Patrick Kage

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Education

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

- Studying weakly supervised learning with explainability, proposal available online.
- 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.

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)

Professional Experience

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

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

Stealth Startup — Senior Scientist
Cambridge, MA, USA — *Jan 2022-*

- Working with satellite imagery and AI at scale.

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.

Talks & Presentations

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

Overview of Engineering Specialties

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

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

Selected Projects

Website P. Kage *HTML/CSS/JS*
Interactive Windows 98 Portfolio
Created an interactive, pixel-accurate Windows 98-themed portfolio website. Written in vanilla javascript, with a sub-1Mb footprint. Includes a full DOS emulation environment and accurate filesystem. Available online at ka.ge, source at pkage/pkage.github.io.

Website P. Kage *HTML/CSS/JS, Python*
KSuite
Created a suite of tooling to automate portions of professional and personal tasks. Includes a URL shortener, synchronized media manager, OAuth2 server with 2FA, pastebin, encrypted file transfer (client-side AES), and Notion-backed static site generator. Available online at ksuite.app.

Library P. Kage *Python*
Wirepickle
Dead-simple remote procedure call library for Python, with serialized Python objects sent over ØMQ. In use at NASA/JPL for CODEX internal processing pool inter-process communications. Source available at pkage/wirepickle, and on PyPI as wirepickle.

Toolkit P. Kage *Javascript*
Depgraph
Javascript dependency graph visualizer, powered by the the esprima AST parser and d3.js. Aims to automatically spot circular dependencies. Used at NASA/JPL for large-scale refactors. Source available at pkage/depgraph.

Daemon P. Kage *Rust*
`focusd`
Rust daemon to add timed blocks to `/etc/hosts.txt` to help productivity. Includes plugins for embedding into system bars, e.g. lemonbar or polybar. Source available at pkage/focusd.