Computational Sensorimotor Systems Laboratory

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Computational Methods in Auditory Neuroscience

- Single Cell Modeling of Coincidence Detection
- MEG Analysis Methods
- Neural Coding in Auditory Cortex

Temporal aspects of neural processing
MEG — Magnetoencephalography

- Non-invasive technique
- Simultaneous Whole Head recordings (~200)
- Sensitive ~100 fT (10^{-13} Tesla) ~ 10^4 neurons
- Temporal Resolution ~ 1 ms
MEG Waveform & ICA

Independent Component Analysis

Analysis by Ahmad Gheith and Nikos Kanlis
Independent Component Analysis

Heart Beats

Magnetic Field (Tesla)

Time (sec)

Heart Beats

Magnetic Field (Tesla)

Time (sec)

Analysis by Ahmad Gheith and Nikos Kanlis
Cortical Surface EEG Before ICA

Moving Ripple: $w = 4\text{Hz}, \Omega = 0.4\text{ cycles/octave}$

Experiment 184s – recording mr.04.w4

Analysis by Nikos Kanlis
ICA & Cortical Surface EEG

Analysis by Nikos Kanlis
ICA Reveals Cortical Traveling Wave

Traveling wave succession

Analysis by Nikos Kanlis
MEG/EEG Methods

• Potentially Poor Signal to Noise Ratio (Neural Variability)

BUT...

• Access to Signal available via clever methods
  • Independent Component Analysis
  • Spectral and Spectro-Temporal Methods
  • Phase Correlational Methods
  • ???

• All methods require knowledge of underlying biology and neuroscience