DEVELOPMENT OF METHODS FOR MRI LONGITUDINAL STUDIES

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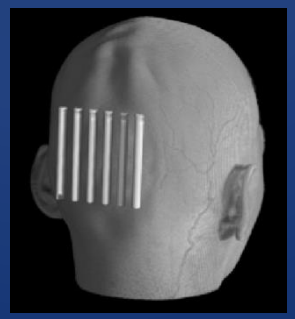
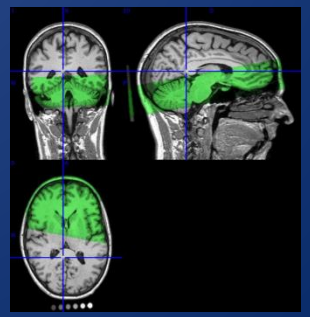
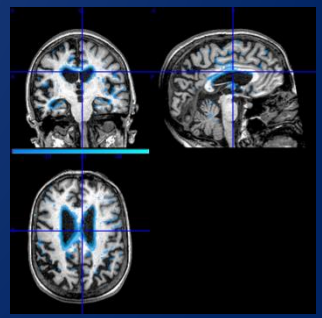






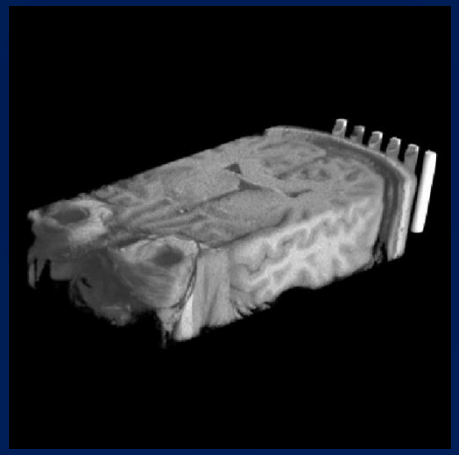
Introduction

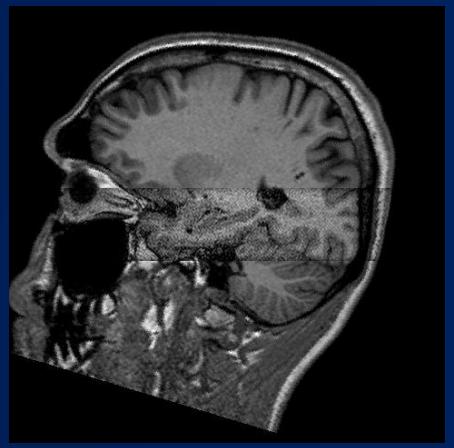
- MRI longitudinal studies have been proposed to detect abnormal brain changes in the early phase of the Alzheimer's disease (AD) during its asymptomatic phase.

- In order to obtain a very high sensitivity in MRI longitudinal studies a number of technical issues have to be addressed.

Materials and Methods

- A high resolution MRI protocol focused on the medial temporal lobe mainly conceived for 1.5T MRI device is developed.





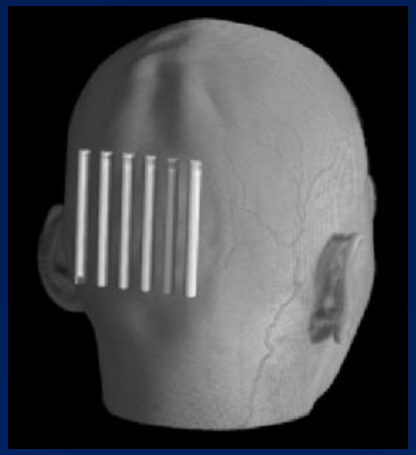
- A grey-level reference object was designed to be used during acquisition to help image post-processing when gray-level comparison is required.

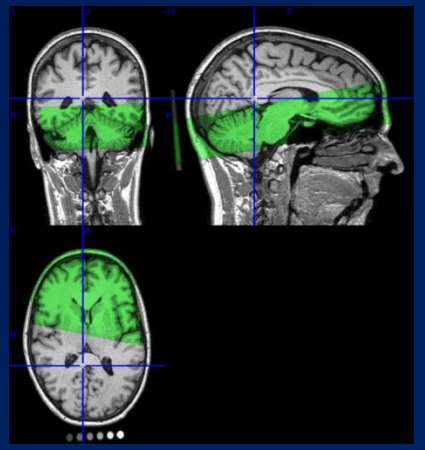
Materials and Methods

- An image analysis protocol for longitudinal studies has been developed, including pre-processing (gray level normalization, image registration) and voxel-based time-course analysis.
- The protocol has been tested on the MIRIAD dataset.

Results

- A specific reference object was designed and used during the scans in order to help the images post-processing when a gray-level comparison is required.
  - It is a polycarbonate 90x80x10 mm^3 reference object where 6 inclusions having 2 ml capacity were created.
  - Solutions based on Gadolinium were used, resulting in 6 absolute references suitable for gray-level calibration.





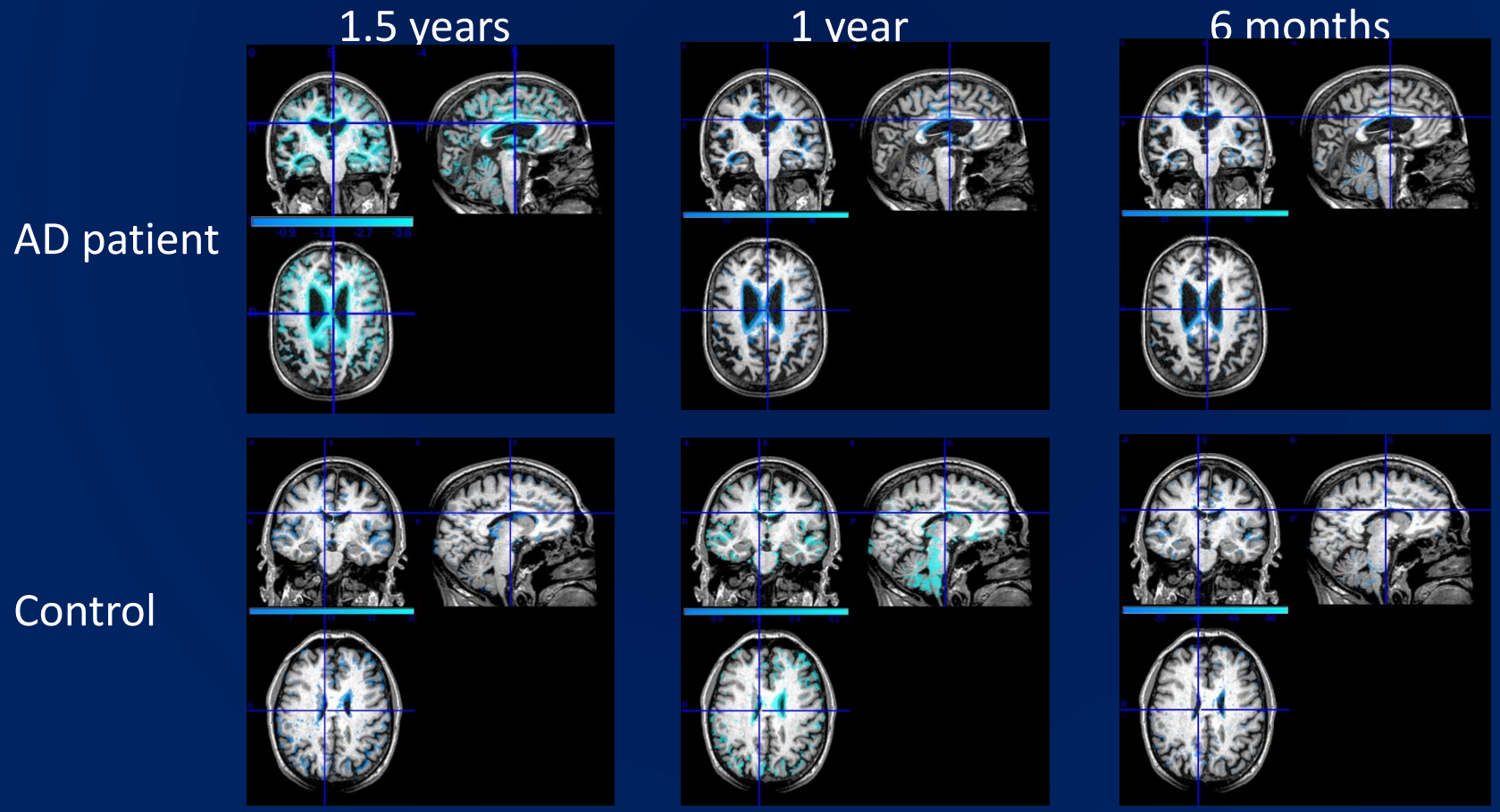
Results

- The new acquisition and gray-level normalization technique is applied in the prospective study on healthy volunteers ongoing in Trieste.

- Preliminary analysis demonstrate the increased reproducibility of the images, compared to the images of the MIRIAD data set.

Results

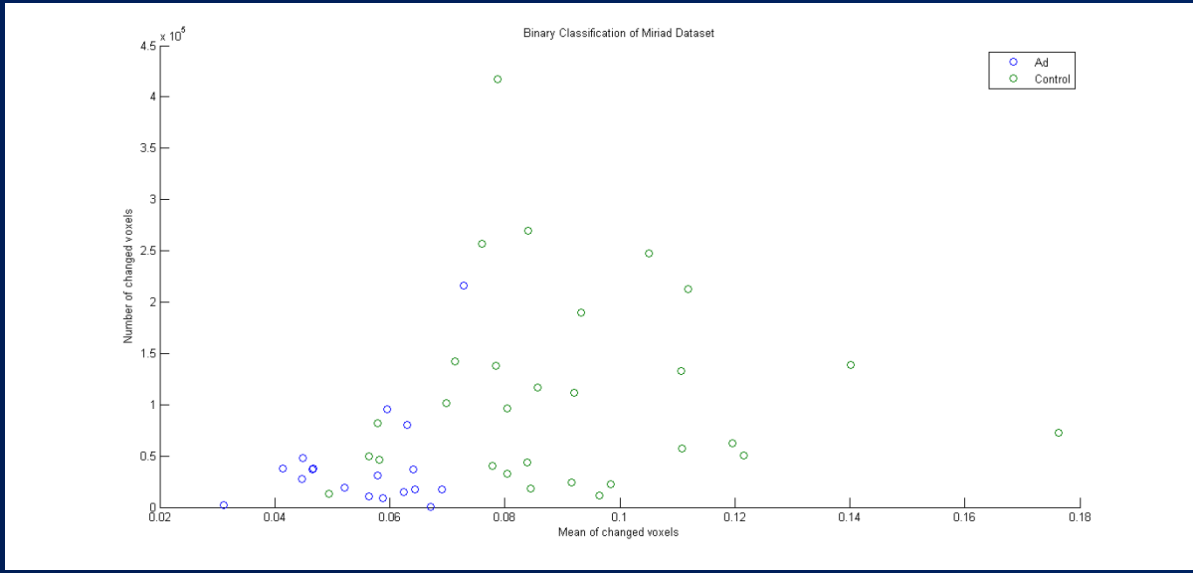
- The MIRIAD dataset has been used for preliminary study.
- The RMSE's of 3x3x3 voxels has been calculated in each exams and the linear regression have been obtained in repeated images over the time of the study (2 years)



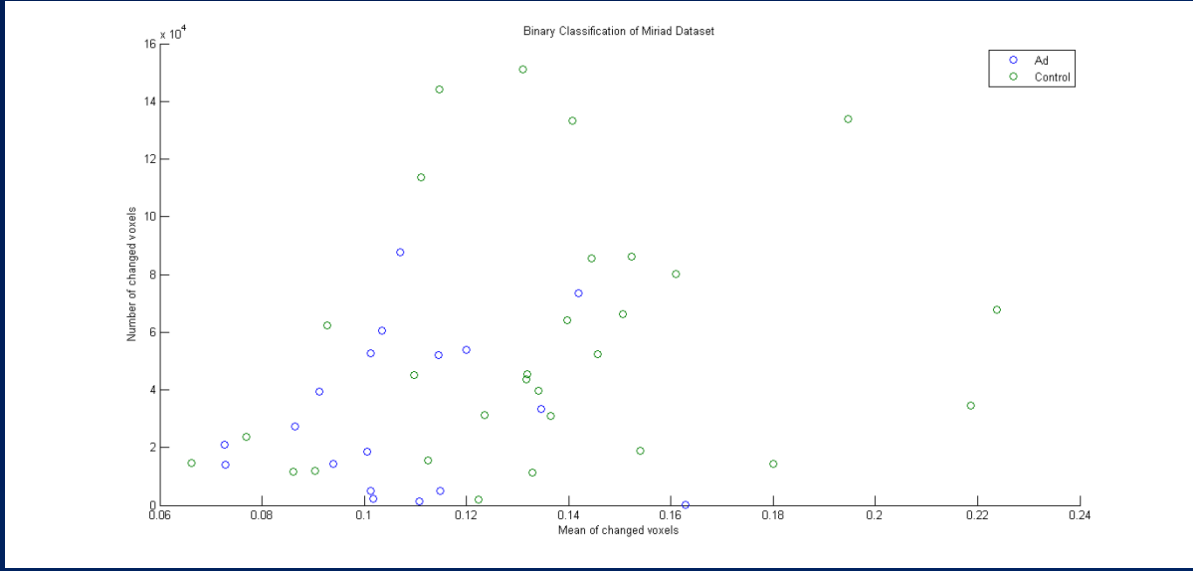
Results

Binary classification of Miriad dataset during 1 year and 6 months of longitudinal study.

1 year classification



6 months classification



Discussion

- The image processing developed for this study demonstrates that the time-course of brain atrophy let us differentiate normal and AD subjects with repeated images acquired in less than 2 years.

Discussion & conclusions

- We expect that repeated images with our acquisition and normalization protocol will allow the discrimination between normal and AD subjects with a reduced number of images acquired in a period of about one year.
- A prospective study on healthy volunteers is ongoing.