MedTech West

Quantitative structural brain connectivity analysis

Combining anatomical image segmentation and probabilistic tractography

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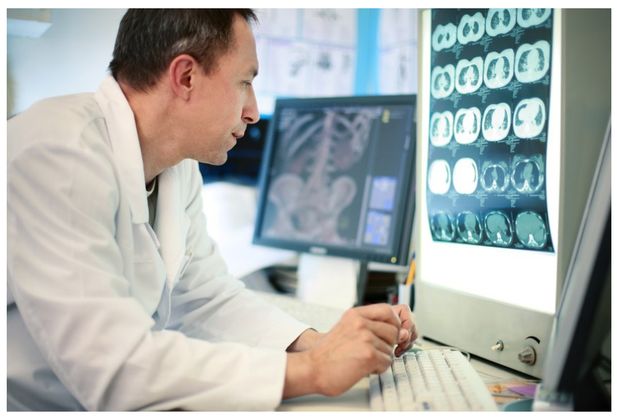
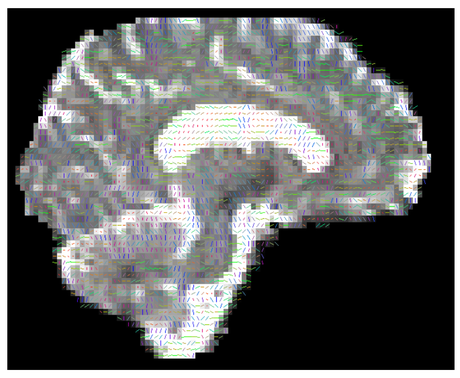
Visual image analysis



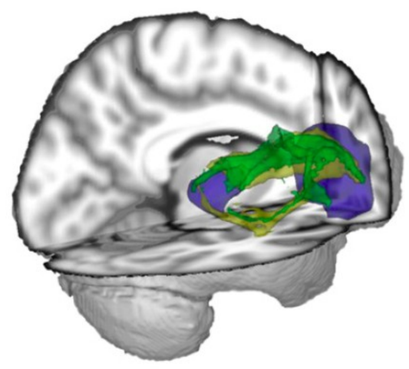
Medical images are exceedingly useful in clinical practice. The technologies, especially magnetic resonance imaging, is developing rapidly, producing more data per scan and becoming more accessible. This results in a flood of data that clinicians have to deal with. Visual analysis requires expertise and is laborious as well as subjective.

Tractography



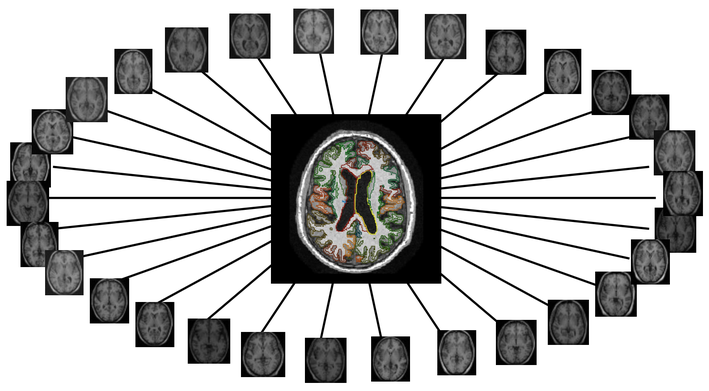
Diffusion-weighted MR images reflect preferential direction of diffusion within tissues

This information enables us to infer the location of tracts (connecting fibre bundles [3]). It also lets us quantify the connectivity between regions.



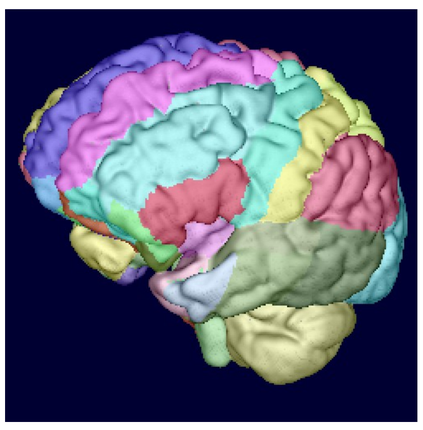
MAPER

T1-weighted MR images reflect anatomical structure accurately



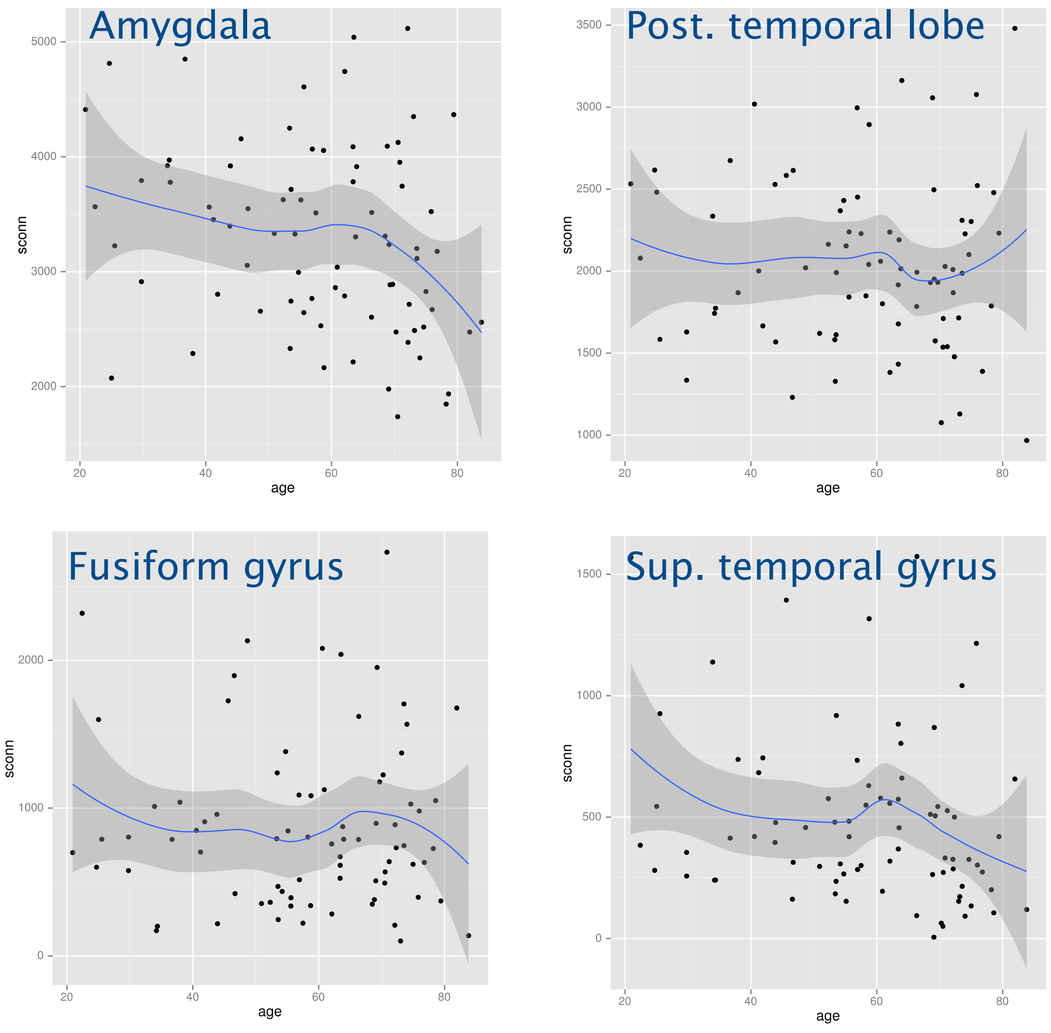
MAPER [1] (multi-atlas propagation with enhanced registration) segments structural MR images by propagating anatomical label information from multiple atlas sets to a target image.

The result is an accurate mapping of anatomical structures in three dimensions. MAPER is robust against changes due to ageing and dementia [2].



Preliminary Results

Connectivity of the hippocampus to selected other regions in a group of 79 healthy adults (age 21-84, median 61)



As expected, hippocampal connectivity to various regions declines with age.

References

[1] Heckemann RA, Keihaninejad S, Aljabar P, Rueckert D, Hajnal JV, Hammers A. Improving intersubject image registration using tissue-class information benefits robustness and accuracy of multi-atlas based anatomical segmentation. Neuroimage 2010

[2] Heckemann RA, Keihaninejad S, Aljabar P, Gray KR, Nielsen C, Rueckert D, Hajnal JV, Hammers A. Automatic morphometry in Alzheimer's disease and mild cognitive impairmentNeuroimage 2011

[3] Behrens TEJ, Johansen-Berg H, Jbabdi S, Rushworth MFS, Woolrich MW. Probabilistic diffusion tractography with multiple fibre orientations. What can we gain? NeuroImage,2007.

Acknowledgements

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The European Union via the Regional Development fund in support of MedTech West.
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Other funders (and, if needed, their logos) should be included here.

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