GERGELY FLAMICH

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PERSONAL STATEMENT

I am a fourth-year PhD candidate in machine learning with strong practical and theoretical research and coding skills, working mainly on **neural data compression** and related **information theory**. My current work focuses on compression **implicit neural representations** (my recent paper on this topic received a **spotlight award** at NeurIPS) and **relative entropy coding / channel simulation**.

EDUCATION

PhD in Machine Learning (St John's College, Cambridge)

Oct 2020 - Present (Expected Graduation: Feb 2025)
Supervisor: Dr José Miguel Hernández-Lobato

Research interests: Compression algorithms using relative entropy coding, learned data compression using variational autoencoders and implicit neural representations, generative modelling, Bayesian optimization

MPhil in Machine Learning and Machine Intelligence (St John's College, Cambridge)

Oct 2018 - Oct 2019
Graduated with Commendation

Courses taken: Deep Learning, Probabilistic Machine Learning, Computer Vision, Reinforcement Learning, Natural Language Processing, Speech Recognition, Advanced Machine Learning, Statistical Machine Translation, Statistical Speech Synthesis, Control Theory, Introduction to Machine Learning, Probabilistic Automata

Average grade: 75% (A)

Dissertation Topic: Compression, Information Theory, Variational Auto-Encoders **(graded 80.5%)**

BSc Joint Honours in Mathematics and Computer Science (University of St Andrews)

Sept 2014 - June 2018
Graduated as Valedictorian in Computer Science, with First Class Honours

Relevant achievements: In my first year of studies, I implemented a **genetic algorithm** to find optimal playing strategies for the game Starcraft 2 in a very large search space, which was assessed by the department to be the best solution **(graded 100%)**. As part of a third-year group project, I have implemented a **parallelised Monte Carlo Tree Search** agent to play the board game Catan **(graded 87.5%)**.

Average grade: 86% (17.2 / 20)

Dissertation Topic: Cryptography, Fully Homomorphic Encryption **(graded 92.5%)**

ACADEMIC ACHIEVEMENTS

2024	Expert Reviewer	Transactions on Machine Learning Research
2024	Spotlight Paper Award	Learn to Compress Workshop @ ISIT 2024
2023	Spotlight Paper Award	NeurIPS 2023, a top venue for machine learning research.
2022	Highlighted Reviewer	ICLR 2022
2021	Finalist	Qualcomm Innovation Fellowship
2019	Commendation	University of Cambridge, *awarded for good performance in my MPhil*
2018	Adobe Prize	University of St Andrews, *highest average grade in Computer Science*
2018	Dean's List Award	University of St Andrews, *annual award for academic excellence*
2016	Dean's List Award	University of St Andrews, *annual award for academic excellence*
2015	Top of Class	First-Year Programming Projects
2013	2nd Prize	International Hungarian Mathematics Competition

WORK EXPERIENCE AND RELEVANT PROJECTS

Student Researcher: Relative Entropy Coding for Practical Data Compression *July 2022 - Dec 2022*
Google Brain, London
Host: Dr Lucas Theis

- Developed data compression algorithm that is significantly faster than previous comparable methods.
- Published work at IEEE ISIT 2023.
- Contributed the noncentral χ^2 distribution to the popular open-source Tensorflow Probability package.

Research Assistantship: Bayesian Optimization & Data Compression *Oct 2019 - July 2020*
University of Cambridge
Supervisor: Dr José Miguel Hernández-Lobato

- Collaborated with researchers from Intel and Harvard.
- Implemented black-box optimization pipeline to find optimal hardware designs.
- Our method consistently found better configurations faster than standard methods used in industry.
- Improved results from my Master's thesis and published it at NeurIPS 2020.

Master's Dissertation: Compression without Quantization *May 2019 - Aug 2019*
University of Cambridge
Supervisors: Marton Havasi, Dr José Miguel Hernández-Lobato

- Developed machine learning-based image compression algorithm.
- Implemented complex machine learning pipeline in Python using Tensorflow.
- Achieved competitive performance with state-of-the-art methods.
- Thesis graded 80.5%.

Research Assistant / Google Soli Alpha Developer: Gesture Recognition *June 2016 - Aug 2016*
St Andrews HCI Group
Supervisor: Prof. Aaron Quigley

- Implemented a deep neural network to recognize hand gestures using the Google Soli radar sensor.
- My model recognized 6 different gestures, such as swiping, thumb-sliding and clicking.
- My work has formed the basis for further research in the lab.

Research Assistant: Categorising Materials with Radar Waves *Jan 2016 - April 2016*
St Andrews HCI Group
Supervisor: Dr David Harris-Birtill, Prof. Aaron Quigley

- Developed an ML algorithm to detect the materials in objects using the Google Soli radar sensor.
- Our system could differentiate more than 20 materials and several different parts of the human body.
- I implemented the ML pipeline in C, C++ and Java using the Weka toolkit.
- We obtained a patent for our invention and also published work in the UIST 2016.

INVITED TALKS

- Design Space Exploration of Heterogeneous SoCs using Multi-Objective Bayesian Optimization. At *Semiconductor Research Corporation (SRC) TECHCON 2020 (Virtual).*

REVIEWING

NeurIPS (2021 – 2024), **ICLR** (2022 – 2024), **ICML** (2021 – 2023), **AISTATS** (2021 – 2023), **TMLR** (2022 – 2024), **UAI** (2024), **ICML Neural Compression Workshop** (2023), **'Learn to Compress' Workshop@ ISIT** (2024), **Foundations and Trends® in Machine Learning** (2024)

PUBLICATIONS

- J. He, **G. Flamich** and J. M. Hernández-Lobato. Accelerating Relative Entropy Coding with Space Partitioning. *Submitted to NeurIPS 2024*.
- **G. Flamich** and L. Wells. Some Notes on the Sample Complexity of Approximate Channel Simulation. In *First 'Learn to Compress' Workshop@ ISIT 2024*. Received **Spotlight award** (top 4 of 16 accepted works).
- D. Goc and **G. Flamich**. On Channel Simulation with Causal Rejection Samplers. In *IEEE International Symposium on Information Theory 2024*.
- J. He†, **G. Flamich**†, Z. Guo, J. M. Hernández-Lobato. RECOMBINER: Robust and Enhanced Compression with Bayesian Implicit Neural Representations. In *ICLR 2024*.
- Sz. Ujváry, **G. Flamich**, V. Fortuin, J. M. Hernández-Lobato. Estimating optimal PAC-Bayes bounds with Hamiltonian Monte Carlo. In *Mathematics of Modern Machine Learning Workshop at NeurIPS 2023*.
- J. A. Lin, **G. Flamich**, J. M. Hernández-Lobato. Minimal Random Code Learning with Mean-KL Parameterization. In *Neural Compression Workshop at ICML 2023*.
- **G. Flamich**. Greedy Poisson Rejection Sampling. In *NeurIPS 2023*.
- **G. Flamich**†, Z. Guo†, J. He, Z. Chen, J. M. Hernández-Lobato. Compression with Bayesian Implicit Neural Representations. In *NeurIPS 2023*. Received **Spotlight award** (top 10% of accepted papers, top 2% of submitted papers).
- **G. Flamich**†, S. Markou†, J. M. Hernández-Lobato. Faster Relative Entropy Coding with Greedy Rejection Coding. In *NeurIPS 2023*.
- **G. Flamich**, L. Theis. Adaptive Greedy Rejection Sampling. In *IEEE International Symposium on Information Theory 2023*.
- **G. Flamich**†, S. Markou†, J. M. Hernández-Lobato. Fast Relative Entropy Coding with A* coding. In *ICML 2022*.
- **G. Flamich**†, M. Havasi†, J. M. Hernández-Lobato. Compressing Images by Encoding Their Latent Representations with Relative Entropy Coding. In *NeurIPS 2020*.
- **G. Flamich**, M. Havasi, J. M. Hernández-Lobato. Compression without Quantization. In *NeurIPS 2019 Workshop on Information Theory and Machine Learning*.
- H.-S. Yeo, **G. Flamich**, P. Schrempf, D. Harris-Birtill, and A. Quigley. RadarCat: Radar categorization for input & interaction. In *Proceedings of the 29th Annual Symposium on User Interface Software and Technology*, pages 833–841. ACM, 2016.

† equal contribution.

TEACHING EXPERIENCE

Master's Thesis Supervision *University of Cambridge*

		Thesis Title
2023	Jiajun He	Compression with Bayesian Implicit Neural Representations • **published** NeurIPS 2023 (spotlight award) and ICLR 2024
2023	Szilvia Ujváry	How tight can a PAC-Bayes bound be? • **published** at M3L Workshop @ NeurIPS 2023
2021	Kristopher Miltiadou	Probabilistic Machine Learning

Undergraduate Supervision *University of Cambridge*

2023	Daniel Goc	8 week undergraduate research project • **published** results at IEEE ISIT 2024
2024	Henry Wilson	Currently supervising an 8 week undergraduate research project

Undergraduate Teaching *University of Cambridge*

2024 Supervised* 3 groups of three fourth-year undergraduate students for *3F8: Inference*
2023 Supervised* 5 groups of two fourth-year undergraduate students for *3F8: Inference*
2022 Supervised* 2 groups of three fourth-year undergraduate students for *3F8: Inference*

* Supervision for undergraduates is a form of small-group teaching at Cambridge and Oxford.

TECHNICAL SKILLS

Programming Languages	Python, Javascript, Java, Haskell, Matlab, C, C++, LaTeX
Frameworks & APIs	Tensorflow, Autograd, SciPy, OpenCV, D3.js, Qt

EXTRACURRICULAR

School President of Computer Science (2017-2018)
- Organised first Computer Science Ball, and Research Fayre for UGs
- Successfully implemented a mentoring scheme for newcomers

Executive Committee Member of the Computing Society (2015-2017)
- Organised 4 hackathons, 9 student talks and 6 programming contests