

# Alex McKinney

✉ [alex.f.mckinney@gmail.com](mailto:alex.f.mckinney@gmail.com) |  [vvwm23](https://github.com/vvwm23) |  [afmck.in](https://afmck.in) |  Scholar

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## Education

### Durham University

MEng. Computer Science

United Kingdom

October 2018 – June 2022

- Graduated with a first class honours degree with a 79.66% average.
- Master's thesis on fast image generation using step-unrolled denoising autoencoders, capable of generating megapixel images in  $\approx 2$  seconds
- *Relevant Modules: Deep Learning, Reinforcement Learning, Machine Learning, Advanced Computer Vision, Natural Language Processing, Parallel Scientific Computing I/II, Single Mathematics A.*

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## Highlighted Projects

### PyTorch Generative Models | Python, PyTorch, Generative Modelling

- Many projects reimplementing recent developments in deep generative modelling and incorporating novel additions where appropriate.
- VQ-VAE-2 implementation that can support an arbitrary number of vector quantization codebooks. Exceptional results on high resolution datasets such as FFHQ1024. [\[Github\]](#)
- Glow implementation with adjustable squeeze rate and gradient checkpointing for significant memory savings. Applied to datasets such as CelebA 128. [\[Github\]](#)
- Implementation of step-unrolled denoising autoencoders (SUNDAE) for non-autoregressive, character-level text generation. Modified with masking during batched sampling to improve inference time further. [\[Github\]](#)
- GPT-style network with efficient Performer self-attention for generating expressive MIDI piano performances using the Google Magenta MAESTRO dataset. [\[Github\]](#)

### ptpt: PyTorch Personal Trainer | Python, PyTorch, DL Tooling

- Personal framework built around PyTorch for rapid experimentation and iteration. Focused on aggressively abstracting implementation details and engineering tricks whilst retaining flexibility.
- Features automatic mixed-precision, compute device management, arbitrary callback functions, and Weights and Biases integration that can all be applied with minimal code change.

### ALBERT Multi-Label Sentiment Analysis | Python, PyTorch, HuggingFace, Natural Language Processing

- PyTorch implementation of A Lite BERT for multi-label sentiment analysis on the *Jigsaw Unintended Bias in Toxicity Classification* dataset.
- Pretrained on the English Wikipedia corpus provided by HuggingFace datasets.
- Deviates from the original formulation by providing options for linear space complexity self-attention approximations.

### Rainbow DQN | Python, PyTorch, OpenAI Gym, Deep Q-Learning

- PyTorch implementations of many DQN variants, including Rainbow DQN – the combination of many DQN improvements.
- Evaluated on the Atari Learning Environment provided by OpenAI Gym.

### sss: Simple Static Site Generator | Rust, Markdown

- Minimalist, markdown static site generator written in Rust. Used to generate my personal website. Supports rendering  $\LaTeX$  expressions and syntax highlighting for code blocks.

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## Research

- **Alex F. McKinney** and Chris G. Willcocks | Megapixel Image Generation with Step-Unrolled Denoising Autoencoders | 2022 | [arXiv]
- **Alex F. McKinney** and Benjamin Cauchi | Non-intrusive Speech Intelligibility Prediction from Discrete Latent Representations | 2022 | [IEEE Signal Processing Letters]

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## Experience

**Teaching Assistant** | *Durham University, United Kingdom* September 2020 – March 2022

- Teaching introductory Python programming and propositional logic to first-year students at a top-10 UK university.
- Involves both remote and in-person teaching, presenting content provided by module leader, and answering questions from students with a variety of technical backgrounds.

**Research Intern** | *OFFIS – Institut für Informatik, Oldenburg, Germany* June – September 2021

- Research Intern as part of the DAAD RISE Germany research exchange scheme and supervised by Dr. Benjamin Cauchi.
- Self-proposed project using contrastive predictive coding for the unsupervised representation learning of binaural audio to improve non-intrusive speech intelligibility prediction systems. Our measure highly correlated with the ground truth (>90%) and surpassed all baselines.
- Paper submitted to IEEE Signal Processing Letters. Preprint available.

**Volunteer** | *ICLR 2021* May 2021

- Student volunteer at the Ninth International Conference on Learning Representations.
- Testing virtual poster sessions and conference website, and providing live technical assistance to the organisers of the workshop “*Neural Conversational AI: Bridging the Gap Between Research and Real World*”.

**Cyber Security Intern** | *Her Majesty's Government, United Kingdom* July – September 2019

- Completed cyber security training courses on offensive and defensive tactics.
- Carried out an individual project into using LSTM neural networks for computer network intrusion detection.

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## Skills

<b>Programming Languages</b>	<i>Proficient in:</i> <i>Experience with:</i>	Python. Rust, C/C++, JavaScript, $\text{\LaTeX}$ .
<b>Libraries and Frameworks</b>	<i>Proficient in:</i> <i>Experience with:</i>	PyTorch, NumPy. JAX, TensorFlow, HuggingFace, Matplotlib, Scikit-learn, Pandas, Weights and Biases.
<b>Software</b>		Git/GitHub, Bash/Zsh, Linux, Conda, Slurm, Vim, Jupyter, Tmux.