Doctoral Candidate 1 - Intra-scan modulation with model-guided AI for accelerated diffusion MRI

Host Institution	University of Antwerp, Belgium
PhD enrolment	University of Antwerp, Belgium
Primary Supervisor	Prof. dr. Jan Sijbers, imec-Vision Lab
Subject area	MR sequence design, simulations and modelling, parameter estimation, physics-informed Deep Learning

About this doctoral project and your tasks

You will develop a **physics-informed AI-supported framework** for the direct estimation of diffusion parameter maps from multi-shot diffusion weighted MRI data, of which each shot (k-space trajectory) is encoded with a different diffusion weighting (q). The framework will merge the advantages of both **data-driven and physical model-based** methods, thereby exploring recently emerging physics-aware deep learning strategies such as the hybrid (quantitative) Recurrent Inference Machine. Finally, the acquisition settings of the framework will be optimized to allow parameter estimation with minimal quantified uncertainty.

Your tasks will include:

- Following the state-of-the-art on **quantitative diffusion MRI** and staying up-to-date with scientific literature on quantitative diffusion MRI throughout the PhD trajectory.
- Developing a **forward model** that describes the dependency of the measured k-q space on the diffusion parameters and acquisition settings and accounts for inter-shot motion.
- Developing, training and testing a **physics-informed neural network (PINN)** for direct, motion-compensated diffusion mapping from intra-scan modulated multi-shot k-q space data.
- Quantifying the **uncertainty** of the estimated diffusion parameter maps.
- Developing a strategy for **optimal experiment design**.
- Testing the network on **(pre)clinical MRI scanners**.

Foreseen secondments

For this project, we foresee secondments to:

- Prof. dr. Julia Schnabel (2 months) at **Helmholtz Munich** (Germany)
- Prof. dr. Dirk Poot (3 months) at **Erasmus MC** (The Netherlands)
- Dr. Thomas Janssens (2 months) at **Siemens Healthineers** (Belgium)

About the host institution and research group

The **University of Antwerp** is a dynamic, forward-thinking university in the second largest city in Belgium. We offer an innovative academic education to more than 20000 students, conduct pioneering scientific research and play an important service-providing role in society. With more than 6000 employees from 100 different countries, we are helping to build tomorrow's world every day.

Imec-Vision Lab is a research group of the Physics department at the University of Antwerp. The Vision Lab has unique expertise in **reconstruction, processing and analysis of imaging data**. The working environment is strongly interdisciplinary, combining techniques and insights from Physics, Engineering, Mathematics and Computer Science. The group has a broad range of national and international collaborations with both academic and industrial partners. More details on Vision Lab's research are available at http://visielab.uantwerpen.be.

About the offer

- The selected candidate will be employed by University of Antwerp for **36 months** on the MSCA-DN project. In line with university regulations and following a positive evaluation by the doctoral committee, University of Antwerp may provide additional funding for a maximum of 12 months to complete the doctoral degree.
- Doctoral candidates are offered a **competitive remuneration** based on the MSCA allowances and the regulations of the host institution. The gross monthly amount at the University of Antwerp corresponds to the amount for doctoral scholarship holders. Moreover, funding is available for technical and personal skills training and participation in international research events.
- **Expected start date**: between April and September 2025. We encourage last-year master students who will graduate by this time to already apply.

More information is available in the general information document for IQ-BRAIN positions.

Specific profile and requirements

- Your profile aligns with the **general requirements and eligibility criteria** of the IQ-BRAIN project.
- You have a master's degree in **physics, computer science, mathematics, biomedical engineering, or related field** (or will have by the time of your appointment).
- Background in **scientific computing and/or magnetic resonance imaging (MRI)** is appreciated.
- You are proficient in at least one **programming language**.

How to apply

All applications must be submitted via the **IQ-BRAIN job platform**:
 https://www.uantwerpen.be/en/projects/iq-brain/jobopenings/apply/.

Deadline for applications: 1 December, 23:59. More information about the application procedure is available in the general information document for IQ-BRAIN positions.

More information

For additional information about the research project, please contact:

Prof. Dr. Jan Sijbers	or	**Dr. ir. Arjan den Dekker**
jan.sijbers@uantwerpen.be		arjan.dendekker@uantwerpen.be