Estimation of Clinical Tremor using ST-AAE

Li Zhang*, Vidya Koemahargyo, and Isaac Galatzer-Levy**
AiCure, New York

* Currently at Coveral Health, ** currently at facebook

BACKGROUND

• Clinical Tremor
  • Rhythmic, involuntary oscillatory movement
  • Diagnostic feature of multiple central system disorder
    • Parkinson's disease
    • Essential tremor
    • Medication side effect
• Monitor across diverse population with limited mobility
• Clear value in automated methods for remote assessments

WHY ST-AAE?

• Limitation of hand detection and tracking
  • Bounded by accuracy and robustness of underlying detection
  • Motion blurring, occlusions, and/or complex hand poses
  • End-to-end training frameworks should be more suitable
• Data collection challenges
  • Large amount data requires major effort, or not possible
  • Intra- or inter-observer variability
• Spatio-temporal adversarial autoencoder (ST-AAE)
  • Integrates spatial and temporal information
  • Adversarial generative subnetwork boosts learning
  • 3D Optical extracts only motion

Volunteer Data Collection

• Simulate tremor using an electronic pulse massager
  • 0 Hz, 4 Hz, and 10 Hz
  • 3068 segments of 53 videos from 28 subjects

Optical Flows at Different Frequencies

Ablation Study

Movement Model Validation: Volunteer Data

Clinical Data

• 33 clinical videos from 9 essential tremor patients
• Clinical videos were coupled with clinical TETRAS scores, from in-person and video-review