YEDITEPE UNIVERSITY
Department of Biomedical Engineering

SEMINAR

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Engineering Building B-310

Visualization of Neurotransmitter Receptor Densities in 3-D in a Rat Brain

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Despite the extensive developments in the 3-D biomedical imaging technology, high resolution autoradiography is still the reference method of validating in-vivo functional results.

In our study, a rat brain is coronally sectioned with 20 µm section thickness. The auto-radiographic images are obtained for 18 different neurotransmitter receptors. All data are digitalized by a high resolution color camera. A high resolution MR (9.4 Tesla, isotropic 90 µm) of a post mortem rat brain is acquired as a 3-D reference brain. Unlike previous studies, we simplify the multi-modal image registration problem by generating masks of images obtained for each modality. The generated masks are registered by a linear 2-D rigid transformation using the ITK toolkit. The mean sum of squared differences is used as the measure of dissimilarity. The data to be visualized are of two different resolutions: (1) the reference brain data (90 µm/slice) and (2) the autoradiographic data (20 µm/slice). At that point one encounters the problem of varying scales in visualization. As a solution to this problem we merge the respective auto-radiographic data into an empty image stack of the same resolution and remove the suitable number of slices to mimic the "thickness" of a single MR slice. In case the image to be removed contains the desired auto-radiographic data, a neighboring slice is removed. The in-plane resolution is reduced during the application of the computed transformations.

Biography

Mehmet Eylem Kirlangic received his PhD degree in Biomedical Engineering from the Technische Universitaet Ilmenau, Germany, as a scholar of the German

Academic Exchange Service (DAAD) in 2005. His BS and MS degrees are in Electrical and Electronics Engineering and Biomedical Engineering of Bogazici University, respectively. He was with the Department of Stereotaxic and Functional Neurosurgery at the University Clinic Cologne, and thereafter, with the Department of Psychiatry and Psychotherapy at the University Clinic RWTH Aachen as a post-doc researcher. During his PhD, Dr. Kirlangic contributed to an EEG-biofeedback system which is based on a brain-computer-interface, and is designed to present the electrical activity of the brain back to the user in terms of visual and/or acoustic components. This system has been awarded the German Innovation Prize 2004 for Biomedical Engineering given by the Stiftung Familie Klee, and is now being distributed by the NeuroConn Company (http://www.neuroconn.de/neuroprax_en/). As an early post-doc, he contributed to the development of a novel deep brain stimulator which was nominated for the German Future Prize given by the Federal President in 2006. Dr. Kirlangic is currently with the Institute of Neuroscience and Medicine – Molecular Organization of the Brain (INM-2) at the Research Center Juelich in Germany. His research interests include biomedical signal and image processing, non-linear dynamics and fractal modeling, and synergetics. He is a member of the German Electrical Engineers Association (VDE) and of the IEEE – Engineering in Biology and Medicine Society.