Multimodal Image Retrieval for Neurodegenerative Diseases

Project Management and Software Development for Medical Applications

General Info

Project Title: Multimodal Image Retrieval for Neurodegenerative Diseases
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Project Abstract

Advanced image retrieval plays an important role in the diagnosis, longitudinal tracking and therapy follow up of neurodegenerative diseases such as its two most common representatives Alzheimer’s disease and Parkinson’s disease.

The goal of this project is to upgrade an existing multimodal database for neurodegenerative diseases at Klinikum r. d. Isar (TUM hospital) with conventional and advanced image retrieval algorithms.

Background and Motivation

Increased prevalence of neurodegenerative disorders have become one of the most important medical and social concerns in our aging society. Neuroimaging using positron emission tomography (PET) and magnetic resonance imaging (MRI) is now widely applied to localize and quantify early abnormalities of brain function, especially as new hybrid PET/MR systems capable of simultaneous PET and MRI data acquisition became available. One main focus of current research is to identify and optimize multimodal neuroimaging biomarkers that enable early detection of the disease, even before the manifestation of clinical symptoms. This research relies on powerful database tools to handle large multimodal imaging datasets and to quickly identify subjects matching diverse and complementary criteria. Multivariate analysis based on multimodal imaging has been reported of great potential for supporting early diagnosis and differential diagnosis of neurodegenerative diseases. During last years, an effective database of neurodegenerative diseases has already been established at TUM. To assist further clinical research and diagnosis of neurodegenerative disorders with multimodal neuroimaging advanced image retrieval algorithms are desired to upgrade and optimize this database.

Student’s Tasks Description

The student is expected to implement two functions on an existing database of neurodegenerative diseases at the Dept. of Nuclear Medicine, Klinikum r. d. Isar (TUM hospital). The first function is to support multimodal input of the database. The second function is to support at least one feature of multimodal image retrieval.

The student is expected to work closely with our clinical experts (Prof. Sibylle Ziegler, PD Dr. Stefan Förster). Intentions of further long term student job, master thesis and PhD study are strongly encouraged.
Technical Prerequisites

Good knowledge of Java and Matlab. Knowledge in machine learning/ image processing would be beneficial.

Administrative Info

Working Time: 100h
Project Location: Klinikum rechts der Isar
Required Equipment: Laptop

Timeline and Milestones

Step 1 (1 month): get familiar with literature and the existing database
Step 2 (1 month): implementation of the function of multimodal input for the database
Step 3 (1-2 month): implementation of at least one multimodal retrieval function for the database
Step 4 (2 weeks): summary and presentation

References

Sun L, et al. (2009) Mining Brain Region Connectivity for Alzheimer’s Disease Study via Sparse Inverse Covariance Estimation, KDD 09