**Course Description:** Analyzing the spectral content of the electroencephalographic (EEG) signal and using the analyses to address topics of student interest.

**Learning Outcomes:** Students will be able to understand and perform EEG spectral content analyses

**Textbook:** Analyzing Neural Time Series Data: Theory and Practice by Mike X. Cohen

**Meetings:** Fridays, 11:30 AM – 2 PM

**Course Content (SUBJECT TO CHANGE)**

|  |  |  |  |
| --- | --- | --- | --- |
| Week | Topic | Textbook Readings | [Lecturelets](http://mikexcohen.com/lectures.html) and [Brain Products Webinars](https://www.gotostage.com/channel/brainproducts) |
| 08/17 – 21 | Introduction and Time-Domain Analyses | Chapters 1 and 9  Review Chapters 2, 3, and 5 if necessary | Introduction to these lecturelets; Broad overview of EEG analyses; How to inspect time-frequency results lecturelets; The three most important equations in neural time series data lecturelets |
| 08/24 – 28 | Frequency and Time-Frequency Domain Analyses | Chapters 10 – 11 | The discrete-time Fourier transform lecturelets (*n* = 6)  Brain Products Spectral Analysis using FFT Webinar |
| 08/31 – 09/04 | Frequency and Time-Frequency Domain Analyses (continued) | Chapters 12 – 13 | Time-frequency analysis via Morlet wavelet convolution lecturelets (*n* = 9)  Brain Products Time-frequency analysis with wavelets |
| 09/07 –11 | Frequency and Time-Frequency Domain Analyses (continued) | Chapters 14 – 17 | Time-frequency analysis via other methods lecturelets (*n* = 5) |
| 09/14 – 18 | Frequency and Time-Frequency Domain Analyses (continued) | Chapter 18 | Normalization and time-frequency post-processing lecturelets (*n* = 6) |
| 09/21 – 25 | Frequency and Time-Frequency Domain Analyses (continued) | Chapters 19 – 21 |  |
| 09/28 – 10/02 | Spatial Filters | Chapters 22 – 24 | Surface Laplacian for cleaning, topological localization, and connectivity lecturelet  Brain Products Introduction to Source Analysis- Distributed Source |
| 10/05 – 09  No Class |  |  |  |
| 10/12 – 16 | Connectivity | Chapters 25 – 27 | Connectivity lecturelets (*n* =3) |
| 10/19 – 23 | Connectivity (continued) | Chapters 28 – 31 | Brain Products Phase and connectivity analysis |
| 10/26 – 30 | Waveform Shape and Parameterizing Spectral Power | Cole & Voytek (2017)  Cole & Voytek (2019)  Haller et al. (preprint) |  |
| 11/02 – 06 | Delta Oscillations as Reward-Prediction Errors Signals and Theta Oscillations as Cognitive Control Signals | Cavanagh & Frank (2014)  Cavanagh (2015) |  |
| 11/09 – 13 | Alpha Oscillations in Inhibition and Attention | Michaelmann, Griffiths, & Hanslmayr (in press) |  |
| 11/16 – 20 | Beta Oscillations in Sensorimotor Processes | Engel & Fries (2010)  Van Wijk et al. (2012) |  |
| 11/23 – 27 No Class |  |  |  |
| 11/30 – 12/04 | Catch-Up/Wrap-Up |  |  |