Cole McCall

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Skills

Programming: Python (Pandas, Scikit-Learn, RasterIO, GDAL, ArcPy, etc), C++ (OpenCV), C#, SQL
Tools: ArcGIS Pro, Microsoft SQL Server, PowerBI, SSIS, Microsoft Office

Education

Northwest Nazarene University Aug 2019 - May 2023
Bachelor of Science, Computer Science (GPA: 3.75/4.00)
Concentrations in Data Science and Cybersecurity

Experience

Student Researcher May 2021 - September 2021
Northwest Nazarene University

- Worked on a team of 4 researchers to develop machine learning tools in C++, Python, and ArcGIS Pro that map wildland forest fires from drone imagery.
- Trained and implemented a Support Vector Machine (SVM) to map burn extent on 4 fires with 77% accuracy.
- Using deep learning (MaskR-CNN), created software that improves the accuracy of the burn extent from 77% to 87%.

Software Test Engineer September 2021 – Present
Northwest Nazarene University

- Performed tests on student and university software to ensure it works correctly, while detecting bugs and errors.
- Worked with developers to make necessary improvements and changes.

Teaching Assistant September 2021 - Present
Northwest Nazarene University

- Fulfill the duties of grading and tutoring, but also collaborate and mentor fellow students enrolled in CS courses such as Data Structures, C++, Database Design/Programming (x2), Computer Architecture (x2), and Spatial Analysis (x2).

Computer Science Lab Administrator September 2021 - May 2022
Northwest Nazarene University

- Oversaw and led various projects to maintain and improve the university's computer science lab.

Student Researcher May 2022 - September 2022
Frontier Development Lab

- Worked on a team with 6 professors, Ph.D. students and postdocs from around the world to develop machine learning tools that prevent fires from starting and new fires from growing into large mega-fires.
- Created python scripts that automate/speed-up the data acquisition and processing phases.
- Planned and developed a system to map wildfires using unsupervised change detection with contrastive learning.

Lead Research Assistant September 2022 - Present
Northwest Nazarene University

- Led semester project groups in the Spatial Analysis course, which continue NNU's Fire Monitoring and Assessment Platform (FireMAP) research, by applying Artificial Intelligence and Machine Learning on remote sensing datasets.
- Continued developing and improving tools in python that use AI/ML to map wildfire from satellite imagery.

Publications

Hamilton, D.; Brothers, K.; McCall, C.; Gautier, B.; Shea, T. (2021). *Mapping Forest Burn Extent from Hyperspatial Imagery Using Machine Learning.* Remote Sens. 13, 3843. https://doi.org/10.3390/rs13193843

Zhang, B., Wang, H., Alabri, A., Bot, K., McCall, C., Hamilton, D., & Růžička, V. (2022). *Unsupervised wildfire change detection based on Contrastive Learning.* AI + HADR 2022 Accepted Papers. https://arxiv.org/abs/2211.14654

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Conferences

- Student Assistant at the 2023 ESRI Developer Summit
- Presented in Fall 2021 Tactical Fire Remote Sensing Advisory Committee (TFRSAC)
- Presented in Fall 2022 Tactical Fire Remote Sensing Advisory Committee (TFRSAC)

Projects

Object Detection and Image Segmentation for Rocksat-X 2022

- Project Description: Two robotic arms were created, mounted onboard a sounding rocket, launched into space by NASA, and attempted to throw and catch a ball in space using Deep Meta Reinforcement Learning (DMRL).
- Role: Computer Vision Developer
- My role involved training and implementing a MaskR-CNN (using TensorFlow) for the robot to detect objects in motion.

General Education Data Management and Analysis

- Project Description: As part of the COMP4340 Advanced Database Design/Programming course at NNU, my team of 3 computer science students worked with the university to perform some data science on course data. The goal of this project was to use to the data to generate valuable statistics regarding general education compliancy.
- Role: Team Leader & Lead Data Scientist
- My tasks included cleaning, storing, and visualizing course data using Python, C#, SQL Server Integration Services (SSIS) and PowerBI., then predicting which courses and professors will be compliant with university standards.

Using a Decision Tree to Determine Multispectral Band Usefulness in Mapping Burn Extent from Satellite Imagery and Machine Learning

- Project Description: As part of the COMP4330 Machine Learning course at NNU, I worked on and a led a team of 3 computer science students to continue the university's FireMAP research effort. There were two goals in this project: mapping burn extent from satellite imagery and machine learning, while also determining which spectral bands were most valuable in the classification process.
- Role: Team Leader & Lead Software Developer
- To complete these goals, I created an Iterative Dichotomiser 3 (ID3) Decision Tree from scratch using C#. Using entropy to measure the information gain of each band, the ID3 could be used to create a decision tree based on data from multispectral satellite imagery. The spectral bands with the most information gain were then extracted and used for supervised classification in ArcGIS Pro. Additionally, I implemented Principal Component Analysis (PCA) to reduce 8-band multispectral imagery to 3-band imagery ready for machine learning. The impact of the number of multispectral bands and their wavelengths on the mapping of burn extent was then examined by my team, and work is currently being done to publish the results in manuscript in Remote Sensing.

Using Artificial Intelligence to play Connect Four

- Project Description: As part of the COMP4220 Artificial Intelligence course at NNU, I created a program in C++ that can autonomously play Connect Four against another user or bot.
- I developed several artificial intelligence agents that use adversarial search algorithms, like the negamax algorithm and the minimax algorithm, to play connect four. I then added features like alpha-beta pruning, prioritizing higher value columns, always taking the win when available, and always blocking an opponent's game winning move, to optimize the agent's probability of winning.

Breaking a Simple Substitution Cipher with Artificial Intelligence

- Project Description: As part of the COMP4220 Artificial Intelligence course at NNU, I created a program in C++ that can read in a ciphered message and decipher it using a genetic algorithm.