

Sophia Danielle Kolak

 [Email](#)  [Website](#)  [Github](#)

Education

Columbia University, Columbia College, New York NY
Computer Science: Intelligent Systems Track
Concentration in Mathematics GPA 3.5

Expected May 2021

Relevant Courses: Machine Learning, Advanced Software Engineering, Artificial Intelligence, Computation and the Brain, senior thesis in Computer Science, Analysis of Algorithms, Modern Analysis, Quantum Computing, Computer Science Theory, Fundamentals of Computer Systems, Advanced Programming, Data Structures, Linear Algebra, Research in CS I & II, Discrete Math, Multivariable Calc

Research Experience

Columbia University - Performance Patterns

Advisor: Baishakhi Ray

Research Assistant

Spring 2020-present

Developed a static, probabilistic analysis technique that uses deep learning to provide useful information about potential performance bugs at the statement level. Scraped leetcode samples from algorithms challenges, and used deepwalk (an unsupervised DL technique) to embed their data dependency graphs in Euclidean space and detect statements in code that significantly impact performance.

Carnegie Mellon University - Neuro-reuse

Advisor: Claire Le Goues, David Garlan

Research Assistant

Summer 2020

Proposed and implemented a method called “neuro-reuse”, wherein a neural network planner leverages information from old ANNs to replan with evolutionary computation. Empirically evaluated this transfer learning method in our exemplar system and found that neuro-reuse converged faster in the majority of trials and was more robust against drastic changes.

Carnegie Mellon University - ROS Ecosystem

Advisor: Claire Le Goues, Michael Hilton, Chris Timperley

Research Assistant

Summer 2019

Created a database of packages in the Robot Operating System (ROS) ecosystem and their dependencies, with the ability to create snapshots of the ecosystem over time. Examined all ROS packages on GitHub along with their dependencies, discovered over 200,000 applications that extend the ROS framework. Analyzed growth in the ROS ecosystem, identified a small set of working groups at the core of its collaboration structure.

Columbia University: Axel Laboratory - Cognitive Spatial Maps

Advisor: Richard Axel, Walter Fischler

Research Assistant

Fall 2018-Spring 2019

Assisted with an experiment that recorded place and time cell activity during a navigation task to examine how mice represent, recognize and employ sparse olfactory landmarks to form a cognitive spatial map. Used machine learning techniques to identify place and time cells in high dimensionality neuron spiking data, and to correlate their activity with behavior.

Publications

- [1] [It Takes a Village to Build a Robot: An Empirical Study of the ROS Ecosystem](#), **Sophia Kolak**, Afsoon Afzal, Claire Le Goues, Michael Hilton, Chris Timperley, in Proceedings of the IEEE 36th annual international conference on software maintenance and evolution, ICSME 2020
- [2] [Detecting Performance Patterns with Deep Learning](#), **Sophia Kolak**, in Proceedings of the ACM SIGPLAN International Conference on Systems, Programming, Languages, and Applications: Software for Humanity, SPLASH Companion '20
- [3] [Reusing 100% of The Brain: Neuro-reuse for Self-* Planning](#), **Sophia Kolak**, Cody Kinneer, David Garlan, Claire Le Goues, *under review* for the IEEE/ACM 43rd annual international conference on software engineering, ICSE '21
- [4] [SHIRLEE: A Sharp-edge Handheld Identifier and Remover in Low-gravity Extravehicular Environments](#), Dada, Ganeshan, Groll, **Kolak**, Ravi, Stein, Wang in Proceedings of American Institute of Aeronautics and Astronautics AIAA SciTech Forum 2021

Presentations

It Takes a Village to Build a Robot, *ROScon 2019, Macau video slides*

Invited Software Quality Panelist, *ROS World, November 2020*

Detecting Performance Patterns with Deep Learning, *SPLASH Student Research Competition '20*

Grants & Awards

Full Travel Grant, ICSE Student Mentoring Workshop 2020

Winning Paper, AIAA Student Research Competition 2020

Winning tool, Micro-G NExt NASA Challenge

Leadership Activities & Teaching

[Association for Women in Mathematics](#) - President

2018-present

Responsible for organizing weekly events to help students navigate their technical courses and build community within the math department. Overseeing mentorship, outreach, events, and club publicity.

[Computer Science Theory \(COMS 3261\)](#) - Teaching Assistant

Semesters: Fall 2019, Spring 2020, Fall 2020

Responsible for holding office hours, grading assignments, managing piazza and holding recitation for Columbia's undergraduate course on automata theory and computational complexity.

[Columbia Space Initiative](#) - Computer Science Mission Co-Lead

2017-present

Led Columbia's team in the NASA-SUITS design competition. Our team created and demoed an augmented reality UI for next-gen spacesuits, which we presented to NASA and Microsoft.

AWM Machine Learning Reading Group - Lead

Fall/Spring 2020

Ran weekly discussions on various introductory topics in machine learning. As a result of the success of these groups, our club was awarded the 2020 AWM Student Chapter Award for Scientific Excellence.

Skills

Programming: Java, Python, C++, C, C#

Databases: MySQL, GraphQL, Neo4j

Frameworks/Libraries: ROS, PyTorch, TensorFlow, Scikit-Learn, Qiskit

Languages: Conversational in BCS (Bosnian/Serbian/Croatian)