David Frey

PhD Candidate in Biomedical Engineering

Curriculum Vitae

djfrey@umich.edu | linkedin.com/in/fmrifrey | github.com/fmrifrey

Education

Ph.D. in Biomedical Engineering — **University of Michigan**
September 2024 - Present — Ann Arbor, MI
3.82/4.00 GPA
Coadvisors: Douglas C. Noll and Jeffrey A. Fessler

B.S.E. in Biomedical Engineering (Electrical Engineering minor) — **University of Michigan**
September 2017 - June 2021 — Ann Arbor, MI
3.36/4.00 GPA

Publications

Lobos RA, Wang X, Fung RTL, He Y, **Frey D**, Gupta D, Liu Z, Fessler JA, Noll DC, “Spatiotemporal Maps for Dynamic MR Reconstruction”, Submitted to IEEE Transactions on Computational Imaging, 2025.

Conferences

Wood TC, Catargiu D, Ball J, Ryden H, **Frey D,** “Maximising Image Quality While Minimising Acoustic Noise in Looping-Star” Accepted to ESMRMB 2026 Annual Meeting, Girona, Spain, 2026.

Frey D, Wood TC, Fessler JA and Noll DC, “Constrained k-space trajectory optimization for silent, T2*-weighted Looping Star fMRI” In Vivo Magnetic Resonance Gordon Research Seminar/Conference, Andover, NH, 2026.

Frey D, “Silent Functional MRI using Looping Star: Recent Technical Developments” University of Michigan fMRI Symposium, Ann Arbor, MI, 2023

Frey D, Xiang H, Fessler JA, and Noll DC, “Reduced spectral interference of aliasing and task signal in Looping Star fMRI via UNFOLD-like regularization” Magnetic Resonance in Madison Conference, Madison, WI, 2025.

Frey D, Xiang H, Fessler JA, and Noll DC, “Improved spatial resolution for Looping Star fMRI using UNFOLD” Proceedings of the 33rd Annual Meeting of ISMRM, Honolulu, HI, 2025.

Frey D and Hernandez-Garcia L,, “A Realistic Two-Compartment Perfusion Phantom for Perfusion MRI” ISMRM Perfusion Workshop, Pamplona, Spain, 2025.

Hong T, **Frey D**, Fessler JA, and Hernandez-Garcia L, “An Unsupervised Method for 3D Variable-Density Spiral Trajectory Optimization” SIAM Imaging Conference, Atlanta, GA, 2024.

Frey D, “Cerebral Blood Volume based ASL fMRI: A step towards achieving layer-specific fMRI at 3T” University of Michigan fMRI Symposium, Ann Arbor, MI, 2023

Frey D, Fessler JA, Noll DC, and Hernandez-Garcia L, “Fast, Isotropic, Whole Head Perfusion Imaging Using A Spin Echo Rotating In-Out Spiral With Velocity Selective Arterial Spin Labeling” Proceedings of the 31st Annual Meeting of ISMRM, Toronto, ON, 2023.

Hernandez-Garcia L, **Frey D**, Nielsen J, and Noll DC, “Blood Volume Based Functional MRI Using Velocity Selective Pulses And SERIOS Readout” Proceedings of the 31st Annual Meeting of ISMRM, Toronto, ON, 2023.

Frey D, Hernandez-Garcia L, “SERIOS VSASL: A New, Efficient Arterial Spin Labeling Sequence for Perfusion Weighted Functional MRI” In Vivo Magnetic Resonance Gordon Research Seminar, Andover, NH, 2022.

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Experience

Graduate Student Research Assistant — **University of Michigan Functional MRI Lab**
October 2024 - Present — Ann Arbor, M
Coadvisors: Douglas C. Noll and Jeffrey A. Fessler

- Developed constrained k-space trajectory optimization methods for silent Looping Star (LS) MRI in PyTorch
- Derived acquisition model and conditioning methods for high resolution LS MRI reconstruction
- Developed advanced model-based spatiotemporal reconstruction methods for LS fMRI in Julia
- Programmed vendor agnostic silent LS pulse sequence in Pulseq

Research Assistant (Rotation Fellowship) — **Michigan Institute for Imaging Technology and Translation (MIITT)**
August 2024 - September 2024 — Ann Arbor, MI
Advisor: Jesse Hamilton

- Simulated cardiac Magnetic Resonance Fingerprinting (cMRF) data with optimized cartesian sampling for high resolution applications
- Implemented dictionary-matching MRF reconstruction algorithms with plug-and-play regularizers in MATLAB

Research Specialist Associate — **University of Michigan Functional MRI Lab**
June 2021 - July 2024 — Ann Arbor, MI
Advisor: Luis Hernandez-Garcia

- Designed and implemented novel ASL MRI pulse sequences in EPIC (C/C++)
- Developed MRI image reconstruction and fMRI processing pipeline in MATLAB and Python
- Operated the MRI scanner for phantom and human subject fMRI experiments

Undergraduate Senior Design Capstone Project — **BME 450, University of Michigan**
Winter 2021 — Ann Arbor, MI
Advisors: Luis Hernandez-Garcia and Douglas C. Noll

- Designed an MRI phantom to simulate blood flow in the brain for cross-validation of ASL methods
- Created a 3D model of the phantom using SolidWorks and simulated perfusion fluid dynamics in COMSOL for cross-validation of MRI data
- Manufactured MRI perfusion phantom using SLA resin 3D printing

Electrical Engineering Internship — **Terumo Heart, Inc.**
August 2019 - December 2019 — Ann Arbor, MI

- Analyzed and diagnosed electrical circuit abnormalities using benchtop testing equipment (oscilloscopes, DMMs, signal generators, etc.)
- Revised circuit V&V procedures to comply with Good Documentation Practices and optimize workflow efficiency
- Programmed MS Excel VBA macros to detect consistency errors in reported data

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Technical experience and skills

Pulse sequence programming

Sequence types: Looping Star, velocity selective ASL (CBV-based & CBF-based fMRI, angiography), MR Fingerprinting, FSE, GRE

k-space trajectories: cartesian, EPI, spiral (3D SPI, SOS, stack-of-cones), radial, Looping Star

Languages: Pulseq (MATLAB), EPIC (C/C++), IDEA

Software development

C/C++, Julia, Python, MATLAB, VBA, LaTeX, Shell scripting (bash, csh, tcsh)

Engineering tools

Solidworks, Catia, Simulink, COMSOL, LabVIEW