CE Course Proposal Summary

# Presenters

1. (Presenter 1, **Course Contact**) John Muschelli, PhD Assistant Scientist in Biostatistics Johns Hopkins Bloomberg School of Public Health Baltimore, Maryland Email: [jmuschel@jhsph.edu](mailto:jmuschel@jhsph.edu)
2. (Presenter 2, **Course Contact**) Kristin Linn, PhD Assistant Professor of Biostatistics Department of Biostatistics, Epidemiology, and Informatics University of Pennsylvania, Philadelphia, PA

# Course Length:

1 Day Course (7 contact hours)

# Co-sponsorship:

Co-sponsor: Biometrics Section of the ASA

# Course Information:

Course Title: Neuroimaging Analysis within R

## Abstract

In the neuroimaging community, there is a diverse and large set of software tools currently being used by analysts and researchers. There have been great strides in standardizing the syntax for multiple pieces of software, yet many of these languages do not have the statistical sophistication demanded to solve cutting-edge problems. R is a programming language that has the state of the art statistical tools that are relevant to imaging analysis. With the rapid and increasing number of open-access neuroimaging datasets, there is a void for an analysis framework that (1) is reproducible and can deal with high-dimensional data structures, (2) is open-access and accessible to a large community, and (3) provides the best environment to perform fast and advanced statistical methods needed for such complex data. In this tutorial, we will provide tutorials on how to use R for structural magnetic resonance imaging (MRI) analysis. We will show how to perform entire analysis in R, from the raw scans to the statistical analysis after image preprocessing. This course will use a real multiple sclerosis dataset and will go from raw image files to performing multiple sclerosis lesion classification.

Materials are located at: <http://johnmuschelli.com/imaging_in_r/> for the course.

## Course Outline

Course materials available to participants (website, handout and its index, videos)

The topics to be cover in the course are as follows:

1. Introduction to the Statistical Software R
2. Read and Write Images
3. Visualization
4. Inhomogeneity Correction
5. Brain Extraction
6. Image Segmentation
7. Coregistration Within and Between MRI Studies
8. Intensity Normalization
9. Harmonization of mutli-site datasets

## Course Learning Objectives

Learning outcomes (performance objectives)

After the short course, participants will be able to: - Work with NIFTI files R, including reading, writing, and manipulating images in this format. This format is one of the most common formats in neuroimaging research - Visualize images in R. - Apply appropriate algorithms implemented in various R packages to pre-process images in preparation for later statistical analyses.  
- Be aware of common errors in the pre-processing pipeline and identify appropriate ways to address them. - Be comfortable with using R to analyze neuroimaging data. - Discuss the state of the art in statistical analysis in structural and functional neuroimaging data

# Presenter Background:

John Muschelli is a Research Assistant Professor in the Department of Biostatistics at the Johns Hopkins Bloomberg School of Public Health. His research has been published in a diverse set of outlets ranging from the Lancet, R Journal, NeuroImage, and Stroke. He has been developing a framework for integrating medical imaging analyses into the R statistical lanaguage. His research has been on patients with hemorrhagic stroke, multiple sclerosis, and

Kristin Linn is an Assistant Professor of Biostatistics in the Department of Biostatistics, Epidemiology, and Informatics at the University of Pennsylvania. She has been working on developing statistical methods for neuroimaging data for the past three years resulting in publications in both statistical and neuroimaging journals. In addition, her applied work has spaned multiple disease areas including Alzheimer's disease, Multiple Sclerosis, Depression, and neurological development in adolescence.

## AV Request:

No additional equipment is required other than wireless internet and a projector.