BARINDER SINGH BANWAIT

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EMPLOYMENT

Quantitative Analyst

Quantile

Sep 2019 – Mar 2020 | London, UK

- Linear, mixed-integer, and multi-objective optimisation for compression of interest-rate derivative portfolios using Gurobi.
- Modelling of reset risk and PV01 for swaptions.
- Analysis of trading data and software development in Python and AMPL.
- Git code management with Bitbucket.

Research Engineer

CMR Surgical

Jan 2018 – Sep 2019 | Cambridge, UK

Transforming Surgery. Developing the next-generation robotic surgical system.

- Research and optimisation of robotic control algorithms, including inverse kinematics and mass-spring-damper models. Key achievements include halving the control loop time of the robot arm, ensuring the joints keep away from their limits during surgical use, and preventing self-collision of the arm.
- Mathematical modelling in Matlab, with Robotics and Control Systems toolboxes.
- Writing production-level, safety-critical embedded C code, compliant with MISRA C and International Standard IEC 62304.
- Time-series telemetry processing in Python, using pandas, numpy, and matplotlib.
- Natural language processing on system log messages with Elasticsearch and kibana.
- Development with Amazon Web Services, including Lambda, S3, and Athena.
- Implementing machine learning algorithms for robot arm condition monitoring, using scikit-learn and Tensorflow.
- Unit and Regression tests in C, C++, and Matlab, including Google Test framework, continuously integrated with TeamCity.
- Agile software development with SVN and Git.

Postdoctoral researcher in Mathematics

Universität Duisburg-Essen

Jan 2015 – Jan 2017 | Essen, Germany

Working in group *Algebraische Geometrie und Zahlentheorie*. Mentor: Prof. Dr. Ulrich Görtz.

Postdoctoral researcher in Cryptography

Institut national de recherche en informatique et en automatique (INRIA)

Jan – Dec 2014 | Bordeaux, France

Working in group *Théorie algorithmique des nombres rapide et flexible*. Mentor: Dr. Andreas Enge.

PUBLICATIONS

- *Del Pezzo surfaces over finite fields and their Frobenius traces*, with F. Fité and D. Loughran. *Mathematical Proceedings of the Cambridge Philosophical Society.* 167(1) (2019) 35-60.
- *Tetrahedral Elliptic Curves and the local-global principle for isogenies*, with J. Cremona. *Algebra and Number Theory.* 8:5 (2014) 1201-1229.

EDUCATION

PhD Mathematics

University of Warwick

Jan 2010 – Sep 2013 | Coventry, UK

Thesis: On some local-to-global phenomena for abelian varieties.
Supervisor: Prof. John Cremona.

BA and MMath Mathematics

University of Cambridge - Christ's College

Oct 2005 – June 2009 | Cambridge, UK

MMath (*Part III of the Mathematical Tripos*) - Distinction

INDEPENDENT PROJECTS

available on my Github

Human Activity Classifier - Tensorflow

2019

- Training a deep neural network to classify human activity from sensor data recorded by a Samsung Galaxy SII.
- 6 categories - walking, walking upstairs, walking downstairs, sitting, standing, lying.
- 92% accuracy with model consisting of 3 densely-connected neural layers and 5 epochs of training.

Elliptic Curve Diffie-Hellman Protocol - Sage

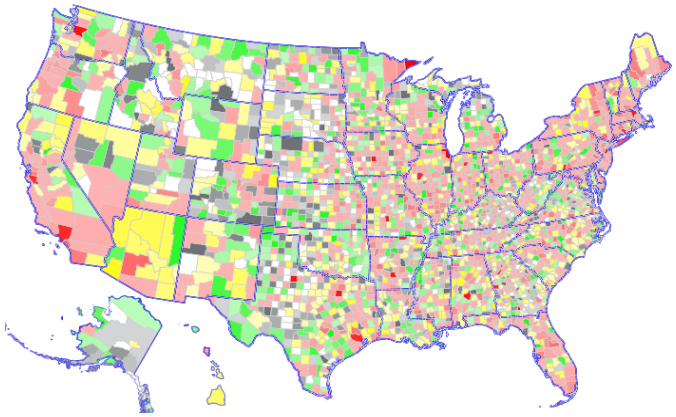
2017

- Simple implementation of public-key cryptosystem developed by Diffie and Hellman.
- Encryption involves randomly chosen element from a finite extension of base field.

H-1B Visa Applications - pandas, scikit-learn, Basemap in matplotlib

2017

- Cleaning and analysing US visa application data from 2014-17.
- Producing datamap of US counties according to application density.
- Predictively modelling salary and visa decision, the latter with 90% accuracy, using a random forest classifier.



Filling US counties by successful H-1B visa application density

TEACHING EXPERIENCE

Course Lecturer

Vertiefung Zahlentheorie

Apr - July 2016 | Essen, Germany

Representability of primes via quadratic forms - from Fermat, Euler, Gauss, and to Artin Reciprocity. Contact time comprised three hours per week, for 15 weeks. Lectures given in German.

Einführung in das Computer-Algebra-Paket *Sage*

Sep 2015 | Essen, Germany

Introductory week-long short-course on *Sage*, aimed at final year undergraduates. First half of week devoted to overview of main features of *Sage*, the second half to programming, and to implementing their very own RSA cryptosystem. Course given in German.

Algebraic Number Theory

July 2009 | Linyi, China

Introductory course at summer-school aimed at second year undergraduates. Topics included: Rings of integers, failure of unique factorisation in some Dedekind rings, class number computations, applications to solving Pell equations.

Seminar Organiser

Algebraic Surfaces

Oct 2015 - Jan 2016 — Essen, Germany

Masters level seminar, organised with Prof. Görtz. We lectured on the foundations: Sheaf cohomology, Serre duality, and intersection theory. Students chose more advanced, specialist topics to give a 90-minute talk on, and obtained credits subject to delivering a satisfactory talk.

Teaching Assistant

A teaching assistant marks the student assignments, and organises a support class to discuss the questions and other problems.

Linear Algebra	Apr - July 2015	Vytautas Paškūnas	Universität Duisburg-Essen
Modular Forms	Oct - Dec 2012	Mehmet Haluk Şengün	University of Warwick
Algebraic Number Theory	Jan - Mar 2012	Johan Bosman	University of Warwick
Elliptic Curves	Oct - Dec 2011	Lassina Dembélé	University of Warwick
Algebraic Number Theory	Jan - Mar 2010	William Hart	University of Warwick

STEP Mentor

Apr 2007 – 2009 — Cambridge, UK

A STEP mentor is assigned a group of 10 A-level students holding a prospective offer to study Mathematics at Cambridge University, whose own schools cannot help them with preparation. The mentor's role is to prepare the students for the STEP entrance examination, by organising classes and lessons on the STEP questions, and generally helping the students mathematically. This takes place during a week in April each year. I was a STEP mentor in 2007, 2008 and 2009.

REFEREE DUTIES FOR JOURNALS

Mathematics of Computation | International Journal of Number Theory | Algebra and Number Theory

LANGUAGES

English	●●●●●●	**Python**	●●●●○○
ਪੰਜਾਬੀ	●●●●●○	**Sage**	●●●○○○
Deutsch	●●●●○○	**C**	●●●○○○
हिंदी	●●●○○○	**Matlab**	●●●○○○
Français	●●●○○○	**Magma**	●●○○○○
		C++	●●○○○○

REFEREES

Prof. John Cremona
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University of Bristol
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Prof. Dr. Ulrich Görtz
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Dr. Andreas Enge
INRIA, Bordeaux
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