Master thesis proposals

Medical image processing & fMRI

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I can supervise master theses in

- fMRI (functional magnetic resonance imaging), studying brain activity and brain connectivity

- Medical image processing
  - Image registration
  - Image denoising
  - Image segmentation

- Machine learning in (medical) image processing

- GPU programming (graphics cards) for image processing (2D, 3D, 4D) and statistics
fMRI

• Started around 1992, some 40 000 papers published according to PubMed

• Study brain activity using MRI

• The blood has different magnetic properties at activity and rest, can be detected with a strong magnetic field (1.5 – 7 Tesla)
fMRI 1, Image distortions

• fMRI data are sensitive to imperfections in the magnetic field, leads to image distortions

• Investigate how correcting for the image distortions (using field maps) affects the brain activity maps

• How much easier does it become to register distortion corrected fMRI data to an anatomical T1 volume?

• Use fMRI data from OpenfMRI.org
Distortion correction

EPI unwarping (FUGUE)

Field map tells us where there are problems
Estimate distortion from field map and remove it
fMRI 2, Image registration

• For group analyses, all brains are normally registered to a brain template

• Compare linear and non-linear image registration for group analyses

• Can the brain activity itself be used to steer the image registration?

• Use fMRI data from OpenfMRI.org
Linear vs non-linear registration
Requirements, fMRI 1 & 2

- Course in basic image processing

- TBMI02 Medical Image Analysis (starts October 31st...)

- Matlab programming
Questions?

Contact me if you have another proposal
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