

RESEARCH INTERESTS

Machine Learning and Engineering Physics for Renewable Energies

- **Machine Learning:** Deep learning, probabilistic forecasting, optimization, manifold learning, density estimation, signal processing, information theory
- **Engineering Physics:** Automatic control systems, dynamical systems theory, fluid mechanics, electromagnetics, quantum mechanics, Riemannian geometry

EDUCATION

Pennsylvania State University

State College, PA

- PhD, *Mechanical Engineering* (Advisor: Distinguished Professor Asok Ray) Aug 2012 - Mar 2018
Thesis: Principles of Riemannian Geometry in Neural Networks
Focus: Neural networks, manifold learning, probabilistic forecasting
- MSc, *Mechanical Engineering* Aug 2012 - Jan 2016
Thesis: Probabilistic forecasting of symbol sequences with neural networks
Focus: Neural networks, digital signal processing, non-parametric density estimation
- MSc, *Electrical Engineering* Aug 2012 - Jan 2016
Thesis: D-Markov machine for modeling high-speed video
Focus: Computer vision, digital signal processing, Markov modeling

University of California, Riverside

Riverside, CA

- MSc, *Mechanical Engineering* Aug 2010 - May 2012
Thesis: Analysis of the multidimensional effects in biofilm
Focus: Mass transfer, fluid mechanics, computational fluid mechanics

University of Toronto

Toronto, ON

- BSc (honours), *Physics* Sep 2006 - May 2010
Thesis: Inducing orbital angular momentum on light
Focus: Quantum optics, electromagnetics, optical filtering
- BSc (honours), *Mathematics* Sep 2006 - May 2010

PROFESSIONAL EMPLOYMENT

University of Pennsylvania, Children's Hospital of Philadelphia

Philadelphia, PA

Postdoctoral Fellow, Center for Autism Research
Dec 2018 - Present
Focus: Computer vision, language modeling, digital signal processing

Applied Research Laboratory

State College, PA

Walker Fellow, Division of Information Sciences and Technology
Oct 2014 - May 2018
Project: Identify appliances from powerline signal
Project: Identify anomalies in 3D printed materials
Focus: Digital signal processing, computer vision, machine learning

GRANTS AND AWARDS

- Oak Ridge National Laboratory CleanTech startup grant semi-finalist (under revision) 2018
- Walker Fellow at the Applied Research Laboratory 2014 - 2018
- Research Fellowship from the Pennsylvania State University (\$5,000) 2012
- Teaching Fellowship from the Pennsylvania State University 2012 - 2013
- Dean's Distinguished Fellowship from the University of California (\$24,640) 2010-2012
- NYU Steinhardt Intensive Classical Brass Summer Workshop full scholarship (\$600) 2008

REVIEWING EXPERIENCE

- Neural Information Processing Systems (NeurIPS) (rated amongst top reviewers award)
- International Conference on Machine Learning (ICML)
- Society for Industrial and Applied Mathematics
- Energies (MDPI Journal)
- American Controls Conference (ACC)
- Conference on Decision and Control (CDC)

PREPRINTS, PUBLICATIONS (REFEREED) AND PATENTS

Preprints and in-progress

4. Y. Fu*, S. Saab*, A. Ray and M. Hauser, “A Dynamically Controlled Recurrent Neural Network for Modeling Dynamical Systems,” in *arXiv:1911.00089* October 2019.
3. M. Hauser, “Training Capsules as a Routing-Weighted Product of Expert Neurons,” in *arXiv:1907.11639* July 2019.
2. M. Hauser, “Training Products of Expert Capsules with Mixing by Dynamic Routing,” in *arXiv:1907.11643* July 2019.
1. M. Hauser, “On Residual Networks Learning a Perturbation from Identity,” in *arXiv:1902.04106* February 2019.

Publications

7. M. Hauser, E. Sariyanidi, B. Tunc, C. Zampella, E. Brodtkin, R. Schultz, J. Parish-Morris, “Using Natural Conversations to Classify Autism with Limited Data: Age Matters,” in *Proceedings of the Sixth Workshop on Computational Linguistics and Clinical Psychology* June 2019.
6. M. Hauser, S. Gunn, S. Saab and A. Ray, “State Space Representations of Deep Neural Networks,” in *Neural Computation* March 2019.
5. M. Hauser, Y. Fu, S. Phoha, and A. Ray, “Probabilistic forecasting of symbol sequences with Long Short-Term Memory,” *Journal of Dynamic Systems, Measurement and Control*, ASME, August 2018.
4. M. Hauser and A. Ray, “Principles of Riemannian Geometry in Neural Networks,” in *Advances in Neural Information Processing Systems (NIPS)*, Long Beach, California, USA December 2017.
3. M. Hauser, Y. Fu, Y. Li, S. Phoha, A. Ray, “Probabilistic forecasting of symbol sequences with deep neural networks,” in *American Controls Conference (ACC)*, Seattle, Washington, USA, July 2017.
2. M. Hauser, Y. Li, , J. Li, and A. Ray, “Real-time combustion state identification via image processing: A dynamic data-driven approach,” in *American Controls Conference (ACC)*, Boston, Massachusetts, USA, July 2016.
1. M. Hauser, and K. Vafai, “Analysis of the multidimensional effects in biofilm,” in *International Journal of Heat and Mass Transfer*, Elsevier, vol. 56, no. 1, pp. 340–349, January 2013.

Patents

1. S. Phoha, A. Ray, J. Petrich, and M. Hauser, “Data-driven Dynamic Machine Learning Algorithm for Event Detection and Classification (DMAC) Using Heterogeneous Sensors,” Publication pending; Publication Data: Pending

TEACHING EXPERIENCE

Courses at PSU (TA)

- ME 450 - Modeling of Dynamic Systems 2013
- ME 370 - Vibrations 2012

Courses at UCR (TA)

- ME 200 - Methods of Engineering Analysis 2012
- ME 153 - Finite Element Methods 2012
- ME 010 - Statics 2011
- ME 004 - Energy and the Environment 2011

MEDIA EXPOSURE AND OUTSIDE PRESENTATIONS

- Principles of Riemannian Geometry in Neural Networks
 - University of Toronto's Deep Learning colloquium, YouTube video has > 4.5k views.
 - Duke University's Machine Learning colloquium.
- State Space Representations of Deep Neural Networks
 - University of Hong Kong's Deep Learning seminar.

INVITED TALKS AND PRESENTATIONS

- Engineering colloquium at the Applied Research Laboratory, State College, PA May 2018
 - Subject: Neural-probabilistic forecasting of symbol sequences
- Quantum Gravity colloquium at Penn State, Physics, State College, PA March 2018
 - Subject: The geometrical anatomy of neural networks
- Renewable energies colloquium at Oak Ridge National Laboratory, Oak Ridge, TN February 2018
 - Subject: Neural-probabilistic forecasting of symbol sequences
- NeurIPS conference at Long Beach, CA December 2017
 - Subject: Principles of Riemannian Geometry in Neural Networks
- Dynamic, Data-Driven Application Systems conference at MIT, Cambridge, MA August 2017
 - Subject: Neural-probabilistic forecasting of symbol sequences
- American Controls Conference, Seattle, WA July 2017
 - Subject: Neural-probabilistic forecasting of symbol sequences
- American Controls Conference, Boston, MA July 2016
 - Subject: Realtime combustion state identification via image processing

TECHNICAL SKILLS

- Languages
 - Python (numpy, scipy, sklearn, tensorflow, theano, matplotlib, pandas, ...), L^AT_EX
- Applications
 - Matlab, Mathematica, Microsoft Office, Google Docs
- Operating Systems
 - Linux (Ubuntu, Redhat), Windows, macOS

REFERENCES

- **Asok Ray** (advisor and committee chair)
Distinguished Professor of Mechanical Engineering and Mathematics
Pennsylvania State University
axr2@psu.edu
- **Shashi Phoha** (committee co-chair)
Division Head of Information Science and Technologies
The Applied Research Laboratory
Professor of Electrical Engineering
Pennsylvania State University
sxp26@arl.psu.edu
- **Carina Curto**
Professor of Mathematics
PI of Mathematical Neuroscience Laboratory
Pennsylvania State University
ccurto@psu.edu
- **Julia Parish-Morris**
Assistant Professor of Clinical Psychology
University of Pennsylvania
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