Shivam Raval

PhD in Physics, Secondary in Data Science
Harvard University

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Google Scholar

RESEARCH INTERESTS

Explainable and Interpretable AI: Explaining and Interpreting Language Models and Vision Networks, using Visualization to uncover insights into Deep Neural Networks; and Teaching Physics

RELEVANT COURSES

PHY 262: Statistical Mechanics
CS 209A Basics of Data Science
CS 209B: Deep Learning
CS 181: Machine Learning
PSY 1401: Computational Cognitive Science
NEURO 131: Computational Neuroscicence
CS 207: Systems Developments for CS

TECHNICAL SKILLS

Comprehensive Understanding of:
1. Regression and Classification Models for Multidimensional Data
2. Bayesian Model Specification
3. Modern Deep Neural Networks for Vision
4. Large Language Models and Transformer Networks

Extensive experience working with:
1. Pytorch and Tensorflow to train, probe and test Neural Networks
2. D3, React and Javascript for building Interactive Web based Visualizations
3. Python, Matlab and C++ for Data Science and Scientific computing

RECENT RESEARCH EXPERIENCE

JAN 2022 - PRESENT

Interaction and Insight Lab, Harvard University

Supervisors: Martin Wattenberg and Fernanda Viegas
On-going projects:
1. Interpreting Deep Neural Networks: Probing Modularity and Specialization in Convolutional Neural Networks and Transformer Models: Exploring the spontaneous emergence of specialized subnetworks in CNNs and Transformers to build Interpretable Networks
2. Explainable AI: Building Tools that extract insights from High Dimensional Data by projection to lower dimensions and Explaining the resulting structures of the data and gain insights from the projected clusters.
3. Data Visualization: Extraction and Visualization of Distinguishing Features in Speech to find trends in the changes in speech over time

AUGUST 2019 - JAN 2021 (RESEARCH ASSISTANTSHIP)

Ultracold Molecules Lab, Harvard University

1. Building and operating Experimental Vacuum System to perform Quantum Computing using Polyatomic Molecules
2. Analysis of Experimental data to interpret and communicate novel results

JUNE 2018 - MARCH 2019 (RESEARCH INTERN)

Atomic, Molecular and Optical Physics Lab, Yale University

1. Building an Experimental Laser System to study Quantum Many-Body interactions between Bosonic atoms
2. Constructing a hardware-software interface to obtain and analyze image data in real-time using a high speed camera

SELECTED PUBLICATIONS

Z Chin, S Raval, F Doshi-Velez, M Wattenberg
Identifying Interpretable Structure in the MIMIC ICU Dataset
NeurIPS Time Series for Health Workshop (2022)

L Baum, NB Vilas, C Hallas, BL Augenbraun, S Raval, D Mitra, JM Doyle
Establishing a nearly closed cycling transition in a polyatomic molecule
Physical Review A 103, 043111 (2021)

BL Augenbraun, ZD Lasner, D Mitra, S Prabhu, S Raval, H Sawaoka, JM Doyle
Assessment and mitigation of aerosol airborne SARS-CoV-2 transmission in laboratory and office environments
Journal of Occupational and Environmental Hygiene 17, 447-456 (2020)

D Mitra, NB Vilas, C Hallas, L Anderegg, BL Augenbraun, L Baum, C Miller, S Raval, JM Doyle
Direct laser cooling of a symmetric top molecule
Science 369 (6509), 1366-1369 (2020)

L Baum, NB Vilas, C Hallas, BL Augenbraun, S Raval, D Mitra, JM Doyle
1D magneto-optical trap of polyatomic molecules
Physical review letters 124 (13), 133201 (2020)

(Full list on Google Scholar)

EDUCATION

2019 – CURRENT **AM and PhD in Physics with Secondary in Data Science**
Harvard University, USA

2013 – 2018 **Bachelors and Masters of Science with Major in Physics (Honors)**
Indian Institute of Technology, Kharagpur, India

TEACHING EXPERIENCE

FALL 2022 **Physics 12B: Electromagnetism and Optics from an Analytic, Numerical and Experimental Perspective**

SPRING 2022 **Physics 12A: Mechanics and Statistical Physics from an Analytic, Numerical and Experimental Perspective**

SUMMER 2021 **CS 109A: Introduction to Data Science**

FALL 2021 **Physics 2: Mechanics, Elasticity, Fluids, and Diffusion**

AWARDS

2019 **Purcell Fellowship**
Harvard University

2012-18 **Young Scientist Encouragement Scheme (KVPY fellowship)**
Indian Institute of Science (IISc)
Bangalore, India

2016 **Summer Research fellowship**
Indian Academy of Sciences (IAS)

2015 **UQ Advantage Grant**
2016 **Certificate for Excellence in Contribution to Current Research**
University of Queensland (UQ)
Brisbane, Australia