

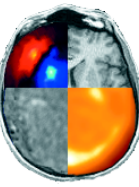


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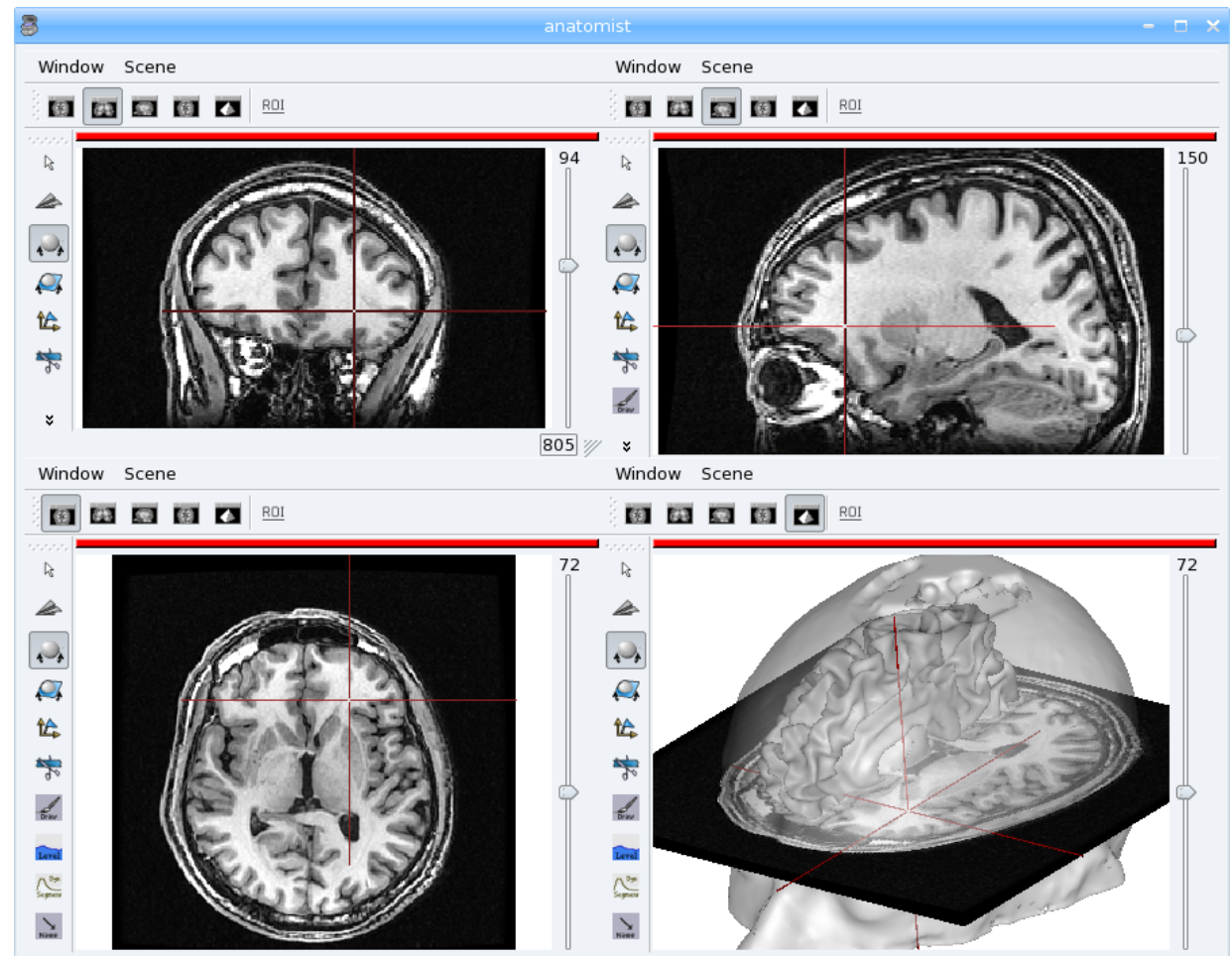
# **Morphologist Pipeline BrainVISA T1 MRI Toolbox**

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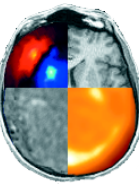
# Human brain T1 MRI image



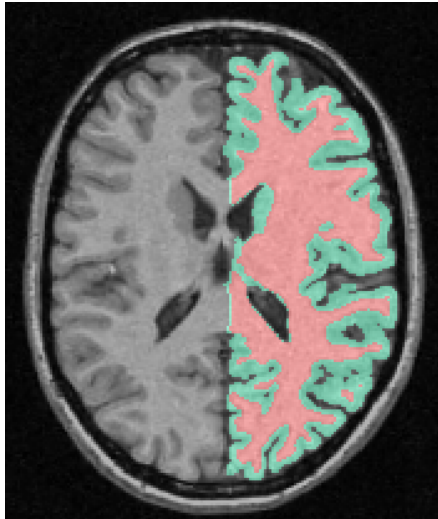
- T1 weighted image
- Anatomical image
- Contrast enable to distinguish tissue: values in white matter > gray matter > CSF



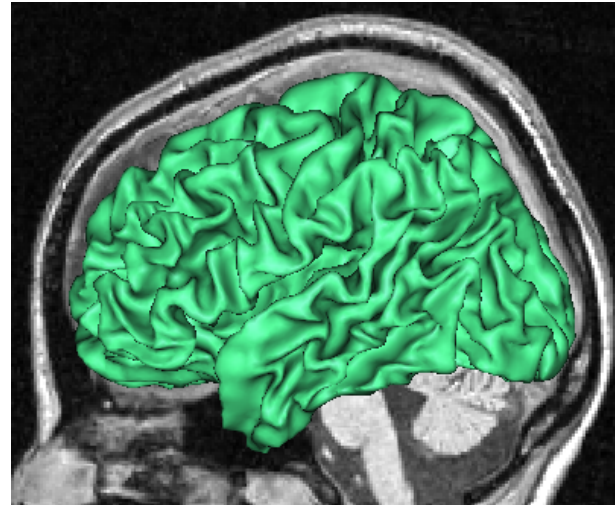
# T1 MRI processing



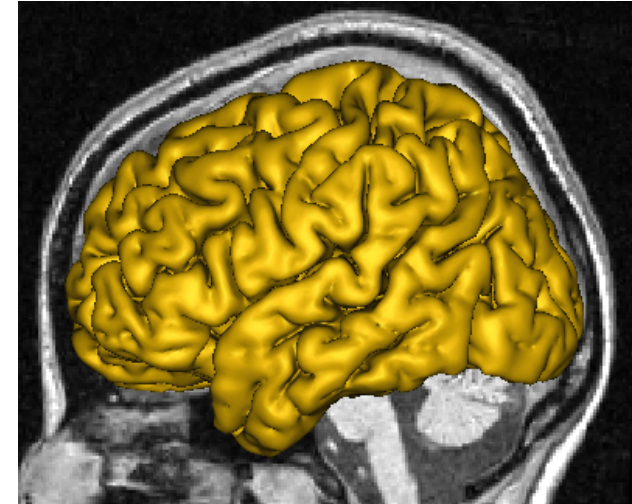
- BrainVISA T1 pipeline



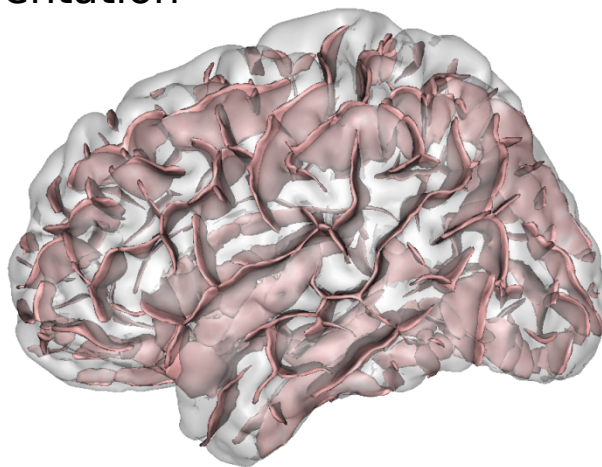
Grey white matter segmentation



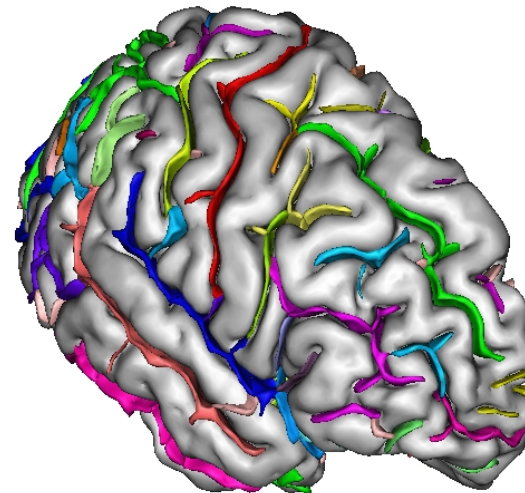
White matter mesh



Grey matter mesh

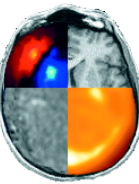


Cortical folds graph

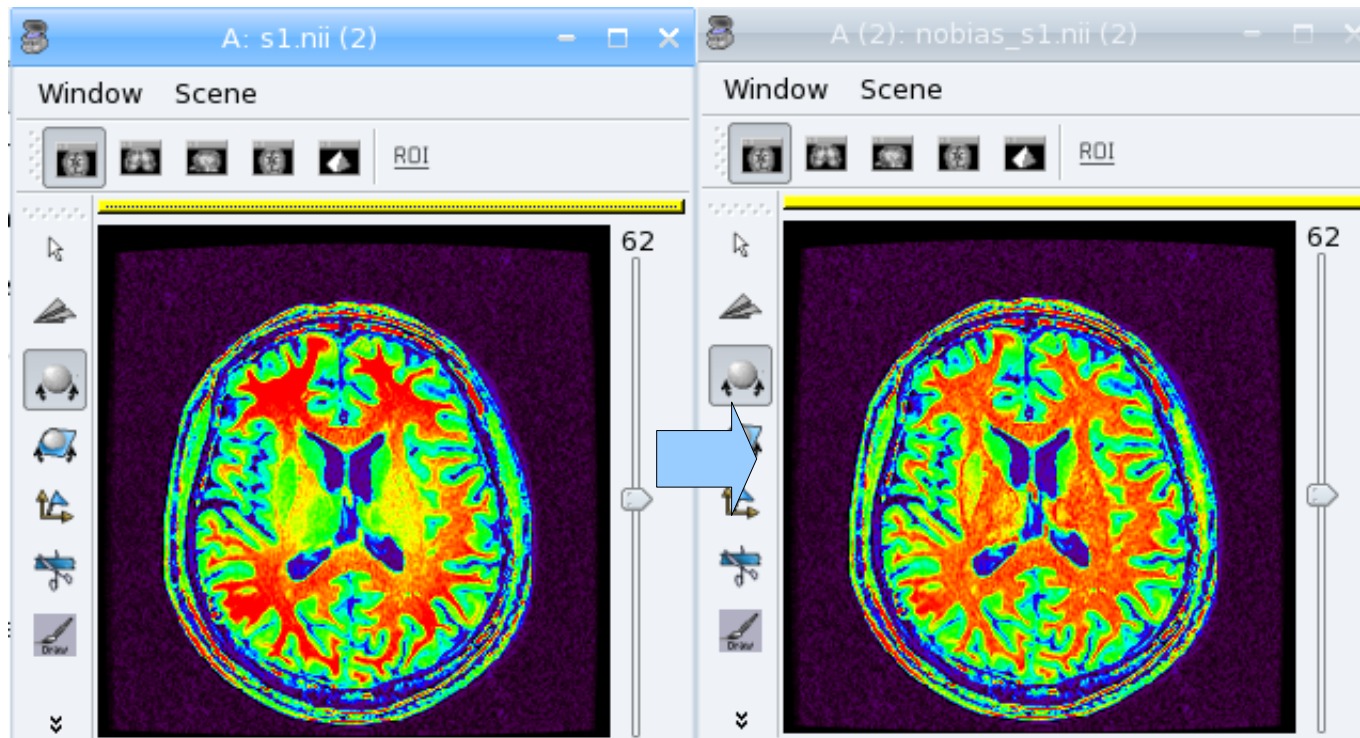


Automatically identified sulci

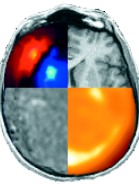
# Bias correction



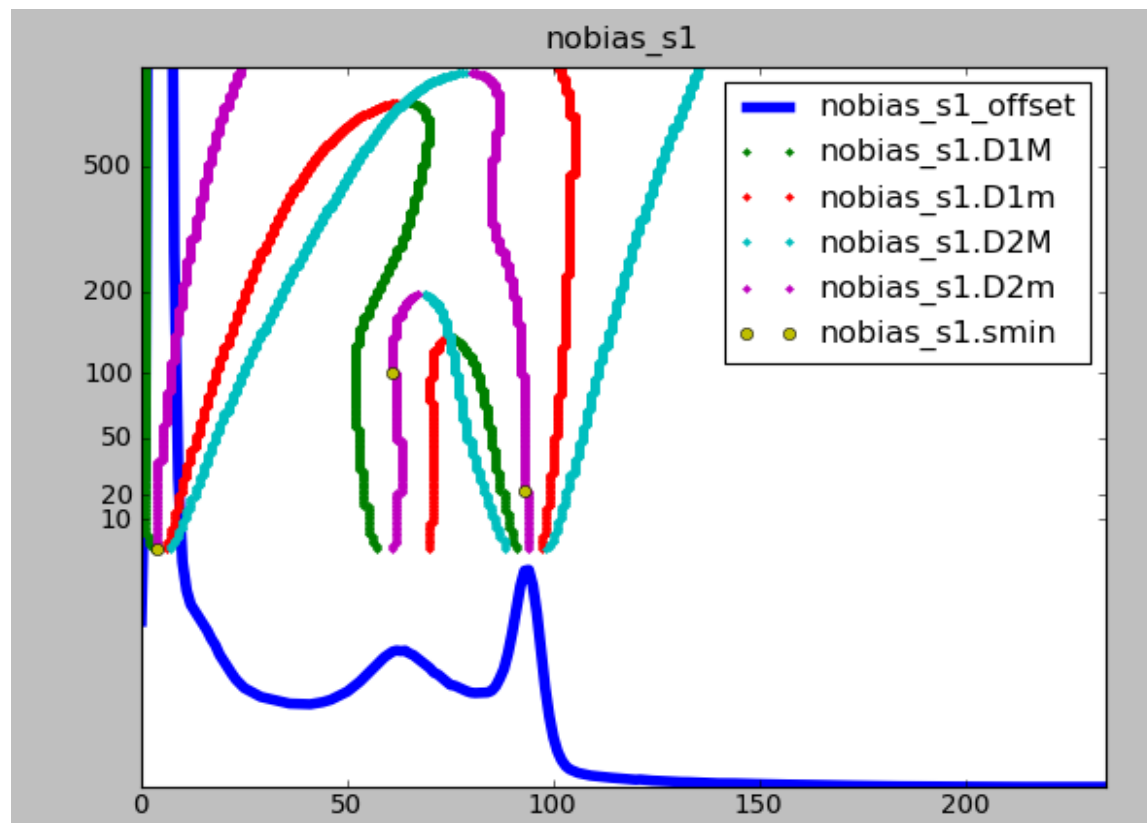
- Spatial bias correction in usual MR images
- Values in raw image not only depend on the tissue but also on the localization in the field of view => need to be corrected before segmentation
- Entropy minimization for automatic correction of intensity non uniformity, J.-F. Mangin, MMBIA (Math. Methods in Biomed. Image Analysis), Hilton Head Island, South Carolina, IEEE Press 162-169, 2000



# Histogram analysis

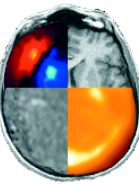


- Analyse a T1-weighted histogram to estimate grey/white statistics
- The histogram shape is variable : 3-5 peaks (background, grey, white, CSF, fat)
- Robust brain segmentation using histogram scale-space analysis and mathematical morphology, J.-F. Mangin, O. Coulon, and V. Frouin MICCAI, MIT, LNCS-1496, Springer Verlag 1230-1241, 1998

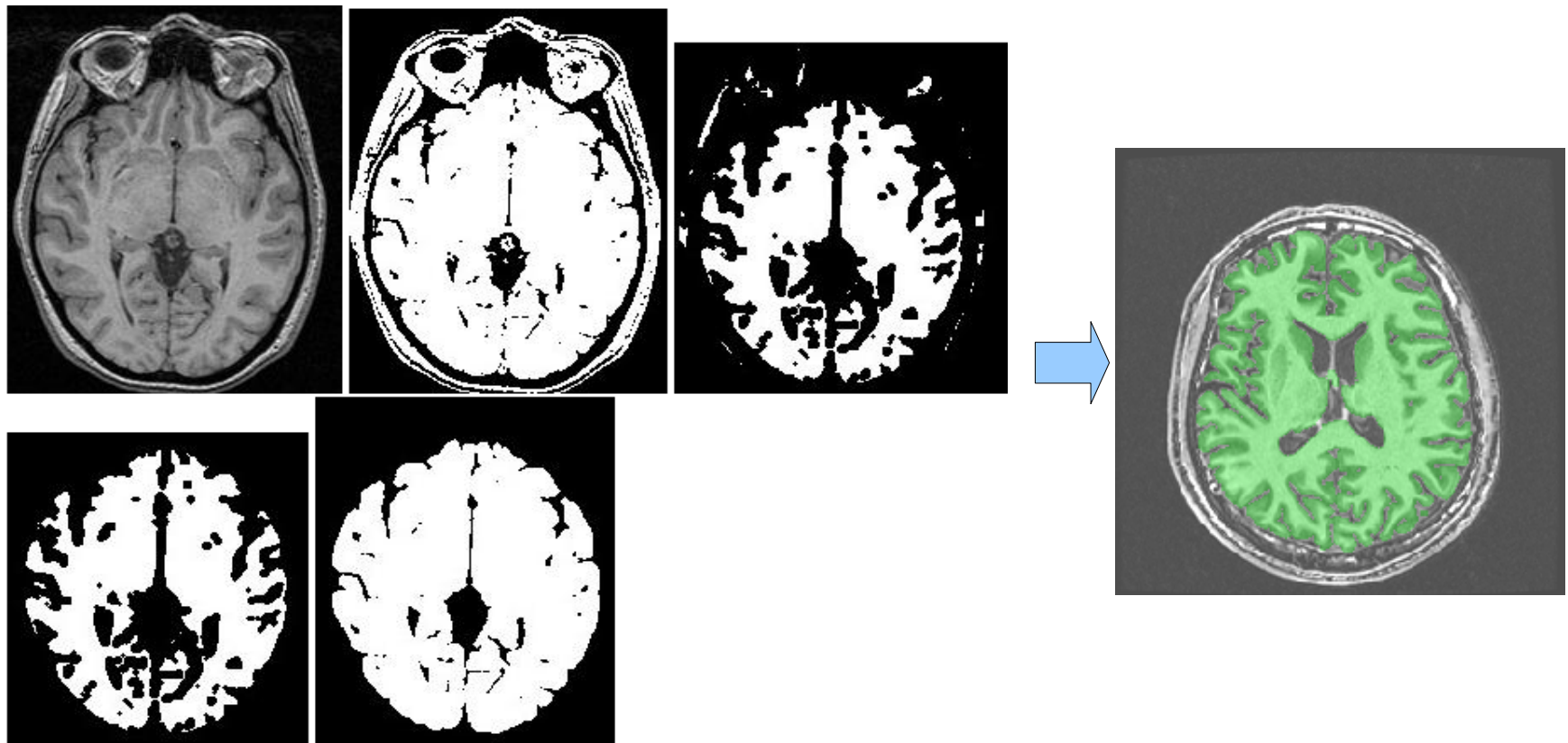




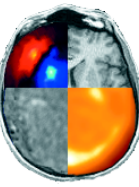
# Brain mask segmentation



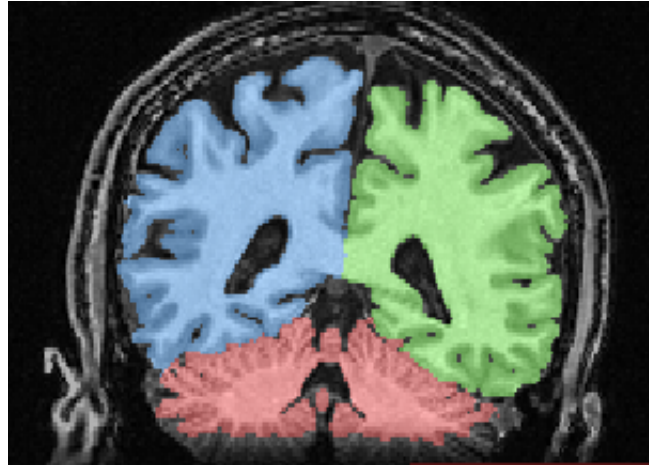
- Computes a binary mask of the brain from a bias corrected T1-weighted image
- thresholding – erosion - dilatation
- Robust brain segmentation using histogram scale-space analysis and mathematical morphology, J.-F. Mangin, O. Coulon, and V. Frouin MICCAI, MIT, LNCS-1496, Springer Verlag 1230-1241, 1998



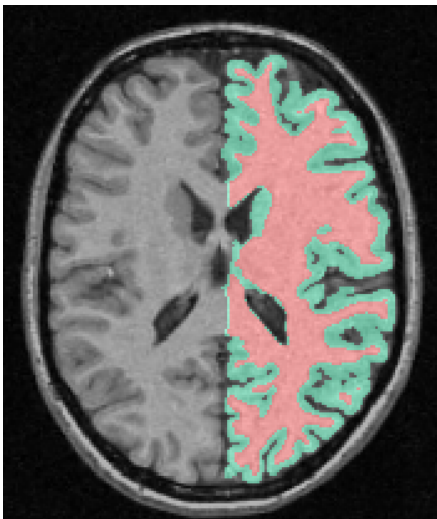
# Segmentation



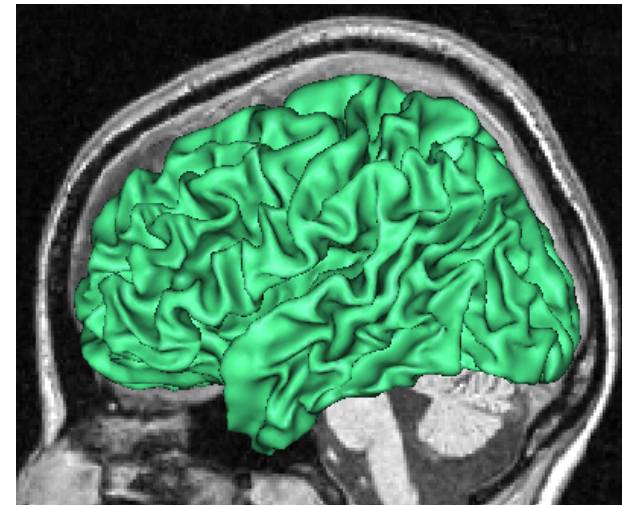
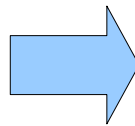
- Split Brain Mask: three parts: hemispheres + cerebellum/stem



- Grey / White interface

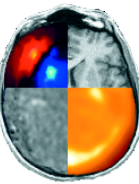


Grey white matter segmentation



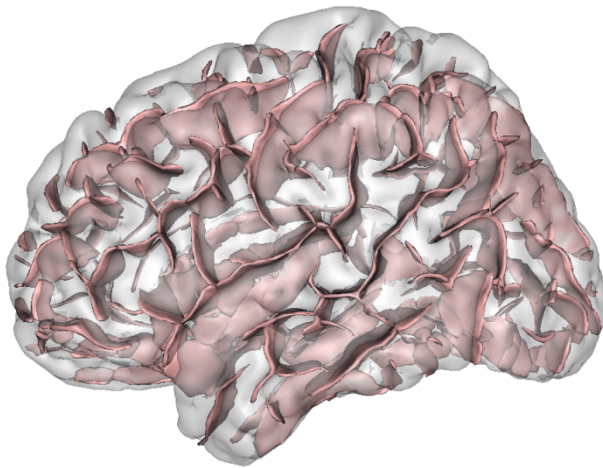
White matter mesh

# Cortical folds

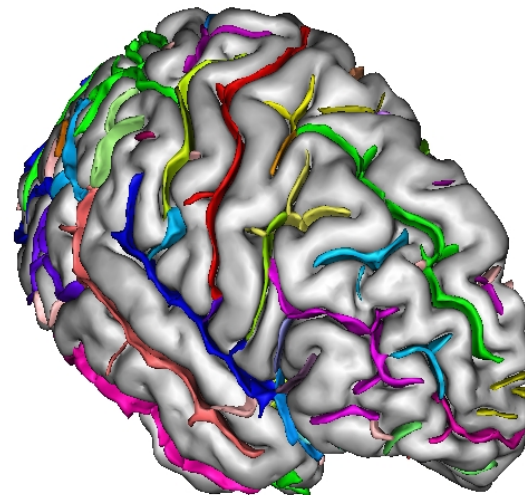


- Structural representation of the sulci folds: surfaces going inside the folds and neighbouring information.
- Automatic recognition of sulci. Several methods exist:
  - Abstract Neural Network (ANN) recognition
  - Statistical Probabilistic Anatomy Map (SPAM) recognition

M. Perrot, D. Rivière, A. Tucholka, and J.-F. Mangin. Joint Bayesian Cortical Sulci Recognition and Spatial Normalization. In Proc. 21th IPMI, LNCS-5636, Williamsburg, VA, pages 176-187, July 2009



Cortical folds graph



Automatically identified sulci