time, a subject becomes better acquainted with the task he must perform, leading to shorter response times. Or they might be due to fatigue, i.e. the fact that a subject tires to perform the same repetitive task, leading to longer response times. Distinguishing between local dependencies and overall trends is difficult. We consider two modeling strategies. First, we apply a traditional approach in which we preliminarily detrend the data and then model the residual local dependencies. This tactic can be unsatisfactory, especially when data from several subjects that appear to require varying degrees of detrending are considered at once. Next, we consider a hierarchical Bayes approach that lets us handle the various modeling choices concurrently and lets us incorporate, in a unified fashion, the effects of experimental covariates and of extreme observations. We use data from several experiments to illustrate and compare the performance of the two modeling strategies.

This talk is based on joint work with Peter Craigmile and Trisha Van Zandt