Christopher J. Miles

Email : chris.john.miles@gmail.com
Computational physicist and mathematician
URL: http://www.chrisjohnmiles.com/

Interests: Reinforcement learning, multi-agent systems, and optimal control theory

Education

Massachusetts Institute of Technology — Cambridge, MA
B.S. in Physics — *Sept. 2006 – June. 2010*

University of Michigan — Ann Arbor, MI
M.S. in Applied Mathematics — *Sept. 2012 – Dec 2014*
Ph.D. in Physics — *Sept. 2012 – April 2018*
Advisor: Prof. Charles R. Doering
Highlighted graduate coursework: Machine Learning, Numerical Linear Algebra, Numerical Methods for Differential Equations, Computer Modeling in Complex Systems, Stochastic Processes, Statistical Mechanics, Complex Systems Theory

Computational Research Projects

University of Michigan: Optimal control of fluid mixing (PhD Thesis) — Ann Arbor, MI
Graduate Student Research Assistant — *Spring 2013 – April 2018*

- Numerically solved Euler-Lagrange equations for a series of optimization problems on fluid mixing using gradient-based optimization methods.
- Click published articles here to read more:
  - **C. J. Miles**, C. R. Doering, A shell model for optimal mixing, Journal of Nonlinear Science, 2017
  - **C. J. Miles**, C. R. Doering, Diffusion-limited mixing by incompressible flows, Nonlinearity, 31, 5, 2018

W.H. Oceanographic Inst.: Collective motion of active multi-agent systems — Woods Hole, MA
Research Fellow — *Summer 2016*

- Developed a custom partial-differential-equation solver to find the solution to the Smoluchowski equation by using a two-step Adams-Bashforth method and a pseudo-spectral Fourier method.
- Click the submitted pre-print article here to read more: **C. J. Miles**, Arthur A. Evans, Michael J. Shelley, and Saverio E. Spagnolie, Active matter invasion of a viscous fluid and a no-flow theorem arXiv:1803.05543[cond-mat.soft]

Personal project: Multi-agent reinforcement learning of self-driving car traffic
Researcher — *Sept. 2017 – Present*

- Implemented Q-learning in a multi-agent gridworld system mimicking self-driving car traffic where many agents are attempting to move across a board while avoiding collision.
- Click white paper here to read more: http://www.chrisjohnmiles.com/personal_projects/sficc

Technical Skills

Programming languages: Python (10k lines), Matlab (10k lines), and Javascript (1k lines)

Version control: Git, Mecurial, Github, and Bitbucket.

Computational models and algorithms: Classic reinforcement learning algorithms, evolutionary game theory models (TA-ed 2 semesters and organized workshop on topic), evolutionary algorithms, agent-based modeling, EM algorithm, K-means clustering, back propagation, HMMs, PCA, SVMs, neural networks, naïve bayes, gradient-based optimization methods, finite-difference methods, pseudo-spectral methods, numerical linear algebra methods

Awards and Fellowships

University of Michigan's Rackham Merit Fellowship — *June 2012 – Present*
Woods Hole Oceanographic Institute's Geophysical Fluid Dynamics Fellowship — *Summer 2016*