Quantitative mapping of structural and functional connectivities in the human brain via non-invasive neuroimaging offers an exciting and unique opportunity to understand brain architecture. A basic question arises when attempting to define and map structural and functional connectivities: how to define and localize the best possible Regions of Interests (ROIs) for brain connectivity mapping? Essentially, when mapping brain connectivities, ROIs provide the structural substrates for measuring connectivities within individual brains and for pooling data across populations. Thus, identification of reliable, reproducible and accurate ROIs is critically important for the success of brain connectivity mapping. This presentation will discuss several major challenges in defining optimal brain ROIs and share a few thoughts based on our own experience [1-7] on how to deal with those challenges.

Figure 1. (a): Local activation map maxima (marked by the cross) shift of one ROI due to spatial volumetric smoothing in a working memory task [1]. The top one was detected using unsmoothed data while the bottom one used smoothed data (FWHM: 6.87 mm). (b): The corresponding fibers for the ROIs in (a). The ROIs are presented using a sphere (radius: 5mm). (c): Activation map differences between the group (top) and one subject (bottom). The highlighted boxes show two of the missing activated ROIs found from the group analysis.

References:
2. Tuo Zhang, Lei Guo, Kaiming Li, Changfeng Jing, Yan Yin, Dajing Zhu, Guangbin Cui, Lingjiang Li, Tianming Liu, Predicting Functional Cortical ROIs via DTI-derived Fiber Shape Models, in press, doi: 10.1093/cercor/bhr152, Cerebral Cortex, 2011.
6. Kaiming Li; Lei Guo; Carlos Faraco; Dajiang Zhu; Hanbo Chen; Yixuan Yuan; Jinglei Lv; Fan Deng; Xi Jiang; Tuo Zhang; Xintao Hu; Degang Zhang; Lloyd Miller, Tianming Liu, Visual Analytics of Brain Networks, in press, NeuroImage, 2012.