

Machine learning in fMRI

Registration

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 - Brain image registration in fMRI



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The registration problem I

- Registration:
 - Interesting for comparing or combining the information given by different images.
 - It is a problem often encountered in many application areas:
 - astro- and geophysics
 - computer vision
 - medicine



Registration in medical imaging I

- Increasingly important role in medical imaging.
- Used in multitude of different applications.
 - Treatment verification of pre- and post-intervention images.
 - Time evolution of an injected agent subject to patient motion.
 - Neurodegeneration detection.



Registration in medical imaging II

- However, the interpretation of medical images and of registration results typically requires expert knowledge.



The problem

- The image registration problem can be phrased in only a few words:
 - Given a reference and a template image, find a suitable transformation such that the transformed template becomes similar to the reference.
- The problem is easy to state, but it is hard to solve:
 - Small changes of the input images can lead to completely different registration results.
 - Moreover, the solution may not be unique.
 - Each application has its own demands with respect to the meaning of similar and suitable.



Registration in fMRI

- Intra-session registration in fMRI for movement-related artifacts removal.
- Intra-subject linear/non-linear registration of T1 images for multi-session comparison.
- Inter-subject non-linear registration of T1 images for population studies.

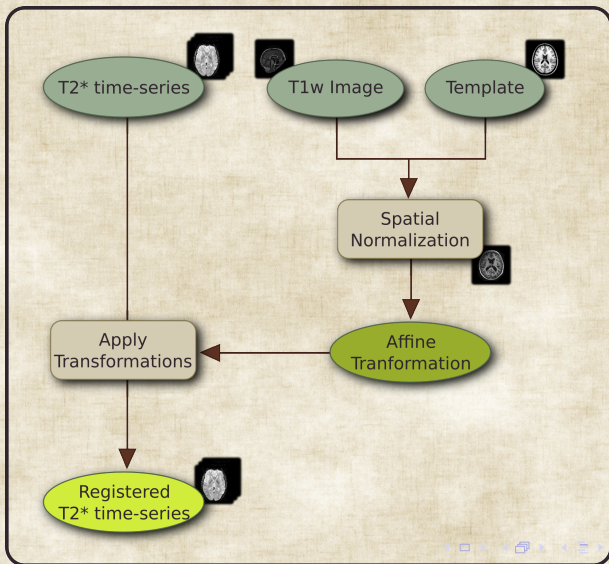


Intra-session registration in fMRI: movement artifacts

- Transformations for modelling and elimination of movement-related artifacts from fMRI time-series.
 - The empirical analyses suggest that (in extreme situations) over 90% of fMRI signal can be attributed to movement, and that this artifactual component can be successfully removed.
[1]



Non-linear registration of T1 images for fMRI studies



References



K J Friston, S Williams, R Howard, R S Frackowiak, and R Turner.

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