# GFPOP for ECG data

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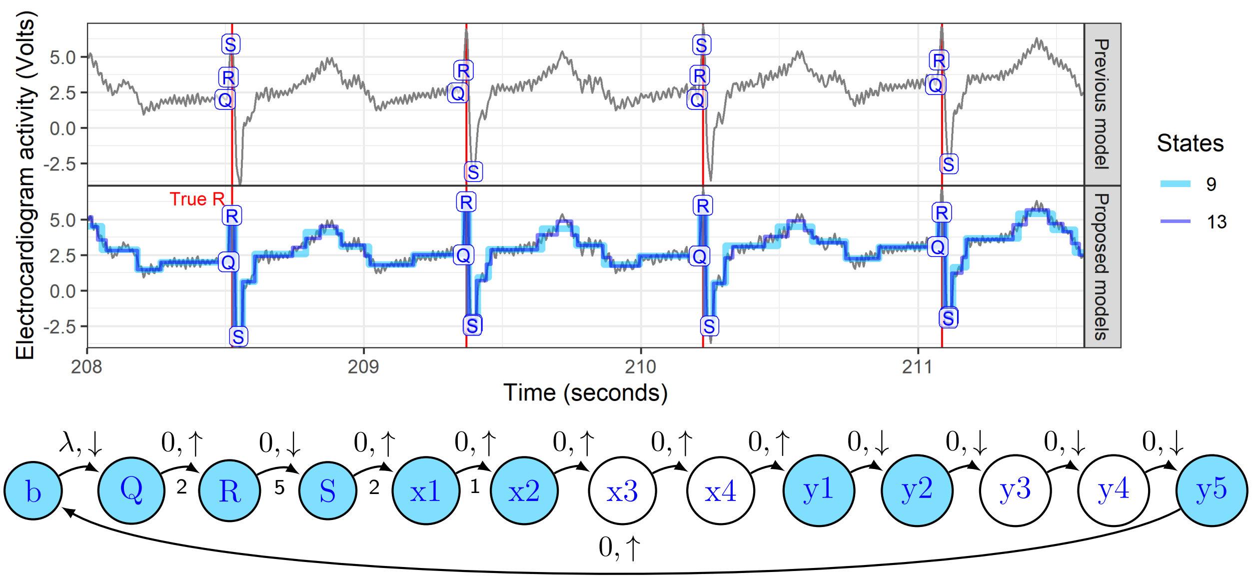


Figure 1: In these electrocardiogram data, it is important for models (blue) to accurately detect the QRS complex (Q is before the peak, R is the peak marked in red, S is the local minimum after the peak). **Top:** Previous model of **?** mistakenly predicts S at the peak. **Bottom:** proposed constrained changepoint model using a graph with 9 vertices accurately predicts R at each peak.

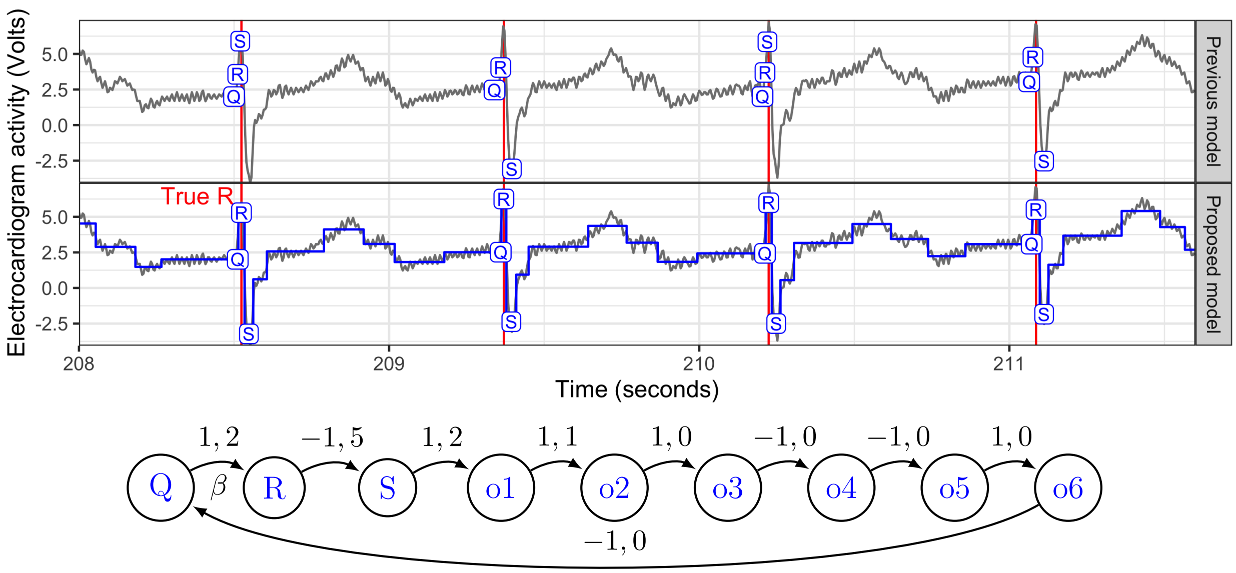


Figure 2: In these electrocardiogram data, it is important for models (blue) to accurately detect the QRS complex (Q is before the peak, R is the peak marked in red, S is the local minimum after the peak, other states o1–6). **Top:** Previous model of **?** mistakenly predicts S at the peak. **Middle:** proposed constrained change-point model accurately predicts R at each peak. **Bottom:** graph structure of proposed nine-state constrained change-point model. Below each edge $e$ we show the penalty $\lambda_e$, which is either a constant $\beta = 8000000$ or zero if nothing is shown; above we show the constants $\delta_e, \gamma_e$ in the constraint function $g_e(m_i, m_{i+1}) = \delta_e(m_i - m_{i+1}) + \gamma_e \leq 0$ ($\delta_e = 1$ for a non-decreasing change, $\delta_e = -1$ for a non-increasing change, $\gamma_e \geq 0$ is the minimum magnitude of change).