Ira Shokar

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Profile

Second Year PhD Candidate at the University of Cambridge's Department of Applied Mathematics and Theoretical Physics and Centre for Doctoral Training in the Application of Artificial Intelligence for Environmental Risk, researching emulation of atmospheric fluid flows using Deep Learning.

Areas of Interest: Fluid Dynamics, Atmospheric and Oceanic Dynamics, Deterministic and Stochastic Dynamical Systems, Deep Learning, Generative Models, Reduced Order Models.

Technical Skills: *Languages*: `Python` (experienced), `Julia` (beginner), `MATLAB` (intermediate) & `C++` (intermediate). *ML Frameworks* : `PyTorch` (experienced), `TensorFlow` (experienced). *HPC* : Fawcett (DAMTP HPC), JASMIN, UCL High Energy Physics Linux Cluster, `AWS Batch`. `Git` & LATEX. Basic `HTML` & `CSS`.

Education

Pembroke College, University of Cambridge   **Cambridge, UK**
PhD. Applied Mathematics - Application of Artificial Intelligence   *Oct 2021 – Present*

○ Awarded UKRI EPSRC full-funding to study at the CDT in the Application of Artificial Intelligence for Environmental Risks as part of the Atmosphere-Ocean Dynamics Group in the Faculty of Mathematics.
○ **Research Topic**: Learning Reduced-Order Stochastic Dynamics using Deep Learning to study Zonal Jets.
  - Using Machine Learning to learn the evolution of a Stochastic PDE to produce an emulation that dramatically reduces the computational cost compared to numerical integration and provides a lower-dimensional latent space that can yield insight into the underlying system dynamics as well as model explainability- see more information here.
  - Co-Supervised by Professors Peter Haynes & Rich Kerswell at DAMTP.
○ **Conference Presentations**: December 2022: UK Fluids Network - Workshop on Data Driven Methods in Fluid Dynamics Conference - Title: 'Learning Stochastic Dynamics with Neural Networks to study Zonal Jets'.
○ **Organised Workshops**: March 2022: Cambridge Centre for Climate Science - Machine Learning for Climate Science Workshop.
  - Along with 2 other graduate students, we organised a workshop introducing Machine Learning to researchers in the atmospheric sciences with 3 interactive sessions & a hackathon implementing ML on real world atmospheric data.
  - In-person attendance reached capacity with 40 attendees, along with 8 virtual attendees. Resources can be found here.
○ **Teaching**: Lent 2022: Supervised Part II Computer Science - Deep Neural Networks.

MRes. Physical Natural Science - Environmental Data Science   *Oct 2020 – Sept 2021*
○ Probationary training year to doctoral study, part of the CDT, awarded UKRI EPSRC full-funding.
○ **Thesis**: 'Deep learning to predict dynamics on an inertial manifold of mid-latitude jet systems'.
○ **Relevant Modules:** Fluid Dynamics of Climate, Foundations of Data Science, Environmental Data Analysis, Deep Neural Networks, Machine Learning and the Physical World, Probabilistic Machine Learning, Statistical Learning in Practice, Inverse Problems, Advanced Topics in Machine Learning or NLP.

University College, University of London   **Bloomsbury, London**
BSc. Physical Natural Science - Theoretical Physics   *Sept 2017 – July 2020*
○ **First Class overall** - First Class in all three years & thesis
○ **Thesis:** 'Deep Learning Classifier Robustness for Neutrino Event Detection using Domain Adversarial Neural Networks'.
○ **Relevant Modules:** Theory of Dynamical Systems and Chaos, Computational Physics (I & II; `Python`), Computational Mathematics (`Mathematica`), Mathematical Methods (I, II, III, for Physics and Astronomy, for Theoretical Physics).

Tiffin School   **Kingston-Upon-Thames, Surrey**
○ **4 A-Levels** : **A*** in Mathematics and Further Mathematics; **A** in Economics and Physics.
○ **2 AS-Levels**: **A** in History and Physical Education and **10 GCSEs**: 6**A*** & 4**A** grades.

Previous Research Experience

○ **Data-Driven Exploration of Mid-Latitude Weather.**
  - *MRes Report*: Developed an Autoencoder to explore whether a Beta-plane turbulence model of tropospheric mid-latitude circulation lay on an internal manifold, with the reduced form leading to a reconstruction error two orders of magnitude smaller than PCA. We also explored the variability of the system due to its stochastic parameterisation scheme. Supervised by Professors Peter Haynes & Rich Kerswell [`Python:  Keras, Tensorflow; MATLAB`].
○ **Assessing Temporal Change In The Exposure Of Informal Settlements Through Repeat Satellite Observation.**
  - *Group Project :* Developed a settlement classifier with a change detection model to repeat satellite imagery, to identify the growth or contraction of informal settlements, from which we quantify exposure variation to natural hazards with available socio-economic data.[`Python:PyTorch, Tensorflow; JASMIN`]. Supervised by Dr Anita Faul.
○ **Quantifying the effectiveness of natural hazard preventions by predicting rainfall runoff in flood risk mitigation.**
  - *Group Project :* Investigating the effectiveness of natural flood management interventions undertaken in the town of Shipston-on-Stour during 2017 to 2020 using an LSTM model. Supervised by Dr Oscar Branson [`Python:Pytorch`].
○ **Deep Learning Classifier Robustness for Neutrino Event Detection using Domain Adversarial Neural Networks.**
  - *Final Year Research Project*: Implemented a Domain-Adversarial Neural Network (DANN) to improve the performance of a Convolutional Neural Network (CNN) to classify neutrino interactions, for the analysis of neutrino oscillations, by training the model to be invariant to the differences in production mechanisms between the data sources: simulated data and the detector data. Supervised by Dr Chris Backhouse [`Python:Keras, Tensorflow; C++:Root, NOvAsoft; Scientific Linux`].

- **HPGe Detector Gamma Ray Spectroscopy simulation of nuclear emission & detector interactions.**
  - *Group Project*: Used a high-purity germanium (HPGe) detector as well as a Monte Carlo simulation to give insight to the reliability of the detection of gamma photons at different energies and to identify gamma-ray-emitting radioactive samples above a 3σ confidence level for given unknown samples. Supervised by Prof Ruben Saakyan `[C++:ROOT, GEANT4]`.
- **Cellular Automata Model to Simulate Motorway Traffic Flow**.
  - Built a Cellular automaton to simulate motorway traffic flows, in order to compare the similarities to granular flow when traffic shockwaves arise. The model was extended to contain different vehicles with different maximal speeds, blockages such as accidents or road closures to try to model a driverless car system. Supervised by Prof David Bowler `[Python]`.

Technical Work Experience

FTI Consulting   **Aldersgate St, City of London**
Data Science & Analytics Summer Intern (kyle.johnson@fticonsulting.com)   *July 2019 – August 2019*
- An 8-week summer internship applying data science pipelines in the form of: data wrangling and data cleaning (dynamic and static web-scraping, parsing structured data and regular expressions), storing large data sets, data mining and querying using `SQL` and applying analysis to search for anomalous activity, fraud and money-laundering.
- My main project involved creating a relationship and transaction graph network using `[Python]` and `[Neo4j]`, applying various network analysis metrics to determine key players and clusters that may require extra investigation. This was used in conjunction with bank records in implementing fuzzy token matching in addition to with anomaly detection models.

Select Machine Learning Hackathons

Developer Circles from Facebook   **Rathbone Square, Fitzrovia, London**
UCL Hackathon Team (president@ucltechsoc.com)   *December 2019*
- I was selected to represent UCL at the AI for Messenger Hackathon where we created a chatbot that returned the translated text from an image containing text in a different language.
- Used `Node.js` for the messenger front end, with `Flask` connecting to the `Pytorch` models, which consited of a CNN to determine the locations of the words, an OCR CNN to recognise the text, and a translation neural network.

UCL Data Science Society Hackathon   **Microsoft Reactor, City of London**
Winning Hackathon Team (su-datascience@ucl.ac.uk)   *November 2019*
- Hackathon hosted by Microsoft and American Express to look at providing insight from their credit card customer datasets.
- I was part of the winning team, where we produced a solution concluding that that product personalisation for customer subsets could increase credit card growth while assessing potential credit default and delinquency risk.
- We conducted exploratory analysis through k-means clustering and build decision tree and random forest models using `Scikit-Learn` and the `Azure API`.

Arm Holdings   **Peterhouse Technology Park, Cambridge**
Applied Machine Learning Insight Challenge (shoko.ueda@arm.com)   *November 2019*
- I was part of the winning team that completed a `Python` debugging challenge applying an adaptive image filter to a webcam image using a CNN during an insight into the research being conducted by ARM in the fields of computer vision and natural language processing for mobile devices.

Non-Technical Roles

Pembroke College, University of Cambridge   **Cambridge, UK**
College Librarian (library@pem.cam.ac.uk)   *Sept 2021 – Present*
- Supervise the library when full time staff are not present in the evenings and weekends - helping to assist readers and enforcing Library rules and dealing with any disturbances.

Housing Officer - Pembroke College Graduate Parlour (gp@pem.cam.ac.uk)   *June 2022 – Present*
- Elected to represent the graduate committee to raise issues with regard to college-owned housing as well as sit on committee meetings with senior college fellows on the topic of the college estate.

President - Pembroke College Graduate Parlour (gp@pem.cam.ac.uk)   *June 2021 – June 2022*
- Elected to lead the committee of 16 members and sit on committee meetings with senior college fellows to shape the college experience for graduate students, current and future.

Events Officer - Pembroke College Graduate Parlour (gp@pem.cam.ac.uk)   *June 2021 – June 2022*
- Elected to organise events, large and small, that will appeal to all aspects of the college community. This includes online events as well as following Covid protocols to ensure all in-person events are run safely and within guidelines.

University of London   **London, UK**
Resident Advisor - Lillian-Penson Hall (derrick.chong@london.ac.uk)   *August 2019 – August 2020*
- Promoting and monitoring residents' personal, mental and social welfare, other pastoral care, dealing with disciplinary issues & conflict resolution, and being in charge of organising the social life of the Hall. Organised events for residents of the hall as well as the wider University of London halls.
- Mental Health First Aid certified (MHFA), Eating disorder and suicide prevention awareness trained (BEAT, Papyrus), Equality, Diversity and Inclusion trained (Definitely Able, All Sorts), Physical First Aid certified (British Red Cross), Fire Safety Awareness & Fire Marshall trained (Health & Safety, University of London).