Charles Ludowici, Ph.D.

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Work Experience

Postdoctoral Scholar, The University of California, Berkeley: 02/2020 - present

- Designed experiments and statistical models (GAMs, in R) that allowed me to be the first to observe how the visual system adapts eye movements to the presence of asymmetric central vision loss, a common property of visual disease
- Built a reinforcement learning model of eye movements in NumPy to validate an analysis of the difference between eye tracking machines
- Building, merging and modeling datasets containing millions of observations of human behavior and eye-movements using R, Python and SQL, regression and classification
- Designing and conducting experiments for research on visual function in ocular disease
- Responsible for training junior researchers and technical screening of lab hires
- **Tools:** Regression, reinforcement learning, multinomial logistic regression, spline bases, frequentist hypothesis tests, signal processing, GAMs, Matlab, Python, R

Visiting Scholar, Harvard University: 02/2019 - 06/2019

- Conducted data analysis in R and experimental design for research investigating why radiologists may miss cancer when viewing medical images
- **Tools:** Matlab, R, frequentist hypothesis tests

PhD Candidate, School of Psychology, The University of Sydney : 2016 - 2020

- Designed and implemented novel mixture models, statistical tests and experimental methods that disproved long-standing theories of visual processing
- Lead author on publications and presentations. Responsible for analysis (R), data visualization (ggplot), causal inference (Bayesian t-tests), responding to peer review, and structuring reproducible modeling and visualization code for hosting on GitHub
- Research funded by an Australian federal government scholarship
- **Tools:** Mixture models, novel analyses based on mixture distributions, mixed models, regression, Bayesian and frequentist hypothesis tests, R, Python, Matlab

TA and Lecturer, The University of Sydney: 2016 - 2018

- Statistics and Research Methods for Psych (PSYC2012)
- Quantitative Research Methods in Health (HSBH3018)

Research Assistant, School of Psychology, The University of Sydney : 2014 - 2016

- Designed and led the analysis (in R) of a stratified experiment investigating children's understanding of other people's behaviour
- Planned and conducted the analysis of data from experiments that investigated how people learn complicated relational information
- Wrote and visualized (ggplot) statistical results for academic papers and and conference presentations
- **Tools:** ANOVA, linear and logistic regression, mixed models, R

Skills and tools

Math - Probability, statistics, linear algebra, multivariable calculus

Experiments - Design and analysis, A/B tests

Statistical inference - Linear regression, generalized linear models, hypothesis testing, custom mixture models (in PhD), spline bases, generalized additive models, mixed models, model validation, model comparison

Machine learning - Reinforcement learning, SVMs, multinomial logistic regression, random forests, MLP,

Data science - NumPy, pandas, ggplot2, SciPy, Matplotlib, Jupyter, Git, SQL

Programming languages - R, Python, MATLAB

Education

2016 - 2020: **PhD (Science, Psychology), The University of Sydney**

Thesis: *Temporal Selection in Dynamic Displays: Sensory Information Persists Despite Masking*

2011 - 2015: **Bachelor of Arts (Psychology, First Class Honours), The University of Sydney**

Thesis: *Scaffolding Individual Differences in Category Learning*

Examples of analytic work

- Causal inference using GAMs in R on company profit data from an A/B test. Shows that the treatment effect is dependent on baseline profit and should be targeted at companies with low profit (link)
- Building a mixed (hierarchical) model in Python without statistics modules and explaining the underlying math (link)

Publications

Ludowici, C,. Holcombe, A. O., (2020) The Dynamics of Buffered and Triggered Selection from RSVP Streams. *Journal of Experimental Psychology: Human Perception and Performance* Preprint

Goldwater, M. B., Gershman, S. J., Moul, C., Ludowici, C., Burton, A., Killer, B., Kuhnert, R.-L., & Ridgway, K. (2020). Children's understanding of habitual behaviour. *Developmental Science,* 23(5), e12951. https://doi.org/10.1111/desc.12951

Coates, D., Ludowici, C., Chung, S. T. L (Under review) *The generality of the critical spacing for crowded optotypes: From Bouma to the 21st century*