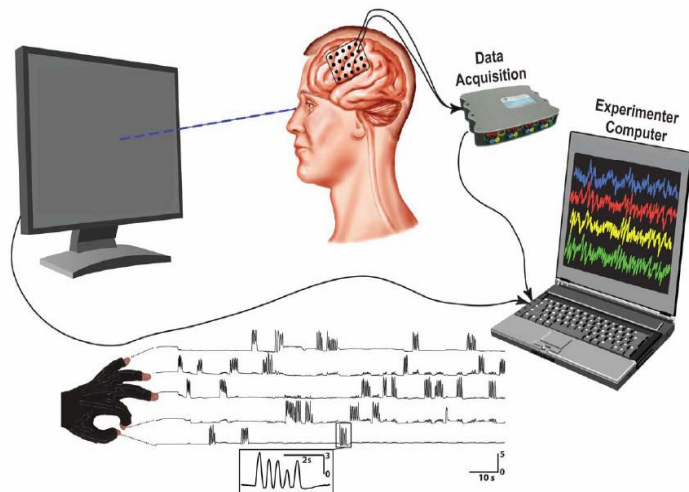# Anatomically Constrained Decoding of Finger Flexion from Electrocorticographic Signals

Zuoguan Wang[1], Gerwin Schalk[2], Qiang Ji[1]

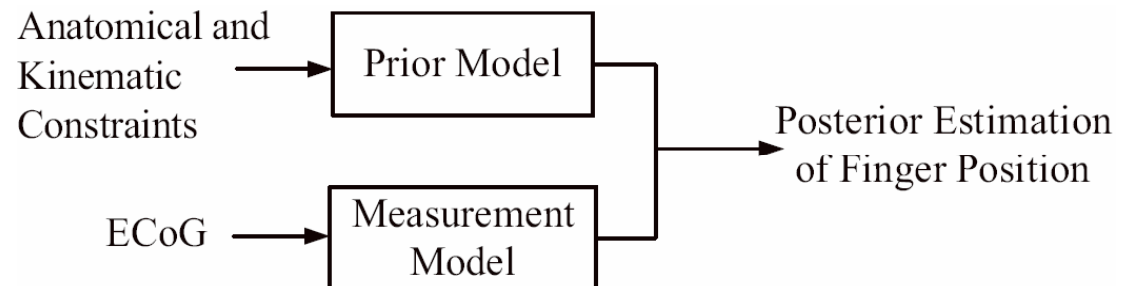1. Rensselaer Polytechnic Institute   2. Wadsworth Center

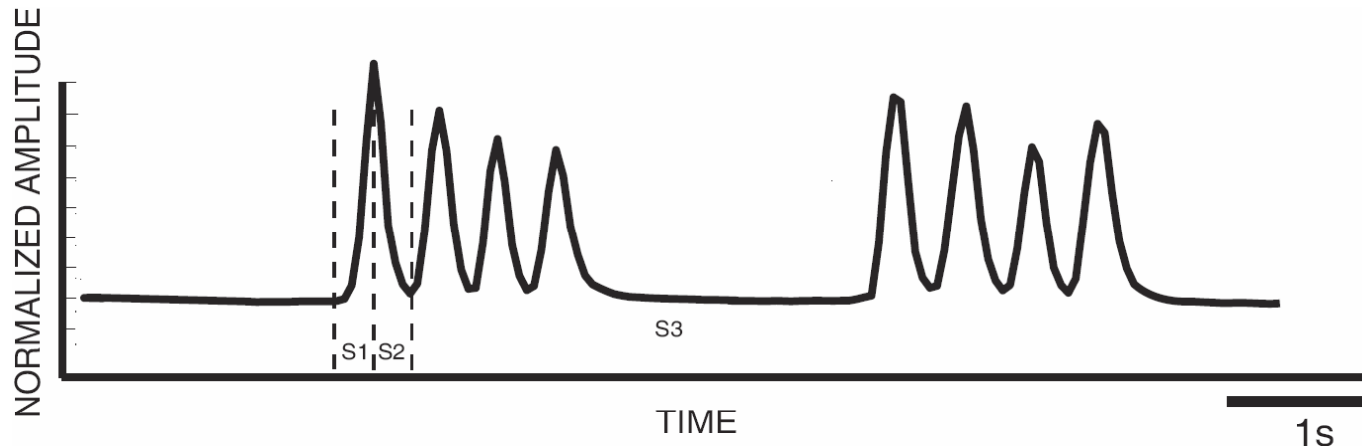**Goal**: Decoding finger flexion from ECoG signals

- ## Motivations
  - Existing decoding methods are mainly data-driven, ignoring anatomical and kinematic constraints on finger motion.

- ## Bayesian Decoding
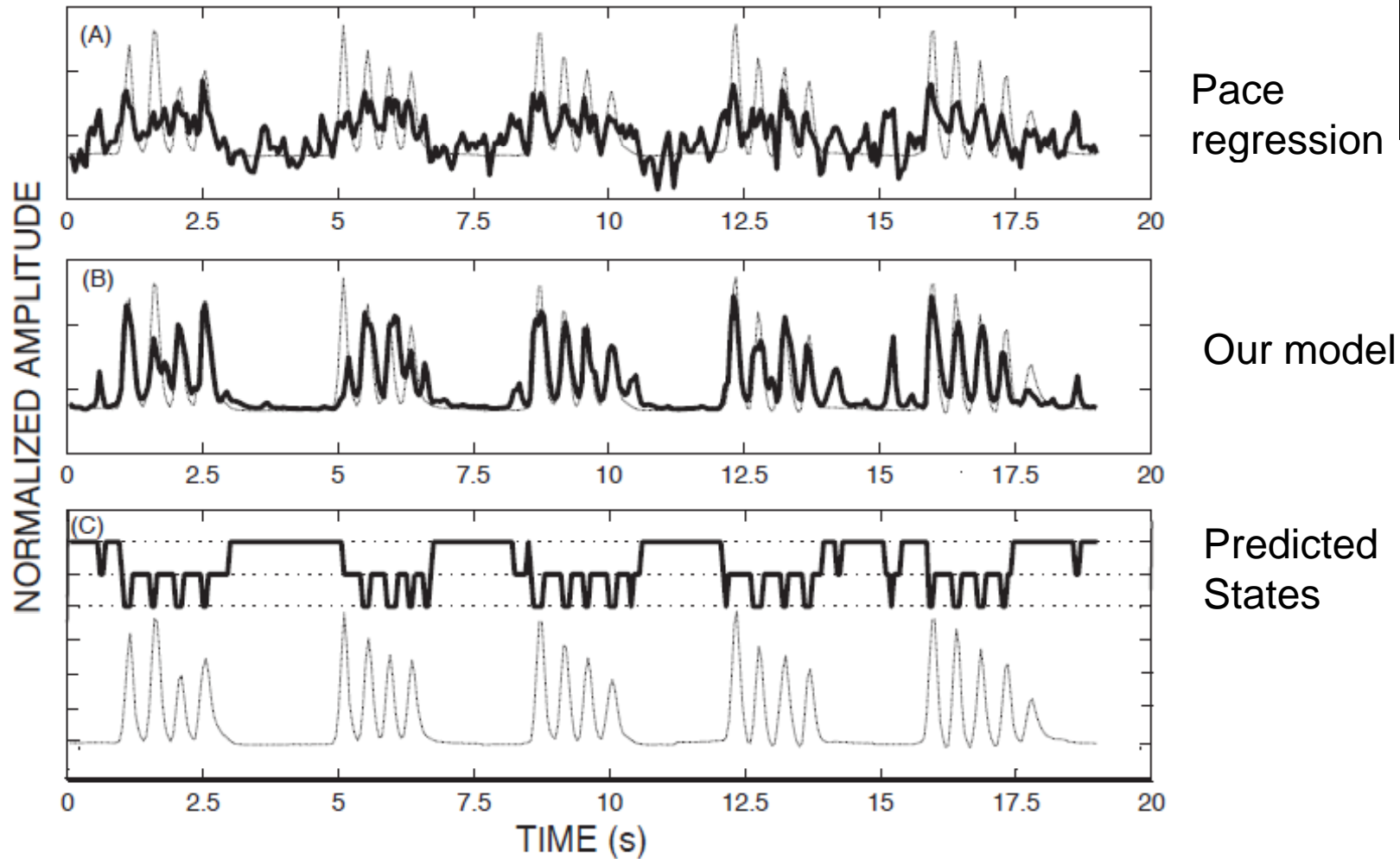
Anatomical and Kinematic Constraints

1. Three states: extension (S1), flexion (S2) and rest (S3)
2. For each state, there are predominant movement patterns
3. For S1 and S2, move faster at middle and slower at two ends
4. Finger movement is limited to certain ranges
5. The transition among states is limited
6. The probability of transitions depends on finger positions

Prior Model (SNDS)

States

Finger position

Measurement

KDE

Extension   Flexion

Rest
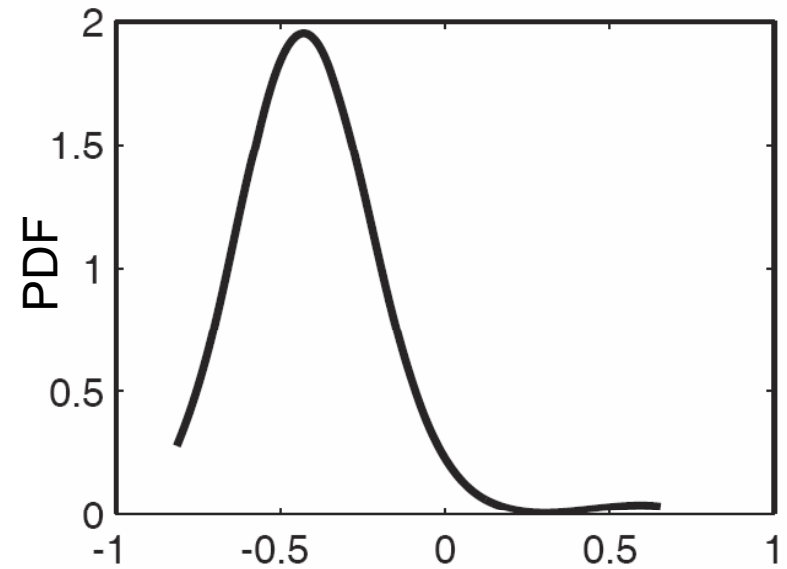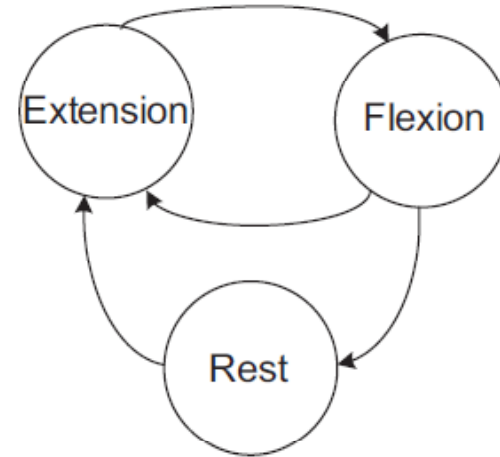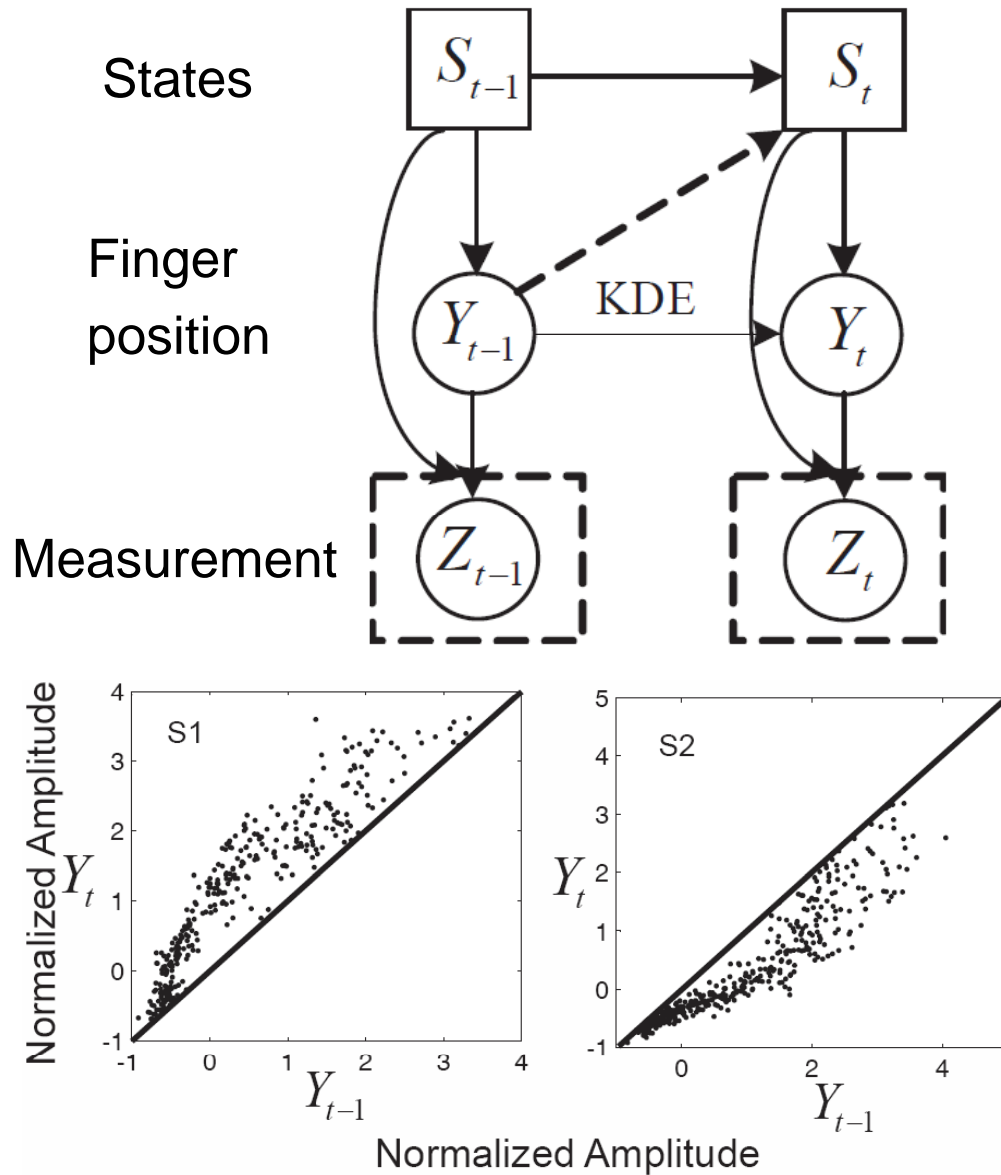
$P(Y_{t-1} \mid S_{t-1} = flexion, S_t = extension)$

Results

(A) Pace regression

(B) Our model

(C) Predicted States

NORMALIZED AMPLITUDE

TIME (s)

26% improvement over pace regression used
in the previous work in terms of MSE