

Research Thesis Course: PET/MR Imaging and AI

Faculty mentor: Chuan Huang, PhD

Format: Independent research with regular faculty meetings and independent project work

Course description

This independent research course provides training in quantitative PET/MR imaging research and the application of artificial intelligence methods to multimodal imaging data. Coursework emphasizes imaging science, rigorous data analysis, reproducible workflows, and clear scientific communication.

Learning objectives

By the end of the term, the student will be able to:

1. Explain core principles of PET, MRI, and integrated PET/MR, including key sources of measurement variability and bias.
2. Conduct image quality control, preprocessing, registration, and quantitative image analysis using reproducible methods.
3. Interpret PET/MR measures in light of physiology, acquisition methods, and relevant confounders.
4. Apply appropriate statistical methods for imaging data, including visualization, regression, covariate adjustment, and sensitivity analyses.
5. Apply AI methods thoughtfully to an imaging research question, with attention to validation, overfitting, interpretability, and responsible use.
6. Communicate research methods, findings, limitations, and next steps clearly in written and oral formats.

Course activities

Activities will include guided reading of relevant literature; discussion of PET/MR physics and quantitative imaging methods; data organization, quality control, and image-processing work; statistical analysis and interpretation; development and assessment of an appropriate AI approach; and regular progress discussions with the faculty mentor.