**USING NEURAL NETWORKS AND SATELLITE IMAGERY TO IMPROVE FLOOD DAMAGE ASSESSMENTS**

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**BACKGROUND**

Climate change is considered the greatest threat to human society in the coming decades and will have far reaching effects on weather patterns, regional climates, wildlife, agriculture, and property. The planet is already experiencing some of the effects of climate change. In the western US, water is becoming scarcer, and fire season is lengthening and getting more costly [5]. In the South Pacific, people are being forced from their homes due to rising sea levels and lack of drinking water [6]. Along the Gulf coast of the US, residents must endure more frequent and stronger hurricanes capable of causing catastrophic flood damage. In August 2017, the Texas Gulf coast was hit by Hurricane Harvey. The storm made landfall on August 25th in Rockport, Texas as a Category 4 storm. Over the next 5 days Harvey stalled over southeastern Texas and dumped more than 27 trillion gallons of water on the area. Some parts of Houston received up to 50 inches of rain during the storm [7]. The catastrophic flooding caused by the storm resulted in an approximately $125 billion in damage to properties and businesses in southeastern Texas. This is the second costliest storm in US history, only behind Hurricane Katrina in 2005.

**PURPOSE**

As the effects of climate change continue to accelerate in the coming years, the cost of cleaning up after a natural disaster will become more complicated and costly. In the aftermath of Hurricane Harvey, many homes and businesses were severely damaged due to intense flooding. **THE PROBLEM:** Insurance companies and FEMA traditionally must drive through these areas to assess the damage and understand the economic costs. This can be a time consuming, expensive, and frequently dangerous task. **SOLUTION:** This study will attempt to improve the evaluation process using available satellite imagery and neural networks to identify areas affected by flooding. **PROJECT VALUE:** This study will provide value for both the federal government and insurance companies who need to assess the costliness of a natural disaster. It can be implemented to help focus efforts on affected areas, cutting down the time an agent spends in a particular area and decreasing travel costs and potential harm.

**DATA**

This dataset was taken from Kaggle.com [3] and originally published on the IEEE website [1]. The authors of the dataset also wrote a paper detailing their approach and findings [2]. The data contains 23000 images of both damaged and undamaged classes. The data is broken into two training and test datasets.

**EVALUATION**

This project will involve multiple parts that were learned over the course of this bootcamp. My goal during this project is to make use of more functions in my code for items that need to be repeated. I’ll start with loading, cleaning, and preprocessing my data. Data cleaning and preprocessing of the images will be done using Python, Pandas, and TensorFlow. I plan to visualize the data with Matplotlib and intend to learn geospatial analysis in Python to display data points using Geopandas. Once I’ve cleaned and visualized the data, I will implement ANN using TensorFlow and Keras. I want to expand my knowledge base of neural networks, so I plan to experiment with other types of neural networks, such as convolution and generative adversarial. I’ll use confusion matrices at the end to compare models and save all results into a Pandas DataFrame for easy comparison.

**POTENTIAL CHALLENGES**

The biggest challenges facing this project is the complexity of the dataset and the imbalance of the second set of test images. I also see my basic knowledge of computer vision being a potential challenge. This dataset is more complicated than the datasets used in the learning material and will require additional research and learning. This project will be challenging, but it will help cement the foundational knowledge of neural networks and computer vision in my brain.

**SOURCES**

**[1]** Original Dataset:https://ieee-dataport.org/open-access/detecting-damaged-buildings-post-hurricane-satellite-imagery-based-customized

**[2]** Original Dataset paper: https://arxiv.org/abs/1807.01688

**[3]** Kaggle Dataset: https://www.kaggle.com/kmader/satellite-images-of-hurricane-damage

**[4]** Nasa Climate Change Research: https://climate.nasa.gov/

**[5]** Western US Fires: https://climate.nasa.gov/blog/3066/the-climate-connections-of-a-record-fire-year-in-the-us-west/

**[6]** Rising Sea Levels (Kiribati): https://www.nytimes.com/2016/07/03/world/asia/climate-change-kiribati.html

**[7]** Hurricane Harvey facts: https://tdem.texas.gov/hurricane-harvey-dr-4332-2/