Dr. Sadiah Zahoor

Mathematics, Research & Generative AI

Email:
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Location:
Melbourne, VIC, Australia

I specialise in generative AI, with an expertise in data engineering, fine-tuning, RAG strategies, and model innovation. My work spans both industrial applications, where I fine-tune and develop AI models, and personal projects that explore the intersections of generative AI and advanced mathematics, demonstrating my commitment to pushing the boundaries of what's possible in AI research and development.

Skills

- Data Engineering
- Fine-Tuning LLM's
- Jupyter Notebooks
- RAG & Vector Databases
- Hugging Face Technologies
- Python
- PyTorch
- NumPy
- LaTeX
- SAGE
- AI & Mathematics Research
- Generative AI in industries
- Number Theory
- Transformers
- Algorithms optimisation
- Teaching and Mentoring
- Educational Content Creation
- Videography
- Blogging

Education

October 2018 - January 2023

PhD. Mathematics - Number Theory, University of Sheffield.

Sheffield, United Kingdom

Supervisor: Prof. Neil Dummigan

Title of Thesis: Congruences related to Hilbert modular forms of integer and half-integer weight.

Access to E-Thesis: https://etheses.whiterose.ac.uk/32103/

Research areas: Modular forms of integer and half-integer weight; Hilbert modular forms of integer and half-integer weights; Related congruences and applications related to Selmer group of elliptic curves.

October 2014 - June 2015

Master of advanced studies in Mathematics - University of Cambridge.

Cambridge, United Kingdom

Essay Supervisor: Prof. John Coates

Title of Essay: The conjecture of Birch and Swinnerton-Dyer

July 2011- June 2014

B.Sc. (Hons) Mathematics - St. Stephens' College, University of Delhi.

Delhi, India

October 1998- October 2010

Tyndale Biscoe and Mallinson Girls' School

Srinagar, Kashmir

Work experience

August 2023- Present

AI Research Scientist (Deep Learning) - CONTINUUM LABS

Melbourne, Australia

Research area: Specializing in fine-tuning Large Language Models (LLMs) for Private Enterprises, I lead initiatives to boost AI capabilities and provide customized solutions. Highlights include:

- **Data Engineering:** Engineering algorithms that produce exceptional datasets, significantly boosting model training efficiency.
- **Model Optimization**: Achieved cost-effective fine-tuning of open-source models like LLAMA-2 and Mistral on Paperspace/Gradient, enhancing performance while reducing costs and time.
- **RAG Integration:** Led the integration of Retrieval-Augmented Generation (RAG) with LLMs, using Pinecone.

April 2023- Present

Independent research

Melbourne, Australia

Research area: Building and training Deep Learning models for mathematics (transformers) using PyTorch first and spelling them out step by step in Jupyter Notebooks.

Note: Code available upon request.

March 2018- July 2018

Research Assistant - Tata Institute of Fundamental Research (TIFR).

Mumbai, India

Supervisor: Dr. Dipendra Prasad

Research area: Analogy between elliptic curves and class groups.

January 2018- June 2018

Research Assistant - Jointly with Indian Statistical Institute (ISI) and Defence Research and Development Organisation (DRDO), Ministry of DefenCe, India.

Delhi, India

Supervisor: Dr. Shanta Laishram

Research area: Elliptic curve discrete logarithmic problem (ECDLP).

July 2013

Visiting Scholar - Visiting Student Research Programme (VSRP), Tata Institute of Fundamental Research (TIFR)

Mumbai, India

Supervisor: Dr. Indranil Biswas

Research area: Projective planes and magic discs.

Awards and scholarships

Asha Chatterjee Prize, St. Stephen's College, University of Delhi, India

Awarded for academics, character and leadership qualities.

S. Kumar Memorial Prize, St. Stephen's College, University of Delhi, India

Awarded for being the best all-round student in Mathematics.

Department Prize (Math), St. Stephen's College, University of Delhi, India

Awarded for being the best all-round student in Mathematics.

Bank of Tokyo-Mitsubishi UFJ Scholarship, St. Stephen's College, University of Delhi, India

Awarded to encourage and continue learning mathematics.

Cambridge Trust Scholarship, University of Cambridge, United Kingdom

Awarded a scholarship of 16,000 GBP to pursue Master of Advanced Studies in Mathematics at the University of Cambridge.

Narotam Sekhsaria Scholarship, India

Awarded a scholarship of 10,000 GBP to pursue Master of Advanced Studies in Mathematics at the University of Cambridge.

Lucy Cavendish College Scholarship, University of Cambridge, United Kingdom

Awarded a scholarship of 1500 GBP to pursue Master of Advanced Studies in Mathematics at the University of Cambridge.

Teaching experience

Math Tutor at MASH (Mathematics and Statistics Help), University of Sheffield

January 2020- August 2022, Sheffield, United Kingdom

Tasks/ Responsibilities:

- Online and in-person one-on-one support for all levels of Mathematics.
- Created math content and learning resources at various levels from scratch in the form of worksheets and videos.

Undergraduate Tutor in Mathematics, University of Sheffield

October 2019- May 2022, Sheffield, United Kingdom

Tasks/ Responsibilities:

- Level 1 Engineering Mathematics: Lead the problem classes and marked annual examination for all three years.
- Linear Algebra and Advanced Calculus (MAS211): Lead the problem classes and marked weekly homework.
- Metric spaces (MAS311): Marked homework.
- Analysis (MAS221): Assisted the problem classes and marked weekly homework.
- Foundation Year Engineering Mathematics (MAS003): Assisted the problem classes and marked annual examination.

Teaching Assistant for STEP (Sixth Term Examination Paper), University of Sheffield

October 2019- May 2022, Sheffield, United Kingdom

Tasks/ Responsibilities:

- Assisted the problem classes for Y12 and Y13 students.

Undergraduate Summer Project Supervisor, University of Sheffield

August 2022, Sheffield, United Kingdom

Tasks/ Responsibilities:

- Supervised a first-year student for an undergraduate research project on the "The conjecture of Birch and Swinnerton-Dyer".

Private Tutoring, Freelance

January 2019- January 2023, Sheffield, United Kingdom.

Tasks/ Responsibilities:

- Taught advanced mathematics related to the book "Road to Reality" by Roger Penrose.
- Taught engineering mathematics for undergraduate Year 1, Year 2 and Year 3 engineering students.
- Taught A-Level mathematics and Further A-Level maths for Y12 and Y13 .

Administrative roles

Student Enquiry Assistant, School of Economics, University of Sheffield

October 2020- June 2021, Sheffield, United Kingdom.

Tasks/ Responsibilities:

- Read university guidelines and policy to respond to student enquiries framing quick and precise responses.

Postgraduate Representative, School of Mathematics and Statistics (SoMaS), University of Sheffield

October 2019- June 2021, Sheffield, United Kingdom.

Tasks/ Responsibilities:

- Working on removing the communication gap between postgraduate students and administration by raising student issues and delivering rewarding feedback experiences to the administration.

Youtube content manager, School of Mathematics and Statistics (SoMaS), University of Sheffield

October 2019- June 2020, Sheffield, United Kingdom.

Tasks/ Responsibilities:

- Organise video recordings of M.Sc. Statistics lectures and make them accessible via Youtube to distance learners.

Seminars, Conferences and workshops

Mathematical challenges in AI, Sydney Mathematical Research Institute (SMRI).

September -November 2023, Sydney, Australia

Delivered a talk on "Toy-Models of Superposition," detailing how models could encapsulate polysemicity by storing additional sparse features in "superposition".

Number Theory Seminar, University of Melbourne

02 August 2023, Melbourne, Australia

Delivered a talk on congruences related to modular forms.

Y-RANT, Young Researchers in Algebraic Number Theory, University of Glasgow

23 August 2022, Glasgow, United Kingdom.

Delivered a talk on congruences related to modular forms.

Number Theory Day on p-adic methods in automorphic forms, University of Warwick

27 July 2022, Warwick, United Kingdom.

Delivered a talk on congruences between modular forms of integer and half-integer weight.

NUTS, Northern Number Theory seminar, University of Nottingham

10 June 2022, Nottingham, United Kingdom.

Delivered a talk on congruences between modular forms of integer and half-integer weight.

WINGS, Spring Retreat - West Lexham, Norfolk

02 June 2022, Norfolk, United Kingdom.

Delivered a talk on congruences between modular forms of integer and half-integer weight.

Egham-Reading - London arithmetic statistics seminar Queen Mary University, London

02 May 2022, London, United Kingdom.

Delivered a talk on congruences between modular forms of integer and half-integer weight.

Arizona Winter School - Automorphic forms beyond GL_{2}, University of Arizona, Tuscon

05-10 March 2022, Arizona, United States of America.

Linfoot Number Theory Seminar, University of Bristol

02 February 2022, Bristol, United Kingdom.

Delivered an online talk in the student seminar related to my research on congruences between Hilbert modular forms.

Number Theory Seminar Talk, University of Sheffield

10 December 2021, Sheffield, United Kingdom.

Delivered an online talk in the student seminar related to my research on congruences between Hilbert modular forms.

Organiser: Number Theory Student's Seminar, University of Sheffield

October 2020- March 2021, Sheffield, United Kingdom.

Organised a reading seminar on Galois Cohomology and Galois Representations.

Swinnerton-Dyer Memorial Workshop, Online

17-18 May 2021.

This online workshop was a part of the London - Paris Number Theory seminar series and was supported by the London Mathematical Society.

Student's Seminar Talk, Tata Institute of Fundamental Research (TIFR), Online

22 Janauary 2021, Mumbai, India.

Delivered a talk on congruences between modular forms of integer and half-integer weight.

WINGS - Women in Number Theory and Geometry, Winter Retreat, Online

07-08 January 2021.

Online conference organised by the London School of Geometry and Number Theory.

Y-RANT, Young Researchers in Algebraic Number Theory, University of Warwick

05-08 November 2019, Warwick, United Kingdom.

Delivered a talk on congruences between half-integer weight modular forms.

CMI-HIMR Summer School in Computational Number Theory, University of Bristol

17-28 June 2019, Bristol, United Kingdom.

AFW, 33rd Automorphic Forms Workshop, Duquesne University, Pittsburg

06-10 May 2019, Pittsburg, Pennsylvania, United States of America.

Y-RANT, Young Researchers in Algebraic Number Theory, University of Sheffield

08-09 November 2018, Sheffield, United Kingdom.

Delivered an expository talk on the Gauss Conjecture.