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Ross Lawrence

Senior Programmer Analyst

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EDUCATION

Master of Science in Biomedical Engineering , Johns Hopkins University <i>Biomedical Data Science Concentration</i>	12/2021
Bachelor of Science in BioEngineering , University of Pittsburgh <i>Major: BioEngineering with a Biomechanics Concentration</i> <i>Minor: Mechanical Engineering</i>	04/2017

SKILLS

Programming	Python, MATLAB, C++, R, git, AWS, Docker, bash, Pytorch, Tensorflow, Pandas, Seaborn, scikit-learn, scikit-image
Machine Learning/AI	Neural Networks (CNN, MLP, RBF, MNN), Deep Learning, Image Classification/Segmentation, Image Super-Resolution, Ensemble Learning (Random Forest, Bayesian Model Averaging), SVM, Regression
Imaging Modalities	MRI, CT, X-ray, Ultrasound, PET, Fluoroscopy
Technical Skills	Philips 3T MRI, Phasespace Motion Capture, Light Microscopy Imaging, Cell Culture, Mouse dissection, Mouse and Macaque handling, Cryo-sectioning, Histology

TECHNICAL EXPERIENCE

Senior Programmer Analyst	02/2022 — Present
Research Assistant <i>Barry Gordon, MD, PhD</i>	01/2019 — 12/2021 <i>Johns Hopkins University</i>

- Researched relationships between physiological signals (heart rate, PNS, verbal) and changes in affect in adults with ASD-3, collaborating with teachers and specialists.
- Collaborated with researchers in other academic institutions for the analysis of EEG data collected from adults with ASD-3
- Developed custom iOS and Windows apps for the collection of heart rate and ECG data transmitted through Bluetooth Low Energy from a Polar H10 device
- Maintained and modified technology used for data collection, including the software present on both iPhones and Polar H10, as well as Physio16 hardware
- Created MATLAB and Python scripts which performed frequency and time domain analyses on collected physiological signals
- Trained machine learning classification algorithms on collected physiological data for the purposes of predicting changes in affect and onset of disruptive outbursts in adults with ASD-3
- Managed and taught a team of Johns Hopkins students tasked with exploration of different analysis techniques for the physiological data, including how to collaborate using Github and Microsoft Teams

Research/Teaching Assistant <i>Joshua Vogelstein, PhD</i>	07/2019 — 01/2022 <i>Johns Hopkins University</i>
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- Led the development of m2g, an open-source python-based diffusion and functional MRI analysis pipeline designed to generate structural and functional connectomes. First author on corresponding manuscript currently under review
- Developed and maintained the neuroparc repository, an open-source centralized collection of brain parcellation files. First author on the published manuscript
- Mentored and supervised Johns Hopkins Biomedical Engineering students as a Teaching Assistant for NeuroData Design I & II. Oversaw student projects related to MRI and medical image analysis
- Collaborated with DIPY group to add functionality from m2g into their open-source, dMRI analysis library
- Assisted in development of dMRIPrep through my attendance at a coding "sprint" event

Research Assistant <i>Xiaoqian Chai, PhD</i>	02/2018 — 07/2019 <i>Johns Hopkins University</i>
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- Researched the effect of self-referential encoding on long term memory in children. First author on published manuscript
- Conducted testing of research subjects aged 5-40 years old, and was responsible for recruitment, screening, and payment of participants
- Programmed stimulus presentation software compatible with Philips 3T MRI machine, as well as software to analyze behavioral data using common statistical measurements
- Created protocols for researcher-participant interaction, data organization, and analysis. This included the creation of IRB-approved practice material
- Received certification to run a Philips 3T MRI machine with child and adult participants

Student Researcher

Omar A. Gharbawie, PhD

05/2016 — 08/2017

Center for Neural Basis of Cognition

- Provided technical support for research that studied the relationships between premotor cortex stimulation and fine hand movement
- Improved upon existing neural image analysis software by streamlining the user interface, reworking statistical calculation, and better organizing results
- Implemented a *PhaseSpace* motion capture system using self-made protocols and customized software to convert captured data into meaningful anatomical relationships
- Assisted in the handling of macaque monkeys during training and motion capture data collections

Student Researcher/Project Co-Leader

Fabrisia Ambrosio, PhD

01/2015 — 05/2016

McGowan Institute for Regenerative Medicine

Collagen Production in Response to Injury

01/2016 — 05/2016

- Studied the effect of injury on collagen production in mouse bicep tissue after an acute injury
- Oversaw the injury, dissection, and histology of mouse skeletal-muscle for collagen production
- Trained several colleagues on histology and use of specialized equipment and image analysis programs

Effect of Arsenic Exposure on Damaged Muscle Regeneration

11/2015 — 05/2016

- Researched the effect of arsenic exposure on mouse bicep regeneration after an acute injury
- Performed sectioning histology, and light microscopy-based imaging on muscle tissue
- Analyzed images to identify myofiber surface area and nuclei location as a metric for regeneration
- Trained M.S. students on cryo-sectioning and histology of frozen muscle tissue

Rehabilitation of Damaged Muscle Treated with Stem Cells

01/2015 — 12/2015

- Injected LacZ transfect muscle stem cells into the T.A. of control and injured mice to monitor response
- Used specialized equipment for mouse training, dissection, and histology of harvested muscle samples
- Imaged sectioned muscles using light microscopy and analyzed images for nuclei location and myofiber cross-sectional area and quantity
- Optimized existing mice muscle cryo-sectioning protocols by improving physical technique and acceptable cryo-sectioning settings Developed image analysis protocol and custom analysis programs using python and ITK toolkit

PUBLICATIONS

PEER-REVIEWED

- [1] Hilary Sweatman, Ross Lawrence, and Xiaoqian J. Chai. "Development of self-referential effect on memory recollection". In: *Child Development* (July 2022), pp. 1–12. DOI: <https://doi.org/10.1111/cdev.13826>. URL: <https://srcd.onlinelibrary.wiley.com/doi/abs/10.1111/cdev.13826>.
- [2] Ross Lawrence and Xiaoqian J. Chai. "Self-referential encoding of source information in recollection memory". In: *PLOS ONE* 16.4 (Apr. 2021), pp. 1–15. DOI: [10.1371/journal.pone.0248044](https://doi.org/10.1371/journal.pone.0248044). URL: <https://doi.org/10.1371/journal.pone.0248044>.
- [3] Ross Lawrence et al. "Standardizing human brain parcellations". In: *Scientific Data* 9 (1 Mar. 2021). DOI: [10.1038/s41597-021-00849-3](https://doi.org/10.1038/s41597-021-00849-3).
- [4] Stefano Lai et al. "A Murine Model of Robotic Training to Evaluate Skeletal Muscle Recovery after Injury". In: *Medicine Science in Sports Exercise* 49 (4 Apr. 2017). DOI: [10.1249/MSS.0000000000001160](https://doi.org/10.1249/MSS.0000000000001160). URL: https://journals.lww.com/acsm-msse/Fulltext/2017/04000/A_Murine_Model_of_Robotic_Training_to_Evaluate.26.aspx.

SUBMITTED/UNDER REVIEW

- [1] Eric W. Bridgeford et al. "Batch Effects are Causal Effects: Applications in Human Connectomics". In: *bioRxiv* (2021). DOI: [10.1101/2021.09.03.458920v2](https://doi.org/10.1101/2021.09.03.458920v2). URL: <https://www.biorxiv.org/content/10.1101/2021.09.03.458920v2>.
- [2] Ross Lawrence et al. "A low-resource reliable pipeline to democratize multi-modal connectome estimation and analysis". In: *bioRxiv* (2021). Ed. by Jeffrey S. Anderson et al. DOI: [10.1101/2021.11.01.466686](https://doi.org/10.1101/2021.11.01.466686). URL: <https://www.biorxiv.org/content/early/2021/11/03/2021.11.01.466686>.

CODING PROJECTS AND CONTRIBUTIONS

Segmentation

09/2022 – Present

- Repository containing code from my personal exploration of machine learning techniques used for image segmentation tasks
- Focus on multi-modal image segmentation for tasks involving 2D and 3D medical imaging (MRI, CT, X-ray, etc.)
- Development of tools for easier image organization and preprocessing to streamline future image segmentation projects

Super-Resolution

06/2022 – Present

- Repository containing code from my personal exploration of machine learning techniques used in the Super-resolution field
- Focus on application of super-resolution to the field of medical imaging, utilizing multiple different modalities (MRI, CT, X-ray, etc.) as both 2D and 3D images
- Development of tools for easier image handling in future super-resolution projects

Polar Strap Data Collection App (PSHR_iOS)

02/2022 – Present

- Created an iPhone app which interfaced with an H10 Polar Strap through Bluetooth Low Energy protocols
- App received transmitted data packets and stored them locally on text files for later analysis
- Coordinated with teachers and specialists on how best to customize the app to suit their needs

Analysis of COVID-19 Cases in Calw, Germany

04/2021 – 03/2021

- Used data from [SORMAS](#) in order to create a comprehensive data analysis of COVID-19 incidence, morbidity, and mortality
- Created an [app](#) consisting of interactive map and plots using the R shiny library

neuroparc

05/2020 – Present

- Created protocols for adding new parcellation files to the repository
- Coordinated with other teams whose software depended on neuroparc about potential improvements
- Addressed bugs related to file distribution and ease of access

m2g

08/2019 – 07/2022

- Led development in adding functional MRI support to an originally diffusion MRI-only pipeline
- Contributed to documentation of the pipeline and creation of tutorials
- Addressed bugs that resulted from edge-case parameters and input data

dipy

12/2019 – 03/2020

- Added functionality which allowed dMRI streamlines to register intersections with multiple ROI's
- Updated internal quality assurance testing on generated connectomes

PRODUCT DEVELOPMENT

Catheter Injection Port Lock

08/2016 – 04/2017

- Developed and tested a catheter injection port lock designed to prohibit patient tampering
- Followed DHF documentation specified by FDA Regulation 21 CFR 820.30. including the creation of verification and validation protocols
- Won second place among fellow senior Bioengineers at the University of Pittsburgh's Design Expo

Engineering Application for Society

01/2014 – 04/2014

- Created and interactive inventory database for the staff of the West Pennsylvania School for Blind Children using HTML and Microsoft SQL