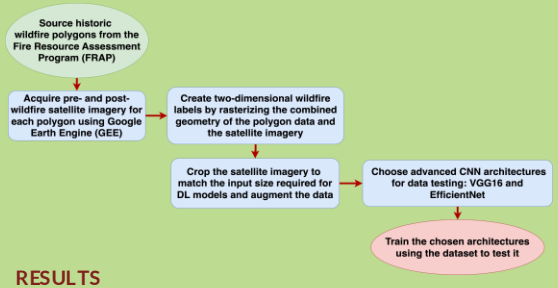
Title: Python-Based GeoImagery Dataset Development for Deep Learning-Driven Forest Wildfire Detection

PRESENTERS: Valeria Martin[1], Derek Morgan[2], and K.Brent Venable[3].

BACKGROUND: Forests are vital ecosystems found globally. Wildfires within these regions are a common natural disaster that can lead to extensive and costly destruction. Earth Observation (EO) systems offer high-resolution imagery for efficient forest monitoring. However, traditional methods for forest wildfire change detection using EO systems may not capture the full complexity of satellite imagery. Deep Learning (DL) algorithms, such as Convolutional Neural Networks (CNNs), show promise in enhancing forest wildfire detection, but they require high amounts of labeled data. Thus, we propose a Python pipeline to facilitate the creation of a labeled Sentinel-2 RGB satellite imagery dataset for DL-driven forest wildfire detection called the California Wildfire GeoImaging Dataset (CWGID). This methodology is highly versatile and can be adapted for other environmental monitoring tasks.

METHODS



RESULTS

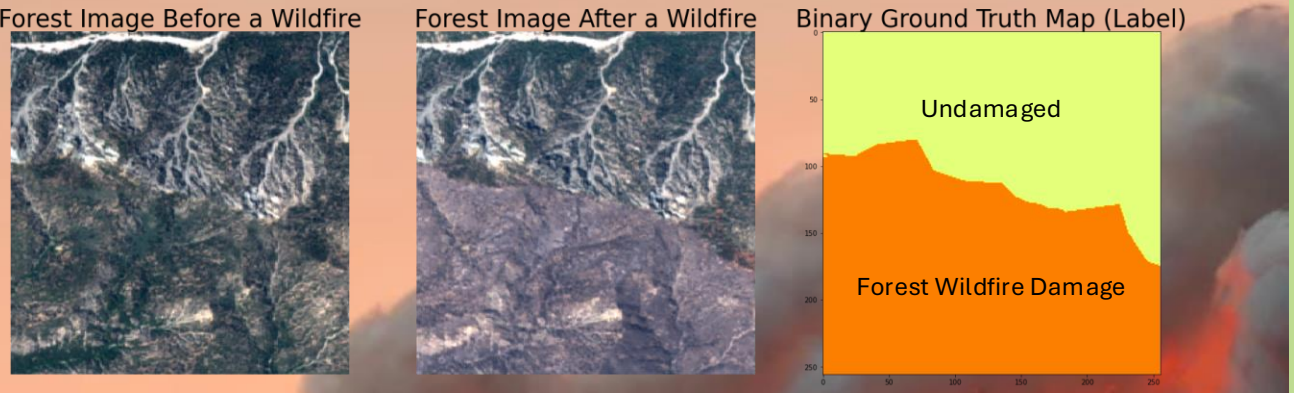
Over a 111,000 labeled RGB 256x256 px before and after image pairs.

	CWGID Data used (%)	Loss	Accuracy	Precision	Recall	Time * (minutes)
EfficientNetB0	25	0.178	0.926	0.925	0.819	933
VGG16	50	1.22	0.832	0.749	0.588	1953

* The models were executed on a MacBook Pro (2019) equipped with a 2.4 GHz Intel Core i9 processor and 16 GB of 2400 MHz DDR4 memory.

We develop a methodology to seamlessly **create large labeled satellite imagery datasets for Deep Learning-driven change detection** and use it to improve forest wildfire detection.

Normalized Pre- and Post- Forest Wildfire GeoTIFF Images and Ground Truth Mask



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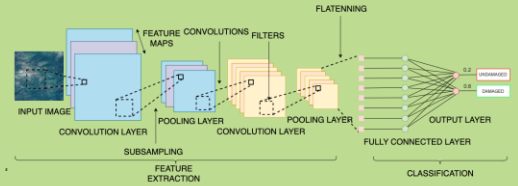
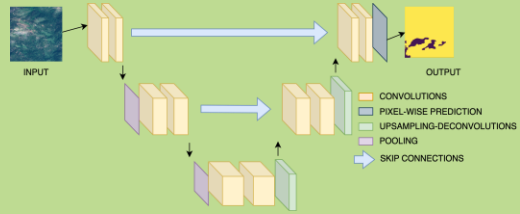
DATASET

DEEP LEARNING ARCHITECTURE USED



NEXT STEPS



REFERENCES

[1] California Department of Forestry and Fire Protection. (2024). Fire and Resource Assessment Program, Historical Fire Perimeter Data. Accessed May 10, 2024. https://www.fire.ca.gov/what-we-do/fire-resource-assessment-program

[2] Simonyan, K., & Zisserman, A. (2015). Very Deep Convolutional Networks for Large-Scale Image Recognition. International Conference on Learning Representations.

[3] Tan, M., & Le, Q. V. (2019). EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks. Proceedings of the 36th International Conference on Machine Learning (ICML), 6105–6114.

[1]Ph.D. Student, Intelligent Systems and Robotics, University of West Florida, vm58@students.uwf.edu
[2]Ph.D., GISP, Associate Professor, Dept. of Earth & Environmental Sciences, University of West Florida, jmorgan3@uwf.edu
[3]Ph.D., Professor, Dept. Computer Science, University of West Florida, bvenable@uwf.edu

University of West Florida