



Joint MD/PhD Fellowships Groningen-Oldenburg

Outline PhD Project

Working title of project	Improving visualisation of quantitative neuroimaging results for routine clinical application with a focus on colour scales
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First contact for inquiries	Please write an e-mail simultaneously to both potential supervisors.

Short Summary of PhD project (mx. 500 words), incl. research question(s), methods, approx. schedule (incl. times in Groningen/Oldenburg)

In clinical routine, quantitative or semi-quantitative information from neuroradiological examinations such as perfusion magnetic resonance imaging (MRI) are usually depicted in greyscale maps or using vendor-specified colour scales. The most frequent colour scales such as a “rainbow” scale suffer from limitations such as having no perceptual order and being perceptually non-linear (e.g. resulting in an relatively abrupt transitions between different colours). These limitations could lead to misinterpretation of findings not only by radiologists or other physicians with impaired colour vision but also with normal visual abilities. Although there are colour scales without these limitations, these are not routinely used in clinical practice or implemented in clinically used software.

Aims of this project are (1) to assess the risk of misinterpretation of perfusion MRI maps in brain tumour imaging and other (semi-)quantitative brain imaging applications across different colour scales in comparison with a grey scale, (2) to define which e.g. perceptual linear scale with perceptual ordering is best in reducing the risk of misinterpretation and (3) optionally to explore tools for augmenting data visualisation beyond parametric maps.

Methods will include handling of neuroimaging data with clinical and scientific software (including limited amounts of coding), application studies with interpretation of maps by



neuroradiologists (or physicians/scientists from related disciplines) and statistical analyses (including inter/intrater reliability). The main clinical application focus is on perfusion MRI in the follow-up of brain tumours (i.e. differentiating between true tumour progression and pseudo-progression in high-grade gliomas) and it is intended to use a pre-existing multi-centre brain tumour imaging dataset from the Netherlands from the PERISCOPE consortium (Lead by Rotterdam/Leiden/Groningen). The project can be extended to (or alternatively be carried out in) open neuroimaging datasets containing different quantitative maps (e.g. perfusion CT in acute ischemic stroke, functional MRI, positron emission tomography, or further advanced neuroimaging techniques).

The project is planned for a period of 3 consecutive years according to the funding periods for the joint MD PhD programme. The work will be structured into overlapping work-packages. Briefly, work in year 1 will focus on regulatory and organisational aspects, data curation, narrowing down the colour scales and additional data visualisation techniques as well as analysis the first results. Year 2 will focus on the main application studies and its analysis. Year 3 will focus on either refinements of data visualisation techniques (incl. a potential smaller-scale application study) or an extension from perfusion MRI to further quantitative neuroimaging modalities, and publication of results. Parts of the work will be carried out both in Oldenburg and Groningen (depending on final data protection / regulatory aspects regarding the datasets). Approximately one third of the workload (varying across work packages) appears to be suitable for work from home.

PhD Candidate Profile/desired qualifications

- fulfil all general requirements for the Joint MD PhD Programme Groningen-Oldenburg
- ability and willingness to travel and carry out work for the project in both cities
- previous experience in radiology/neuroradiology, neurology, neurosurgery or scientific brain imaging (e.g. through internships or a previous research project) desired but not expected
- openness to acquire and apply knowledge about the psychology / cognitive neuroscience of visual perception
- openness to acquire additional IT skills for handling neuroimaging data (including limited coding tasks), previous coding / programming experience is desirable but not a prerequisite
- normal or near normal colour vision (due to the scientific nature of the project)