Tom Earnest

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EDUCATION

Doctor of Philosophy, Computational and Data Sciences 2026 (expected)
Division of Computational and Data Sciences
Washington University in St Louis

Master of Science, Psychiatric Research 2017
Institute of Psychiatry, Psychology, and Neuroscience
King's College London

Bachelor of Arts, Biology with Concentration in Neuroscience 2016
Grinnell College

WORK EXPERIENCE

Data Science Intern Summer 2024
Reinsurance Group of America

- Analyzed internal logs of employee interactions with a large language model (LLM) chatbot, developing a Streamlit dashboard for summarizing and forecasting usage costs
- Committed to company codebase for internal LLM deployment
- Developed custom tools and applied Amazon Textract for extracting insights from company tax forms

RESEARCH EXPERIENCE

Doctoral Research 2020-current
Washington University in St. Louis
Advised by Aristeidis Sotiras, Ph.D.

- Used data-driven methods (especially non-negative matrix factorization) to define and evaluate a staging system for brain pathology in Alzheimer's Disease
- Applied supervised machine learning with nested cross-validation for prediction of cognitive decline in Alzheimer's Disease
- Managed storage and organization of three multimodal neuroimaging datasets in a high-performance computing cluster
- Developed code for preprocessing, analysis, and visualization of neuroimaging data from >1,000 subjects

Research Technician II 2019-2020
Washington University in St. Louis
Supervised by Alexxai Kravitz, Ph.D., and Meaghan Creed, Ph.D.

- Created two graphical user interfaces in Python for analysis and visualization of data from open-source rodent experimentation devices
- Developed code for visualization of rodent electrophysiological data
- Collected behavioral and neuroanatomical data to study reward and motivation circuits in rodents

Postbac Fellow 2017-2019
National Institute of Dental and Craniofacial Research
Supervised by Hans Jürgen Solinski, Ph.D., and Mark Hoon, Ph.D.

- Ran behavioral experiments to study the neurobiology of sensorimotor circuits in mice
- Bred and genotyped transgenic mice
- Used confocal imaging to characterize neuronal populations involved in pain and itch
- Learned programming to automate research tasks, such as experimental blinding and cell counting

Master's Research 2016-2017

Institute of Psychiatry, Psychology, and Neuroscience; King's College London
Supervised by Elizabeth Shephard, Ph.D., and Patrick Bolton, Ph.D.

- Primary researcher on a project using movement trackers to assess hyperactivity in a population of children and adolescents with tuberous sclerosis complex
- Traveled within England to administer psychometric assessments to individuals with varying levels of cognitive and behavioral impairment (~30 visits)
- Developed statistical analyses of motion tracking data to predict cognitive constructs

Mentored Advanced Project 2015-2016

Grinnell College
Supervised by Nancy Rempel-Clower, Ph.D.

- Co-planned and ran a project studying the effects of stress on behavior and neurobiology in adolescent rodents
- Applied tests to study anxiety-like behavior in rats
- Conducted brain dissections to measure neuroanatomical changes correlated with behavioral differences

PUBLICATIONS

Leading asterisk signifies preprint or submitted work.

Bani, A., Ha, S. M., Xiao, P., **Earnest, T.**, Lee, J., & Sotiras, A. (2023). Scalable Orthonormal Projective NMF via Diversified Stochastic Optimization. In A. Frangi, M. de Bruijne, D. Wassermann, & N. Navab (Eds.), *Information Processing in Medical Imaging* (pp. 497–508). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-34048-2_38

De Araujo Salgado, I., Li, C., Burnett, C. J., Rodriguez Gonzalez, S., Becker, J. J., Horvath, A., **Earnest, T.**, Kravitz, A. V., & Krashes, M. J. (2023). Toggling between food-seeking and self-preservation behaviors via hypothalamic response networks. *Neuron*, *111*(18), 2899-2917.e6. https://doi.org/10.1016/j.neuron.2023.06.006

Earnest, T., Bani, A., Ha, S. M., Hobbs, D. A., Kothapalli, D., Yang, B., Lee, J. J., Benzinger, T. L. S., Gordon, B. A., Sotiras, A., & Initiative, for the A. D. N. (2024). Data-driven decomposition and staging of flortaucipir uptake in Alzheimer's disease. *Alzheimer's & Dementia*, *20*(6). https://doi.org/10.1002/alz.13769

Earnest, T., Shephard, E., Tye, C., McEwen, F., Woodhouse, E., Liang, H., Sheerin, F., & Bolton, P. F. (2020). Actigraph-Measured Movement Correlates of Attention-Deficit/Hyperactivity Disorder (ADHD) Symptoms in Young People with Tuberous Sclerosis Complex (TSC) with and without Intellectual Disability and Autism Spectrum Disorder (ASD). *Brain Sciences*, *10*(8), Article 8. https://doi.org/10.3390/brainsci10080491

* **Earnest, T.**, Yang, B., Kothapalli, D., Sotiras, A., & Initiative, A. D. N. (2024). Comprehensive evaluation of AT (N) imaging biomarkers for predicting cognition. *medRxiv*, 2024–11.

* Kumar, S., **Earnest, T.**, Payne, P. R. O., Sotiras, A., & Initiative, the A. D. N. (2023). *Analyse patient-level heterogeneity in Alzheimer's Disease using multimodal normative modelling* (p. 2023.08.15.553412). bioRxiv. https://doi.org/10.1101/2023.08.15.553412

* Lee, J. J., **Earnest, T.**, Ha, S. M., Bani, A., Kothapalli, D., Liu, P., Sotiras, A., & Initiative, the A. D. N. (2023). *Patterns of Glucose Metabolism in [18F]FDG PET Indicate Regional Variability and Neurodegeneration in the Progression of Alzheimer's Dementia* (p. 2023.11.10.23298396). medRxiv. https://doi.org/10.1101/2023.11.10.23298396

Lenzini, P., **Earnest, T.**, Ha, S. M., Bani, A., Sotiras, A., & Bijsterbosch, J. (2023). Morphological Versus Functional Network Organization: A Comparison Between Structural Covariance Networks and Probabilistic Functional Modes. In A. Abdulkadir, D. R. Bathula, N. C. Dvornek, S. T. Govindarajan, M. Habes, V. Kumar, E.

Leonardsen, T. Wolfers, & Y. Xiao (Eds.), *Machine Learning in Clinical Neuroimaging* (pp. 163–172). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-44858-4_16

Matikainen-Ankney, B. A., **Earnest, T.**, Ali, M., Casey, E., Wang, J. G., Sutton, A. K., Legaria, A. A., Barclay, K. M., Murdaugh, L. B., Norris, M. R., Chang, Y.-H., Nguyen, K. P., Lin, E., Reichenbach, A., Clarke, R. E., Stark, R., Conway, S. M., Carvalho, F., Al-Hasani, R., … Kravitz, A. V. (2021). An open-source device for measuring food intake and operant behavior in rodent home-cages. *eLife*, *10*, e66173. https://doi.org/10.7554/eLife.66173

Reimann, G. E., Dupont, R. M., Sotiras, A., **Earnest, T.**, Jeong, H. J., Durham, E. L., Archer, C., Moore, T. M., Lahey, B. B., & Kaczkurkin, A. N. (2024). Using machine learning to derive neurobiological subtypes of general psychopathology in late childhood. *Journal of Psychopathology and Clinical Science*, *133*(8), 647.

Shephard, E., McEwen, F. S., **Earnest, T.**, Friedrich, N., Mörtl, I., Liang, H., Woodhouse, E., Tye, C., & Bolton, P. F. (2022). Oscillatory neural network alterations in young people with tuberous sclerosis complex and associations with co-occurring symptoms of autism spectrum disorder and attention-deficit/hyperactivity disorder. *Cortex*, *146*, 50–65. https://doi.org/10.1016/j.cortex.2021.10.007

Slivicki, R. A., **Earnest, T.**, Chang, Y.-H., Pareta, R., Casey, E., Li, J.-N., Tooley, J., Abiraman, K., Vachez, Y. M., Wolf, D. K., Sackey, J. T., Kumar Pitchai, D., Moore, T., Gereau IV, R. W., Copits, B. A., Kravitz, A. V., & Creed, M. C. (2023). Oral oxycodone self-administration leads to features of opioid misuse in male and female mice. *Addiction Biology*, *28*(1), e13253. https://doi.org/10.1111/adb.13253

Solinski, H. J., Dranchak, P., Oliphant, E., Gu, X., **Earnest, T. W.**, Braisted, J., Inglese, J., & Hoon, M. A. (2019). Inhibition of natriuretic peptide receptor 1 reduces itch in mice. *Science Translational Medicine*, *11*(500), eaav5464. https://doi.org/10.1126/scitranslmed.aav5464

Solinski, H. J., Kriegbaum, M. C., Tseng, P.-Y., **Earnest, T. W.**, Gu, X., Barik, A., Chesler, A. T., & Hoon, M. A. (2019). Nppb Neurons Are Sensors of Mast Cell-Induced Itch. *Cell Reports*, *26*(13), 3561-3573.e4. https://doi.org/10.1016/j.celrep.2019.02.089

Vachez, Y. M., Tooley, J. R., Abiraman, K., Matikainen-Ankney, B., Casey, E., **Earnest, T.**, Ramos, L. M., Silberberg, H., Godynyuk, E., Uddin, O., Marconi, L., Le Pichon, C. E., & Creed, M. C. (2021). Ventral arkypallidal neurons inhibit accumbal firing to promote reward consumption. *Nature Neuroscience*, *24*(3), Article 3. https://doi.org/10.1038/s41593-020-00772-7

Yang, B., **Earnest, T.**, Kumar, S., Kothapalli, D., Benzinger, T., Gordon, B., & Sotiras, A. (2024). Evaluation of ComBat Harmonization for Reducing Across-Tracer Differences in Regional Amyloid PET Analyses. *Human Brain Mapping*, *45*(16), e70068.

PRESENTATIONS

Earnest, T., Bani, A., Ha, S. M., Kothapalli, D., Yang, B., Lee, J., Sotiras, A. (2023, July). *Detecting flortaucipir signatures of Alzheimer's Disease with non-negative matrix factorization.* Poster at Organization for Human Brain Mapping 2023. Montreal, Canada.

Earnest, T. W., Solinski, H. J., Kriegbaum, M. C., Tseng, P. Y., Gu, X., Barik, A., … Hoon, M. A. (2019, May). *Nppb-neurons are sensors of mast cell-induced itch.* Poster at NIH Postbac Poster Day. Bethesda, MD.

Earnest, T. W., Solinski, H. J., Kriegbaum, M. C., Tseng, P. Y., Gu, X., Barik, A., … Hoon, M. A. (2019, April). *Nppb-neurons are sensors of mast cell-induced itch.* Poster at the NIDCR Fellows Retreat. Washington, DC.

Earnest, T. (2017, July). *Using actigraphy to measure ADHD symptoms in tuberous sclerosis complex.* Poster at the IoPPN Psychiatric Research MSc year end session. London, UK.

Earnest, T. (2016, February). *Behavioral and morphological effects of stress in adolescent rats.* Talk in the Biology Student Seminar Series at Grinnell College. Grinnell, IA.

Earnest, T., Yetter, M. (2015, November). *Behavioral and morphological effects of stress in adolescent rats.* Talk in the Psychology Student Seminar Series at Grinnell College. Grinnell, IA.

Yetter, M., **Earnest, T.**, Rempel-Clower, N. (2015, October). *Acute corticosterone treatment increases anxiety and dendritic elongation and arborization in the orbitofrontal cortex in mid-adolescent but not early-adolescent rats.* Poster at the Faculty for Undergraduate Neuroscience at the Society for Neuroscience Annual Meeting. Chicago, IL.

Earnest, T. (2015, September). *Acute stress increases anxiety behaviors in mid-adolescent rats and may cause dendritic elongation & arborization in the orbitofrontal cortex*. Poster at Iowa State Neuroscience Research Day. Ames, IA.

REVIEWER

- American Journal of Neuroradiology
- Imaging Neuroscience (2x)

TEACHING EXPERIENCE

Assistant to the Instructor (AI) – Washington University in St Louis

- ESE 359: Signals, Data, and Equity
- PSYCH 3604: Cognitive Neuroscience (planned: Spring 2024)

AWARDS

- American Journal of Neuroradiology Academy of Reviewers (2024): Exemplary example of peer review shared for potential reviewers
- Outstanding Poster Award at NIH Postbac Poster Day (2019)
- NIH Postbaccalaureate Intramural Research Training Award (2017)
- Dean's Medal (2017): Best overall performance in all postgraduate taught programs in the Institute of Psychology, Psychiatry, and Neuroscience
- Sir Robin Murray Prize (2017): Best overall performance in the Psychiatric Research MSc
- Honorable Mention for poster presented at the Iowa State Neuroscience Research Day (2015)
- Dean's List for all semesters at Grinnell College (2012-2016)
- Trustee Honor Scholarship at Grinnell College (2012-2016)

TECHNICAL SKILLS

Programming

- Python (proficient):
  - Packages: abagen, langchain, matplotlib, neuromaps, nibabel, nilearn, numpy, pandas, PyQT, scikit-image, scikit-learn, scipy, seaborn, statsmodels, streamlit
  - Applications: data science, machine learning, deep learning, data visualization, interactive visualizations, graphical user interfaces, packaging, documentation, neuroimaging, data wrangling, open-source software development
- R (proficient)
  - Packages: anticlust, dplyr, ggplot2, ggseg, mclust, lme4, stringr, survival, tidyverse
  - Applications: data science, statistical analysis, regression, data visualization, data wrangling, neuroimaging
- Bash (experienced):
  - Applications: neuroimaging, high performance computing, scripting
- MATLAB (familiar):
  - Applications: optimization, unsupervised machine learning

Open-source projects

- seedir: A Python package for creating, editing, and reading folder tree diagrams
- nifti-overlay: Program for creating tiled images of volumetric neuroimaging data
- FED3VIZ / fed3: Software for analyzing data from open-source rodent experimentation devices
- wubwub: Create mini sequencer music with Python

- cargoat: Custom Monty Hall problem simulations in Python

Software

- Automated text extraction (Amazon Textract)
- Data visualization (Graphpad Prism, Microsoft Office)
- High performance computing (AWS EC2, AWS S3, Domino Data Lab, SLURM)
- Large Language Models (Amazon Bedrock)
- Neuroimaging (FSL, ANTs, FreeSurfer)
- Presentation and publication (Microsoft Office, Latex, Marp, Typora)
- Project Management (Trello, Miro, Microsoft Office)
- Statistical analysis (SPSS)
- Version control (Git/GitHub)