

Image Processing and Semantic Segmentation Software for Flood and Inundation Mapping (2022-049)

A deep learning algorithm used to study flood images and assign learnable weights to various objects in the image.

Market Overview

This product is designed to help scientist calculate the severity of a flood in densely populated areas and to control the damage the flood will cause. The pipeline is smartly designed to train images and calculate flood water levels in inundated areas and can be used to identify flood depth, severity, and risk.

MarketWatch estimates that the global Flood Insurance market size is projected to reach \$29790 million by 2027, at a CAGR of 15.9% during 2021-2027. Much of current flood analytics and inundation mapping technology is limited to processing data only after a natural disaster has occurred. Clemson University researchers have developed a software program to calculate flood water levels that can assist with providing key details about floods and danger to populated areas in real time. "FloodImageClassifier" is designed to load flood related images, label the objects, and then calculate flood severity and inundation areas.

Technical Summary

"FloodImageClassifier" can classify and detect objects within the collected flood images. "FloodImageClassifier" includes various convolutional neural networks (CNNs) architectures such as YOLOv3 (You look only once version 3), Fast R-CNN (Region-based CNN), Mask R-CNN, SSD MobileNet (Single Shot MultiBox Detector MobileNet), and EfficientDet (Efficient Object Detection) to perform both object detection and segmentation simultaneously. Canny edge detection and aspect ratio concepts are also programmed in the package for flood water level estimation and inundation area calculation. The pipeline is smartly designed to train a large number of images and calculate flood water levels and inundation areas, which can be used to identify flood depth, severity, and risk. "FloodImageClassifier" can be embedded with the USGS live river cameras and 511 traffic cameras to monitor river and road flooding conditions, as well as provide early intelligence to emergency response authorities in real-time.

Application

Flood analytics, Inundation mapping, Software data, Deep learning algorithm

Development Stage

TRL 6: Provisional Application

Advantages

- Canny edge detection and aspect ratio concepts, increasing accuracy for flood water level estimation and inundation area calculation
- Easy embedment in modern surveillance technology, providing early and accurate intelligence for emergency response authorities
- Can be customized by end-user, increasing expansiveness in usage

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Provisional Application	United States	N/A	NA	2022-049	Dr. Vidya Samadi Rakshit Pally Rishav Karanjit

About the Inventors



Vidya Samadi

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Dr. Vidya Samadi is an Assistant Professor in the Clemson University Water Resources Engineering program and Director of Clemson Hydrosystem and Hydroinformatics Research (HHR) Group. She earned her PhD in Water Engineering and Science from the University of Tehran. She serves as Chair of the Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) Standing Committee on Informatics and board member of the International Environmental Modeling and Software Society. Dr. Samadi has received the Clemson Support for Early Exploration and Development Award, the Advanced Support for Innovative Research Excellence Award, and the Outstanding Review Award from the American Society of Civil Engineering (ASCE) Journal of Hydrologic Engineering. She is also a founding member of Women in Artificial Intelligence for Water (WomenInAI4Water). Her research focuses on hydroinformatics and cyber-physical modeling systems.



Rakshit Pally

Data Science Engineer at ValueMomentum

Rakshit Pally is a Data Science Engineer at ValueMomentum and Clemson alumnus. He earned his Master of Science in Computer Science from Clemson University, where he worked with Dr. Samadi in her HHR group. Some of his past projects include developing a facial recognition system, Tac-News, an activity tracking system using AWS, a student performance predictor, an agricultural and environmental data analytics system, and biases in word embedding system.



Rishav Karanjit

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Rishav Karanjit is a Computer Science graduate student and research assistant at Clemson University. He earned his Bachelor's in Computer Science and Engineering from the Siddaganga Institute of Technology. Some of his past projects include developing a Model-Template-View (MTV) architecture in Python-based Django framework, building a personal assistant that controls 15 basic computer functions, developing ensemble learning algorithm to automatically grade essays, and using Pokémon API to create a quiz app to guess the Pokémon. Karanjit also came in 3rd place at the 2022 Universities Council on Water Resources (UCOWR) Annual Water Resources Conference.

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