



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 of 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

Habeck, C. et al. (2008) Multivariate and univariate neuroimaging biomarkers of Alzheimer's disease. *NeuroImage* 40, 1503–1515

Moeller, J.R. and Strother, S.C. (1991) A regional covariance approach to the analysis of functional patterns in positron emission tomographic data. *J. cereb. Blood Flow Metab.* 11, A121–135

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

