



Recovering Piecewise Constant Signals from Noisy Time Series

Max A. Little[†] and Nick S. Jones[†]

[†]Oxford Complex Systems, Oxford Centre for Integrative Systems Biology,
Dept. of Physics, University of Oxford, Oxford OX1 3PU, UK
Email: littlem@physics.ox.ac.uk, n.jones1@physics.ox.ac.uk

Abstract– Piecewise constant (PWC) signals exhibit flat regions with abrupt jumps. These occur in many physical situations, including jump-diffusion in financial markets, atomic diffusion in crystal lattices, step-like motion of molecular machines, and single-molecule nanopore sequencers. Time series containing PWC signals typically observed in experimental setups are often contaminated by significant noise. The abrupt transitions make recovery of the PWC signal from the noisy time series a major challenge for classical linear time series analysis. In this talk, I will describe several new techniques that exploit concepts such as sparsity, shrinkage and fusion, to provide more accurate estimates of the underlying PWC signal. I will describe some applications in the analysis of the dynamics of molecular machines.