Kyle Buettner

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Website: https://krbuettner.github.io/ | Google Scholar (6 publications, 37 citations as of 3/1/24)

RESEARCH INTERESTS

- Vision-language modeling, model robustness under domain shift, foundational AI models, object detection, data-efficient and parameter-efficient training, prompt learning, AI robustness for diverse cultures and languages

EDUCATION

University of Pittsburgh – Pittsburgh, USA

Doctor of Philosophy, Intelligent Systems — *Sep 2021 – Apr 2025 (Expected)*

Master of Science, Electrical and Computer Engineering — *Sep 2019 – Apr 2021*

- **Graduate GPA:** 3.99/4.00
- **Coursework:** Artificial Intelligence, Machine Learning, Natural Language Processing, Vision-Language Modeling, Theory of Computation, Statistical Methods, Information Retrieval, Computer Architecture

Bachelor of Science, Computer Engineering — *Sep 2015 – Apr 2019*

- **Undergraduate GPA:** 3.94/4.00
- **Coursework:** Computer Vision, Digital Design, Software Engineering, Algorithms
- **Award:** Honorable Mention for Top Computer Engineering Student

INDUSTRY EXPERIENCE

GatherAI – Pittsburgh, USA

Machine Learning Intern — *May 2021 – Aug 2021; May 2022 – Aug 2022*

- Enhanced company's drone-derived insight offerings through R&D on new vision pipeline (*+20% accuracy inc. for beta)*
- Devised an image filtering pipeline that resulted in *>3x reduction in error for customer-facing inventory analytics*
- Orchestrated full model lifecycles, with frequent error analysis and manual annotation (*>1k size*) for detection/segmentation

UPMC Enterprises – Pittsburgh, USA

Software Engineering Intern on the NLP Team — *June 2018 – Aug 2018*

- Engineered visualization tool for EHR domain ontologies (*process time for knowledge dept. moved from hours to minutes*)

EQT Corporation – Pittsburgh, USA

Reservoir Engineering Intern — *May 2017 – Aug 2017*

- Created decline curve modeling tool with Excel for predictive analysis of region-based economics

RESEARCH EXPERIENCE

University of Pittsburgh – Pittsburgh, USA

Ph.D. Student Researcher, Intelligent Systems — *Sep 2021 – Present*

Advisor: Adriana Kovashka

- **Current Project:** adaptation of vision-language models for robustness across geographies and languages
- **Notable Past Projects:** object detection robustness following contrastive pretraining, measuring and enhancing the use of attribute information in vision-language pretraining, modeling climax of video advertisements
- **Accomplishments:** 1st author in CVPR24, WACV24, AAAI23 PracticalDL workshop; 2nd author in BMVC18
- Pretrained/finetuned powerful models (BERT, CLIP, Faster R-CNN) on large-scale datasets (>100k size - COCO, ImageNet)
- Projects frequently entailed prompt engineering (chain-of-thought, exemplar design) with large-language models (ChatGPT)

M.S. Student Researcher, Electrical & Computer Engineering — *Sep 2019 – Apr 2021*

Advisor: Alan George

- **M.S. Thesis:** Analyzing energy, latency, and accuracy of neural networks for heartbeat classification across AI hardware (neural hardware such as Google Coral Edge TPU, neuromorphic hardware such as Intel Loihi)
- **Accomplishments:** 1st author ISVLSI21, 3rd author HPEC20
- Served as NSF SHREC (Space, High-Performance, and Resilient Computing) rep to Intel Neuromorphic Research Community

SKILLS

- **Areas:** Artificial Intelligence, Computer Vision, Natural Language Processing, Machine Learning, Deep Learning, Statistics, Large Language Models, Prompt Engineering, Software Development, High-Performance Computing
- **Programming Languages:** Python, R, C++, C, Java, MATLAB, CUDA, OpenCL, OpenMP, MPI, VHDL, Linux

- **Machine Learning Libraries:** PyTorch, TensorFlow, OpenCV, SciKit-Learn, SpaCy, NLTK, Pandas, NumPy, Matplotlib, Whoosh, Nengo, SNN-Toolbox, Detectron2, MMDetection, NetworkX
- **Software Engineering:** Git, Jupyter Notebook, Agile, Scrum

PEER-REVIEWED PUBLICATIONS

- Buettner, Kyle, Sina Malakouti, Xiang Lorraine Li, and Adriana Kovashka. "Incorporating Geo-Diverse Knowledge into Prompting for Increased Geographical Robustness in Object Recognition." To appear, *IEEE/CVF Conference on Computer Vision and Pattern Recognition* (CVPR), June 2024.
- Buettner, Kyle and Adriana Kovashka. "Investigating the Role of Attribute Context in Vision-Language Models for Object Recognition and Detection." *Winter Conference on Applications of Computer Vision* (WACV), 2024.
- Buettner, Kyle and Adriana Kovashka. "Contrastive View Design Strategies to Enhance Robustness to Domain Shifts in Downstream Object Detection." *AAAI Workshop on Practical Deep Learning in the Wild*, 2023.
- Buettner, Kyle and Alan D. George. "Heartbeat Classification with Spiking Neural Networks on the Loihi Neuromorphic Processor." *IEEE Computer Society Annual Symposium on VLSI* (ISVLSI), 2021.
- Langerman, David, Alex Johnson, Kyle Buettner, and Alan D. George. "Beyond FLOPs: CNN Performance Prediction with Critical Datapath Length." *IEEE High Performance Extreme Computing Conference* (HPEC), 2020.
- Ye, Keren, Kyle Buettner, and Adriana Kovashka. "Story Understanding in Video Advertisements." *British Machine Vision Conference* (BMVC), 2018.

LEADERSHIP AND TEACHING ROLES

Computer Vision Instructor, **Pitt HexAI Research Laboratory – Pittsburgh, USA** *July 2023*

- Volunteered in the 2023 IEEE Mini Summer Camp on Object Detection/Localization in Medical Images using AI
- Delivered various lessons to high-school students about the fundamentals of object detection/localization

Video Game Design Instructor, **Pitt School of Computing & Information Outreach – Pittsburgh, USA** *Oct 2021 – July 2022*

- Taught Scratch video game design lessons to kids as part of neighborhood commitment program
- Composed 6-week Python curriculum to provide practical computer science skills

Sports Coach, **West Mifflin Soccer – West Mifflin, USA** *Aug 2018 – Aug 2021*

- Served as soccer coach in community, running practices and offseason workouts (at youth and high school levels)

Teaching Assistant in Various Courses, **University of Pittsburgh – Pittsburgh, USA** *Sep 2016 – Present*

- Dependable Computer Architecture, Business Calculus, Precalculus, Java, Human-Robot Interaction, Machine Learning

NOTABLE PROJECTS

COVID-19 Search Engine Prototype *Spring 2022*

- Contributed to design of information retrieval system to search for relevant info about COVID-19 pandemic
- Leveraged query likelihood statistical language model and Boolean model for text matching with CORD-19 corpus
- Designed UI through Tkinter, implemented indexing through Whoosh library, used NLTK for text processing

Paint-By-Numbers Canvas Generator *Spring 2021*

- Engineered image processing pipeline with OpenCV and Python for creation of a "paint-by-numbers" canvas
- Evaluated GPU/PyCUDA acceleration of color quantization, median filtering, and edge/contour detection (*2.6x app speedup*)

Last Updated: 3-1-2024