

## **BSTA 751: Statistical Methods for Neuroimaging**

Overview. This course is intended for students interested in both statistical methodology, and the process of developing this methodology, for the field of neuroimaging. This will include quantitative techniques that allow for inference and prediction from ultra-high dimensional and complex images. In this course, basics of imaging neuroscience and preprocessing will be covered to provide students with requisite knowledge to develop the next generation of statistical approaches for imaging studies. High-performance computational neuroscience tools and approaches for voxel- and region-level analyses will be studied. The multiple testing problem will be discussed, and the state-of-the art in the area will be examined. Finally, the course will end with a detailed study of multivariate pattern analysis, which aims to harness patterns in images to identify disease effects and provide sensitive and specific biomarkers. The student will be evaluated based on 3 homework assignments and a final in-class presentation.

### Course textbook:

- Moo K. Chung, Statistical and Computational Methods in Brain Image Analysis
- Hernando Ombao, Martin Lindquist, Wesley Thompson, John Aston, Handbook of Neuroimaging Data Analysis

### Course format:

- This course will have a hybrid lecture/seminar format, with Drs. Shinohara and Shou presenting lectures and several guests who will describe important aspects of imaging statistics from their perspectives as engineers, computer scientists, and other neuroscientists.

### Participating faculty and their roles

- Russell Shinohara and Haochang Shou will serve as course directors and lecturers.

Course unit: 1.0 course unit.

### Number of contact hours per week-and proposed days of the week:

- The course will consist of two 1.5 hour lectures each week on **Tuesday** and **Thursday**.

### Course materials:

- Course materials will include course notes that concentrate on background knowledge about image processing, and functional and structural imaging analyses, and recent advances in the field of imaging statistics.

### Prerequisites

- BSTA 651, BSTA 620, BSTA 621 or equivalents and permission of the instructor.

Students the course is expected to attract:

- This course is expected to attract students from the second year and above in their PhD program, and will likely include students in GGEB as well as perhaps students in other groups, such as Bioengineering and Applied Mathematics, who meet the prerequisites.

Enrollment limits and whether certain students will be given priority

- This course will be open to 20 students, and BGS students will be given priority.

Evaluation of student performance:

- Students will be evaluated based on 3 homework assignments and a final in-class presentation.