Patrick Kage

Research Postgraduate Student
Artificial Intelligence and its Applications Institute
School of Informatics, University of Edinburgh
10 Crichton Street, Newington, Edinburgh EH8 9AB

email : patrick@ka.ge / p.kage@ed.ac.uk
github: pkage
web: ka.ge

EDUCATION

The University of Edinburgh   PhD
Artificial Intelligence and its Applications Institute   *2022–*

- Studying learning under deficient labeling, with a focus on applying methods to Earth observation.
- Supervised by Dr. Pavlos Andreadis and Dr. Siddharth Narayanaswamy.

The University of Edinburgh   BSc(Hons), 1ˢᵗ Class
Artificial Intelligence and Computer Science   *2017–2021*

- Honours thesis: *Class Introspection: A Novel Technique for Detecting Unlabeled Subclasses by Leveraging Classifier Explainability Methods*, publication version available on ArXiv (2107.01657).
- Technical Secretary at CompSoc as of summer 2018. CompSoc is the largest tech society in Scotland and largest society in the university.
- Heavily involved in organising the 2019, 2020, and 2021 Hack the Burgh events, the largest 24 hour hackathon in Scotland.

TALKS & PRESENTATIONS

Oct 2024	P. Kage and P. Andreadis	*Workshop*
	Multi-modal, Multi-scale Representation Learning Just Needs a Good ALiBi	
	Presentation on my research on multi-modal/multi-scale representation learning with a modified linear bias transformer attention. Will be presented at the *4th Space Imaging Workshop* at Georgia Tech.	
June 2024	P. Kage	*Talk*
	AIAI Seminar: Representation Learning for Geospatial Analysis	
	Presentation on my research on multi-modal/multi-scale representation learning with a modified linear bias transformer attention.	
Jan 2023	P. Kage	*Talk*
	AIAI Seminar: Mitigation Strategies for Corrupted and Inaccurate Labelings	
	Presentation on the weak supervision/semi-supervision problem space, and the progress on my research in the area.	
May 2022	A. Attia, S. Rakshit, P. Kage, and P. Andreadis	*Panel*
	Panel discussion on the impact of an Edinburgh Informatics degree	
	Invited panelist. Presented at the *Informatics Teaching Festival*.	
Nov 2021	P. Kage and P. Andreadis	*Workshop*
	Class Introspection: A Novel Technique for Detecting Unlabeled Subclasses by Leveraging Classifier Explainability Methods	
	Presented at the *Workshop on Knowledge Representation for Hybrid & Compositional AI* at *KR 2021: 18th International Conference on Principles of Knowledge Representation and Reasoning*	
	Available online at ka.ge/x/krhcai-talk	

Aug 2021	P. Horton and P. Kage	*Workshop*

Securing your Hackathon with Discord Check-in Bots
Presented at *Hackcon IX* from Major League Hacking
Available online at ka.ge/x/hackcon-talk

Published Materials

Nov 2021	P. Kage and P. Andreadis	*Workshop*

Class Introspection: A Novel Technique for Detecting Unlabeled Subclasses by Leveraging Classifier Explainability Methods
In the *Workshop on Knowledge Representation for Hybrid & Compositional AI* at *KR 2021: 18th International Conference on Principles of Knowledge Representation and Reasoning*
[ArXiv (2107.01657)](ArXiv)

Professional Experience

SpaceRake, Inc.   Senior Scientist
Cambridge, MA, USA   *Jan 2022-*

- Working with satellite imagery and AI at scale, with a focus towards providing insights from publicly-available imagery captured from USGS/NASA/ESA satellites (Landsat, Sentinel, etc.).
- Developing firmware for laser communication systems.
- Experience with writing SBIR/other grant application vehicles for the U.S. Dept. of Defense.

The University of Edinburgh   Teaching Support
Edinburgh, Scotland   *May 2022-April 2023*

- Preparing course materials for the "AI and Storytelling" course at the Edinburgh Futures Institute.
- Creating a toolkit for running large-scale language models (GPT-2, OPT-3b, etc.) and image generation models based on DALL·E and Stable Diffusion on Google Colab.
- Additional work on deploying image generation models based on DALL·E and Stable Diffusion.

NASA Jet Propulsion Laboratory   Software Engineering Affiliate
Pasadena, CA, USA   *Summers 2016-2020*

- **2020** — Continued work on CODEX with MLIA. Building on last year's work, enabled automatic downsampling of datasets for frontend and removed backend bottlenecks allowing for 3-4 orders-of-magnitude faster performance on large datasets.
- **2019** — Continued work on CODEX with MLIA, taking a leadership position on the frontend. Focused on ensuring that the CODEX application remained performant under heavy load, enabling multiple users, and enforcing data consistency. These goals required robust concurrency logic, even under limited conditions and high net/IO/CPU loads.
- **2018** — Developed CODEX, a first-pass data analytics framework for scientific data from JPL/external missions through the Machine Learning and Instrument Automation (MLIA) group. Focused on the frontend, leading a major refactor towards adding unit testing, removing bad practice code, adding documentation, and transitioning the data model to use immutable.js + Redux. Additionally, wrote a static analysis toolkit to aid refactoring of poorly written and undocumented codebases in Javascript.
- **2017** — Continued work from 2016 on the Integrated Modeling Environment (IME). Developed a plugin system for IME through JPL's 397-M group. Focused on data visualization and rapid development. Produced a series of demo plugins, including utilizing WebVR to display satellite models.
- **2016** — Worked in JPL's 397-F (Ops Lab/Human Interfaces Group) to develop mission formulation software to enable design of satellite propulsion systems in support of Team X and Xc's model-based systems engineering modernization initiatives. Resulting project made part of JPL's long-term strategic plan.

Aurora Flight Sciences   Software Engineering Intern
Cambridge, MA, USA   *2016-2017*

- Developed flight/ground station software and hardware for upcoming micro- satellite missions, focusing on software systems engineering. Created new IP
- Worked on the Deformable Mirror Demonstration mission (DeMi) cubesat flight and ground software, a joint project with MIT Space Telecommunications Astronomy and Radiation Lab (STARLab).

Massachusetts Institute of Technology   Research Assistant
Cambridge MA, USA   *Summer 2015, 2016-2017*

- **Summer 2015** — Developed ground/flight software for MIT Space Telecommunications, Astronomy, and Radiation Lab (STAR Lab)'s microsatellite project (MiRaTA), as well as working remotely on JPL mission formulation software. Ground software written at this time is still in use at MIT Lincoln Labs.
- **2016-2017** — Created visualization software to model satellite constellations to support ongoing research at STARLab. Represented STARLab and MIT professionally at the MIT Industry Liaison Conference in Vienna, Austria.

OVERVIEW OF ENGINEERING SPECIALTIES
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Specialization in rapidly prototyping products that solve hard problems, with a focus on web applications.

Languages	**Frameworks**	**Areas**
Python	PyTorch	AI/ML
Javascript	Tensorflow	Semi-supervised Learning
HTML	FastAPI	Latent embedding
CSS	Svelte	Generative models
Julia	React	Frontend
SQL	Postgres	Backend
C	SQLite	Systems
Rust	Node.js	Embedded
Kotlin	D3.js	GIS
	THREE.js	Data visualization
	Vue.js	Unsupervised Learning