Julian D'Costa

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Profile

Energetic PhD student in Computer Science with previous experience in research methods and machine learning. Currently looking for internships (late June – early Oct 2023) where I can apply insights and tools from mathematics and theoretical computer science to reason about and build intelligent impactful systems.

Education

University of Oxford **2020–present**
Oxford *DPhil in Computer Science*
Inaugural Stephen Cameron Scholar at Keble College + CS Department Scholarship

Indian Institute of Science **2016–2020**
Bangalore *B.S. (Research) in Mathematics*
First Class with Distinction · KVPY Fellowship

Experience

Junior Researcher **August 2022–October 2022**
Algorithmiq
Algorithmiq works on applying near-term quantum computers to life sciences. I used my synthetic biology and ML experience to help Algorithmiq explore the fast-changing landscape of AI and QC-aided drug discovery and development.

Web Developer **February 2022–August 2022**
Interintellect
I wrote custom Wordpress plugins, Stripe integrations and back-end code in Laravel to enable users to host, view and buy tickets for salons on the Interintellect website. I also conducted a full review of website and social media positioning.

Data Science R&D Internship **August 2021–October 2021**
QuantumBlack, a McKinsey company
Worked with the Explainable AI team to incorporate causality into Shapley Values, the current standard industry method of explaining an ML model's prediction by attributing credit to features of the input. Reviewed the academic literature, analysed and benchmarked implementations and ran experiments in Python and R to determine which proposals were theoretically sound and viable in production. Published results internally via notebooks and talks to position QB to take advantage of developments in the field.

Innovate India Drug Discovery Hackathon 2020 **July 2020–October 2020**
ddhackiisc
Collaborated with a team of biochemists in a Govt of India competition to develop machine learning models to identify better drugs. I combined ideas from sequence to sequence neural translation with variational autoencoders to develop SMILES VAE (link), a generative model for molecules represented in the SMILES text format. I also collaborated on a moonshot proposal to develop miniprotein inhibitors using an end-to-end differentiable model leveraging geometric deep learning-based molecular fingerprints. We won the Grand Prize and our proposals have been awarded 3,500,000 INR in grant funding by the Indian government.

Monsoon Math Camp **June 2021, April 2020**
IISc, MIT, Oxford students (ESPR/SPARC alumni)
Co-founded a online mathematics camp for talented Indian high-schoolers, aiming to introduce them to advanced mathematical topics not covered in the school or university curriculum. Designed and developed the website, www.monsoonmath.org. Currently responsible for administering the Monsoon Math Fund, which makes small grants to support students with self-driven projects.

Bachelor Thesis: Error-Prone Model Learning **January–June 2020**
IISc

Worked on speeding up classical automata learning techniques with recurrent neural networks. Implemented RNNs that learned finite state systems like the gnuTLS protocol using pytorch. Combined Python models with Java-based automata libraries. Analysed sample complexity of learning with errors.
Experimental work joint with Alvin George. Advised by Deepak D'Souza and Chiranjeeb Bhattacharya (IISc CSA) and Sriram Rajamani (Director, Microsoft Research India)

Machine Learning Experiment Contractor and Analyst **July 2019–February 2020**
Ought, San Francisco (Remote)
Participated in experiments and ran analyses for `ought.org`, a research lab aiming to train machine learning systems to answer complex and open-ended questions

MPI-SWS Summer Internship **May–July 2019**
Max Planck Institute for Software Systems, Saarbrucken
Worked on analysis of continuous linear dynamical systems as models of cyber-physical systems with Prof. Joël Ouaknine and Prof. James Worrell (Oxford CS). Presented our results at STACS 2020.

IISc Summer Research Internship **May–July 2018**
Mathematics Department, IISc
Worked with Prof Siddhartha Gadgil on the ProvingGround project (link). The ProvingGround project aims to convert structured mathematical text (eg latex source of a paper) to something that can be formalized in Homotopy Type Theory. Studied basic functional programming, parse trees and recursive translation of a controlled natural language.

Skills

ML coursework (all graduate level courses): Machine Learning, Practical Data Science, Foundations of Data Science & High Dimensional Probability, Deep Learning Theory and Practice (IISc & Microsoft Research), Digital Epidemiology (IISc & Strand Life Sciences)

Selected other math and CS coursework: Algorithms, Automata Logic & Games , Probability & Computing, Computer Security, Scientific Computing, Measure Theory, Linear Algebra, Complex Analysis

Languages: Python, C++, PHP, Scala (beginner), Javascript (beginner), R(beginner)

Other skills include technical and creative writing (340/340 GRE), leadership and public speaking experience

Selected Research and Writing

The Pseudo-Skolem Problem is Decidable: With T. Karimov, R.Majumdar, J. Ouaknine, M. Salamati, S. Soudjani and J. Worrell. MFCS 2021. (link)

Adversarial Examples for CNNs: Analysed Wasserstein distance based approaches to building robust image classifiers. Experimented with various types of adversarial attacks and training using approximations to the Wasserstein ball. With Gaurang Sriramanan. Final project for Deep Learning: Theory and Practice. (link)

Resistance: Tales from A Post-Antibiotic World: Edited an anthology of short fiction themed around antibiotic resistance. 96pp. Published by IIScPress (2019).

GCODe: Engineering project, Summer-Fall 2017. Designed an automated process to speed up synthetic biology experiments as part of iFLOAT, the IISc iGEM 2017 project. Wrote the technical documentation at `http://2017.igem.org/Team:IISc-Bangalore/Hardware`.

Selected Awards and Honours

Grand Prize Winner: Innovate India Drug Discovery Hackathon **2020**
Awarded 100,000 INR grand prize + 3,500,000 INR grant funding for 2 projects *Delhi*
Ministry of Innovation, Government of India

International Genetically Engineered Machine Competition (iGEM) Gold Medallist **2017 and 2018**
Gold Medal + Best Hardware Nomination for iFLOAT ('17), Gold Medal for PhageShift ('18) *Boston*
iGEM Foundation

National Bal Shree Awardee in Creative Scientific Innovation **2012**
1 of 8 Science Awardees that year across India *Delhi*
Ministry of HRD, Government of India

IIT-Bombay Mathematics Olympiad **2015**
2nd Place in India *Mumbai*
Indian Institute of Technology, Powai