Dr. Scott Vinay

DATA SCIENTIST | QUANTUM PHYSICIST

Derby, UK

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Employment and Other Experience

Data Scientist
ISGOOD.AI

Melbourne, Australia

Aug. 2019 – April 2020

- Co-designed, developed, and tested a novel machine learning pipeline for rapid understanding of a client's text, and semantically matched it to a database of existing text.
- Developed a highly modular code structure to allow for ease of delegation of tasks across a team and deployed iteratively via Gitlab.
- Set up and used Google Cloud Platform for storage and training of large models.
- Took on a leadership role during the absence of the team leader, which involved tutoring new members on complex methods and assigning and reviewing progress on subtasks.

Contract Consultant
RMIT UNIVERSITY

Melbourne, Australia

Dec. 2019

- Subject matter expert. Designed assignments for the Introduction to Analysis module for the Master of Data Science course. This involved the automatic generation of unique problems and answers for each student, mainly using R.

Data Technician
BLACK.AI

Melbourne, Australia

Jan. 2020 – April 2020

- Helped create and verify the dataset for a massive-scale image recognition system.
- Worked closely with development and machine-learning teams to help optimise efficiency of classification models.

Postgraduate Teaching Assistant
UNIVERSITY OF SHEFFIELD

Sheffield, United Kingdom

Sep. 2016 – April 2019

- Demonstrator for the courses of Advanced Quantum Mechanics, Programming in Python (for 3 years), and Advanced Programming in Python (for 2 years).
- Assisted students working on problem sets, marked homework, graded formal assessments, and designed assignments.
- Advanced Programming in Python involved the teaching of object-oriented programming and neural network construction.

Tutor
PRIVATE

Sheffield, United Kingdom

Sept. 2018 – April 2019

- I have privately tutored students at A-level and undergraduate degree level, helping to improve their understanding of various concepts in maths and physics.
- Received commendations for greatly improving students' understanding.

Undergraduate Research Internship - Fluid Dynamics
UNIVERSITY OF WARWICK

Coventry, United Kingdom

Summer 2014

- Modelled swimmers in the Stokes regime as sets of singularities, and used a method of images similar to that used in electromagnetism to calculate the resultant flow and behaviour when brought near to a wall. Used to investigate the behaviour of so-called "squirmer"-type creatures.

Undergraduate Research Internship - Computer Vision
UNIVERSITY OF WARWICK

Coventry, United Kingdom

Summer 2013

- Designed and constructed a computer vision system, that used OpenCV to capture an image of a set of counters at a skewed angle, load the positions into an atomic energy simulator, and find the local-minimum energy. This allowed for researchers to easily test hypothesised atomic configurations in a tactile way, which I demonstrated at a university open day.

Education

PhD in Quantum Cryptography   *Sheffield, United Kingdom*

THE UNIVERSITY OF SHEFFIELD   *Sept. 2015 - March 2019*

- Thesis on *The Statistics and Security of Quantum Key Distribution.*
- Research included development of both practical proposals for technological protocols and novel mathematical frameworks for efficient statistical analysis of arbitrary networks.
- Supervised by Pieter Kok and Stephano Pirandola.

MPhys in Physics   *Coventry, United Kingdom*

THE UNIVERSITY OF WARWICK   *Oct. 2011 - Jun. 2015*

- 1st class honours with an 84% average grade.
- Dissertation on *Energetics of Knotted Defects in Nematic Liquid Crystals.*
- Supervised by Gareth Alexander.

Machine Learning MOOC   *Via Coursera*

STANFORD UNIVERSITY   *2018*

Data Science Project Highlights

Goodreads review analysis

GITHUB.COM/SCOTTVINAY/GOODREADS_REVIEW_ANALYSIS

- An extensive investigation of book reviews from Goodreads.com, in which we predict the sentiment of a review from its text, in addition to a performing a range of other statistical analyses.
- Review score was predicted from complex text with an accuracy of 59%, easily beating human readers who were given the same task and achieved a result of 50%.
- Techniques used: Python, Pandas, Keras, natural language processing, LSTMs, sentiment analysis, web scraping, advanced visualisation, analytic Bayesian statistics.

Visual hand sign recognition

GITHUB.COM/SCOTTVINAY/VISUAL_HAND_SIGN_RECOGNITION

- Construction of a convolutional neural network pipeline to detect and localise hand signs shown to a webcam.
- Techniques used: Python, convolutional neural networks, live video analysis, OpenCV, Google Colab, localisation.

DengAI

GITHUB.COM/SCOTTVINAY/DENGAI

- An entry to DrivenData competition to predict cases of dengue fever.
- Techniques used: Sklearn, random forests, xgboost, ensemble methods.

Publications

Statistical analysis of quantum entangled network generation   *Physical Review A*

SCOTT E. VINAY AND PIETER KOK   *April 2019*

- We developed novel numerical and analytic techniques for the analysis of probabilistic network generation, which we apply to the specific case of quantum communication to prove new security bounds.
- Improved secure communication rates by three orders of magnitude over more simplistic methods.
- Techniques used: Markov chains, Cauchy's residue theorem, Fourier transforms, complex analysis.

Extended analysis of the Trojan-horse attack in quantum key distribution   *Physical Review A*

SCOTT E. VINAY AND PIETER KOK   *April 2018*

- We analysed the effect of a side-channel attack on quantum communication, proving an increased bound on security while relaxing the assumptions previously used.
- Techniques used: Covariance matrices, Krauss-decomposition of channels.

Practical repeaters for ultralong-distance quantum communication   *Physical Review A*

SCOTT E. VINAY AND PIETER KOK   *May 2017*

- We presented a complete protocol for a quantum repeater, and an analysis of its efficiency that takes probabilistic effects into careful consideration. We show that it produces high secret key rates relative to comparable protocols.
- Techniques used: Order statistics, entanglement distillation.

Skills and Personal

Software

- Highly proficient in the use of Python for research applications, including object-oriented approaches. Highly proficient with Pandas, Numpy, Matplotlib, Git, and machine learning packages including Sklearn and Keras.
- Significant experience using Mathematica, Unix, LaTeX, R, and SQL.
- Comfortable and confident in the Google Cloud Platform (GCP) architecture, including the Cloud Compute, Storage, and Cloud Functions systems.
- Some experience with C and MATLAB.

Presentational

- Confident at public speaking on complex topics.
- Delivered talks at multiple department symposia, as well as at meetings of the multi-university White Rose group.
- Research presented at conferences at the University of Cambridge (UK), Technische Universität Wien (Vienna), and the University of Nottingham (UK).

Personal

- In my personal time I like to keep active through rock climbing and snowboarding.
- I am a keen chess and go player.