**Abstract for GR-TR Conference on Statistical Mechanics and Dynamical Systems**

Talk Invited Invited Talk

# Quantization and Analysis of Morphometric Changes in Brain Tissues due to Neurodegenerative Diseases

Elvan Ceyhan*

Department of Mathematics, Koc University, Istanbul-Turkey
* Electronic Address: elceyhan@ku.edu.tr

Neuropsychiatric disorders have been demonstrated to manifest shape differences in brain tissues, e.g., in cortical structures. Many tools are available to quantize the changes in the morphometry (shape and size) of the brain tissues due to a disease (over time). I will only present two such tools, Labeled Cortical Distance Mapping (LCDM) and Large Deformation Diffeomorphic Metric Mapping (LDDMM). LCDM is a powerful tool in quantifying such morphometric differences and characterizes the morphometry of the laminar cortical mantle of cortical structures. Specifically, LCDM data are distances of labeled gray matter (GM) voxels with respect to the gray/white matter cortical surface. On the other hand, the LDDMM algorithm can be used to quantize changes in a brain tissue due to a mental disease. LDDMM provides (i) a metric distance to quantize the morphometric differences and (ii) dense one-to-one correspondence vector fields between hippocampal shapes. These algorithms provide information on different aspects of morphometry. As illustrative examples, I will present the analysis of GM in the ventral medial prefrontal cortex (VMPFC) in subjects with major depressive disorder (MDD), subjects at high risk (HR) of MDD, and healthy subjects. Also, I will present the use of LDDMM to analyze changes in hippocampal morphometry due to very mild dementia of Alzheimers type. Our analysis indicates that these tools can be powerful in detecting differences in morphometry of brain tissues.