

MR Image texture analysis applied to the diagnosis of Alzheimer's Disease

By

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Problem Definition:

Is it possible to classify MRI data of the hippocampus into groups of healthy controls vs Alzheimer's patients, using a predefined set of image texture metrics, with an accuracy greater than 80%?

Data:

Labeled MRI data (3D volumes) of subjects from both groups (50 of each) are provided, along with subject specific voxel masks identifying both left and right hippocampal regions.

Method:

Features from Texture

The grey-level co-occurrence matrix (GLCM) texture measures will be used as a baseline, and for comparison against previous work in the field.

A set of parameters (distance, angle) suitable for the size of the brain region will be pre-selected.

A selection of summary statistics calculated from the GLCM will be used as features for classification.

At least one other texture measure will be chosen after a literature search.

Classifiers

KNN classifier, with and without centering/normalization.

Classification will be performed in a leave-one-out cross-validation scheme.

Analysis

Statistical analysis of results to assess classification accuracy.

Assessment of classifier performance (is it overfitting?)

Comparison of results against previous studies.

Comparison of 2D GLCM vs 3D GLCM.

Comparison of GLCM and the alternative texture measure.

Implementations – texture

Code to employ existing 2D GLCM routines to the data.

Code to employ existing summary statistics to the GLCM matrices.

New implementation of GLCM in 3D (standard toolboxes only work for 2D data).

New implementation of the complete set of GLCM summary statistics (as reported in Freeborough 1998), as most toolboxes only generate a subset of these.

Code to employ (at least one) existing alternative texture measures.

New implementation of one (or more) alternative texture measures.

Implementations – classifier

New implementation of the KNN classifier

New implementation of the cross-validation framework.

Timeline:

- One week on literature review
- Two weeks on texture features
- Mid-way rapport turned in
- One week on coding classifiers
- One week on calculations
- Two weeks on iterative correction of code due to bugs and recalculations
- Two weeks of analysis of results
- Report writing will be ongoing throughout the entire project.
- This leaves us with three weeks to finalize the report and buffer for unexpected time delays.

For the deadline we will have a program that can take some MRI data as input and then be able to tell if the person has AD or not.

As minimum we need a computer and MATLAB to be able to make the calculations and perhaps python

To be able to make machine learning on the data, we need to process some image texture analysis

Workload:

The time usage will be minimum 25 hours per week per person. That includes reading and research and not just coding and testing.