Karolinska Institutet

Institutionen för klinisk vetenskap, intervention och teknik (CLINTEC),
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Multivariate data analysis applied to MRS and MRI studies of aging and spinal cord injury

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av

Johanna Öberg
Civilingenjör

Huvudhandledare
Docent Tie-Qiang Li
Karolinska Institutet
Institutionen för klinisk vetenskap, intervention och teknik
Enheten för medicinsk bild, funktion och teknologi

Bihandledare
Professor Peter Aspelin
Karolinska Institutet
Institutionen för klinisk vetenskap, intervention och teknik
Enheten för medicinsk bild, funktion och teknologi

PhD Rouslan Sitnikov
University College London
Department of Neuroinflammation

Docent Stefan Brené
Karolinska Institutet
Institutionen för neurobiologi, vårdvetenskap och samhälle
Sektionen för klinisk geriatrik

Fakultetsopponent
Professor Peter Lundberg
Linköpings Universitet
Institutionen för medicin och hälsa

Betygsnämnd
Docent Peter Fransson
Karolinska Institutet
Institutionen för Klinisk Neurovetenskap

PhD Else Rubaek Danielsen
University of Copenhagen
Department of Radiology

Docent Jan Weis
Uppsala Universitet
Institutionen för radiologi, onkologi och strålningsvetenskap
Enheten för radiologi

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Abstract

Magnetic resonance can be used for non-invasive studies of the body without the use of ionizing radiation. Magnetic resonance imaging and magnetic resonance spectroscopy have proven to be valuable utilities for research in life sciences.

This thesis deals with magnetic resonance investigations of the central nervous system *in vivo* and is based on four studies. In studies I-III *in vivo* proton magnetic resonance spectroscopy data were acquired in three animal models. These models were designed to monitor Alzheimer's disease, spinal cord injury and premature aging. We wanted to quantify and evaluate the differences in metabolite levels in diseased animals in comparison with controls. In study IV, resting-state functional magnetic resonance imaging was applied to investigate young and elderly human subjects. Three different pre-processing procedures were also evaluated. Furthermore, in this thesis we aimed to explore how data acquired with magnetic resonance spectroscopy and functional magnetic resonance imaging can be extracted and analyzed using model free and model driven multivariate data analyses. The linear multivariate data analysis methods principal components analysis and partial least squares projections to latent structures were applied to magnetic resonance spectroscopy data acquired in rodents. Independent component analysis was applied to the resting-state functional magnetic resonance imaging data acquired in human subjects.

Group differences in brain metabolites between diseased and control animals were observed and reported in study I-III. By applying the method partial least squares projections to latent structures to all detected metabolites, we were able to develop models that could differentiate the diseased rodents from the normal controls and evaluate the sensitivity and specificity of the models.

In study IV we investigated the effects of preprocessing prior to independent component analysis. We found that global signal removal can enhance anti-correlation in resting-state functional connectivity networks. We also found that normal brain aging can lead to significant changes in functional connectivity.

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