# Graph-constrained changepoint detection, toby.hocking@nau.edu

I am working on a paper about a statistical framework for detecting abrupt changes in data measured over space or time. We call it "graph-constrained" changepoint detection because a graph can be used to specify the expected sequence of changes (like the "prior" in Bayesian statistics). The novelty of our algorithm is twofold:

- whereas previous algos such as Hidden Markov Models are never guaranteed to compute the optimal model parameters, our algo is guaranteed to compute the globally optimal changepoints/states/means (given a particular graph and cost function), which results in highly accurate changepoint detection!
- for $N$ data the algo is $O(N \log N)$ time, which is fast enough for huge data sets! `https://github.com/vrunge/gfpop`

If your research involves sequence data with abrupt changes, please get in touch so we can collaborate!

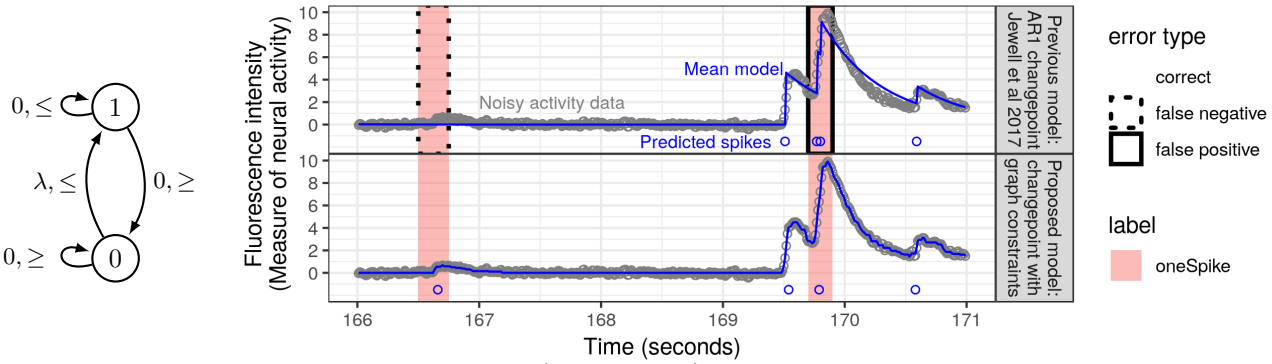


Figure 1: Detecting spikes in calcium imaging data (neuroscience). **Top:** previous AR1 model misses a spike in the left label (false negative) and predicts two spikes where there should be only one in the right label (false positive). **Bottom:** The proposed multi-modal regression model correctly detects one spike in each of the two labeled regions.

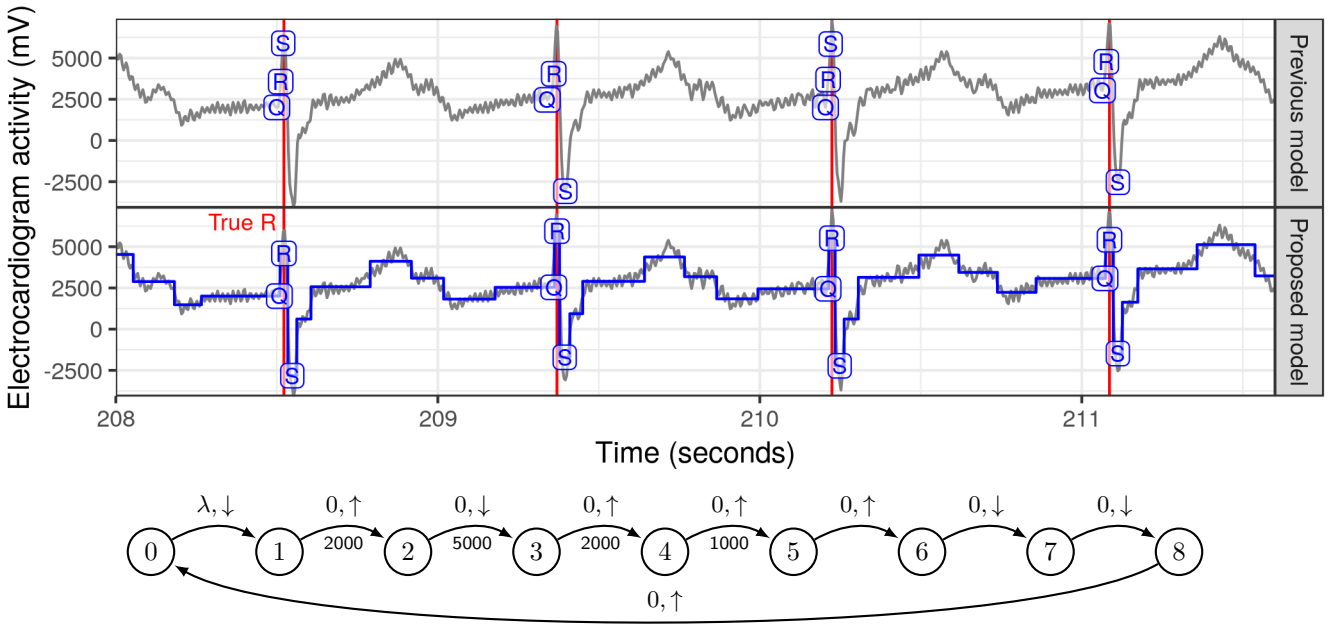


Figure 2: In these electrocardiogram data (collaboration with Dr. Fatemeh Afghah), it is important for models (blue) to accurately detect the QRS complex (Q is before the peak, R is the peak marked in red, S is the local minimum after the peak). **Top:** Previous model mistakenly predicts S at the peak. **Middle:** proposed constrained changepoint model accurately predicts R at each peak. **Bottom:** graph structure of proposed nine-state constrained changepoint model.

**Finally also please email me if you would like to participate in next month's bathroom reading group by creating a 1-page poster about your research.**