

A grayscale aerial satellite image showing a large agricultural field. A significant portion of the field is flooded, appearing as a lighter shade of gray. Overlaid on the image is a large, semi-transparent green circle that covers the flooded area. The surrounding land appears dry and in various shades of brown and tan. In the bottom right corner, there is a small, distinctively colored patch of crops, possibly corn, with horizontal stripes of yellow, red, and green.

# FLOOD DAMAGE DETECTION IN SATELLITE IMAGERY USING MACHINE LEARNING

MARGARITA POPOVA

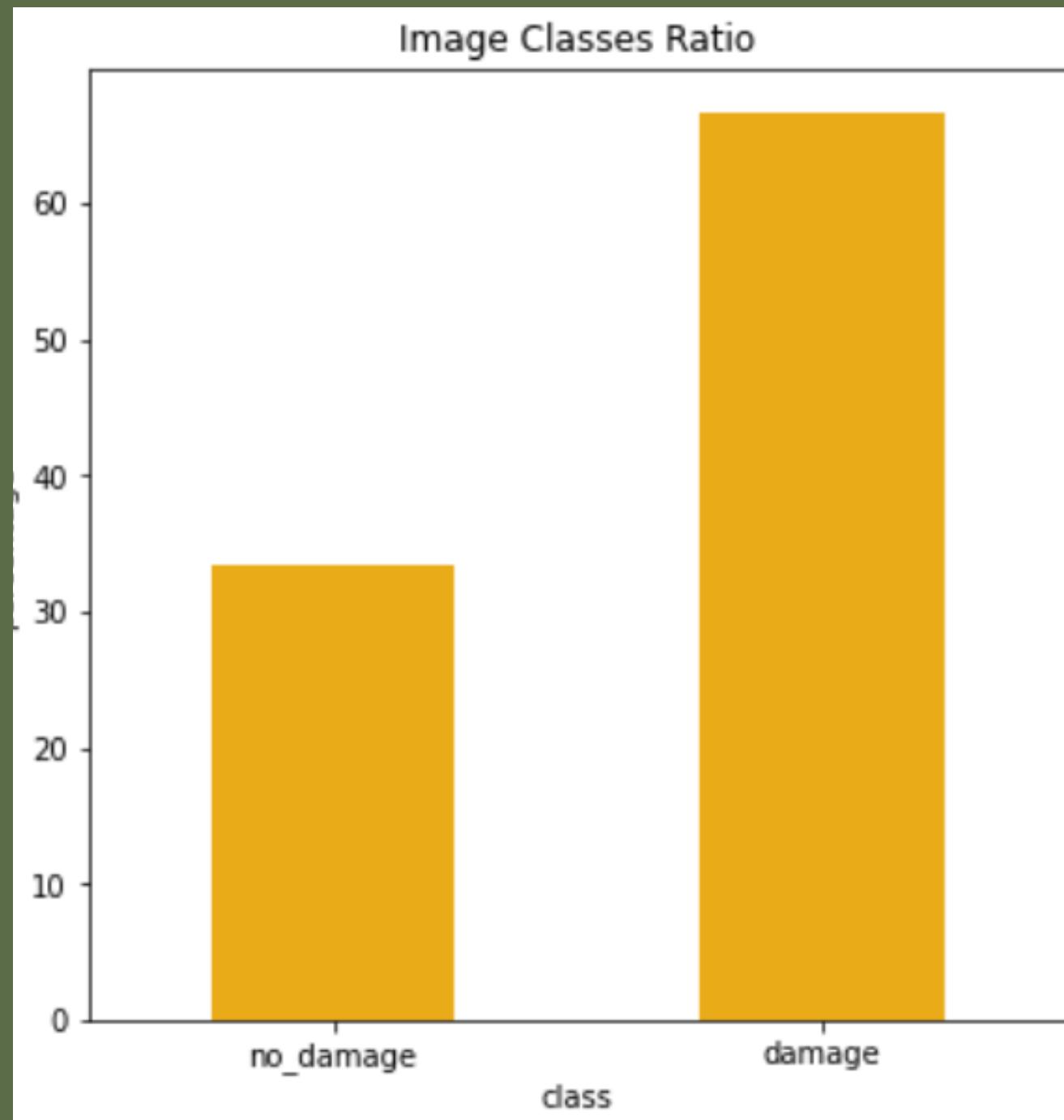
# INTRODUCTION



Hurricane Harvey damaged 204,000 homes

- **Natural Disasters require quick operational monitoring**
- **Satellite Images cover large areas and have high spatial and time resolution**
- **ML techniques allow to process images quickly which is critical for emergency managers**

# DATA DESCRIPTION



The total number of images:  
21057

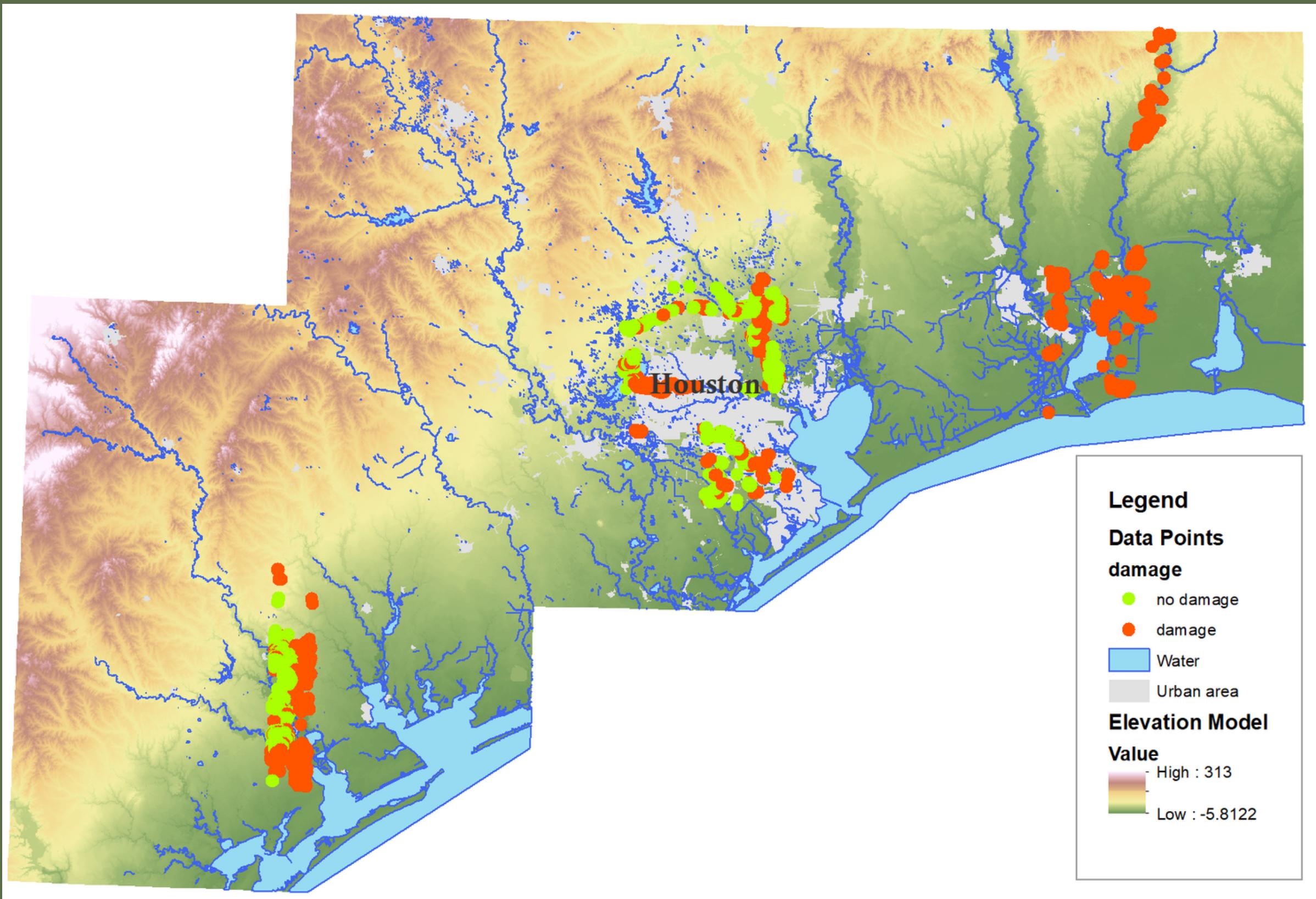
DAMAGE



NO DAMAGE



# DATA EXPLORATION



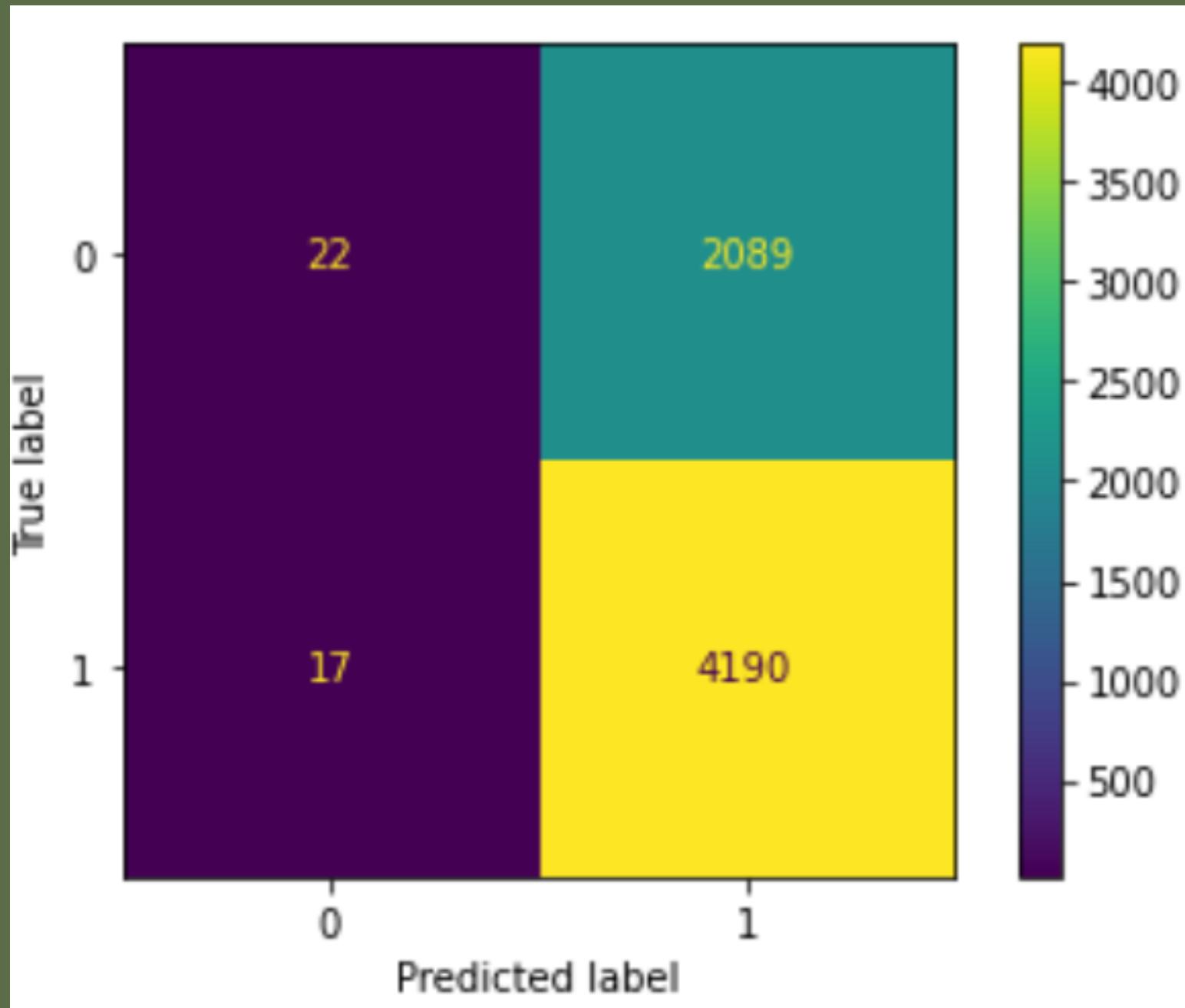
**MAXAR**

the source of images

**USGS**

the source of DEM

# MODELLING



Logistic Regression Accuracy

Precision

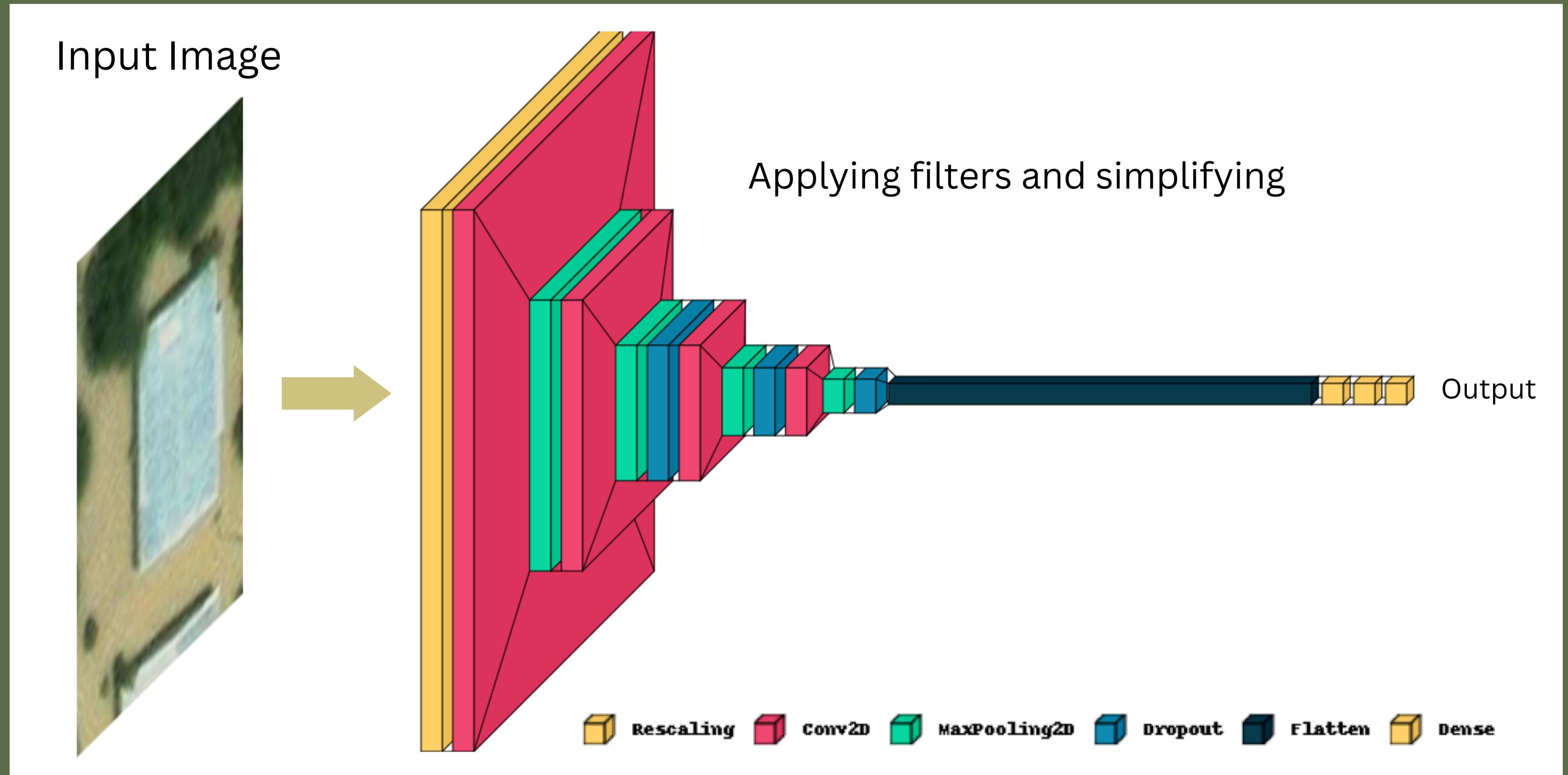
Recall

66%

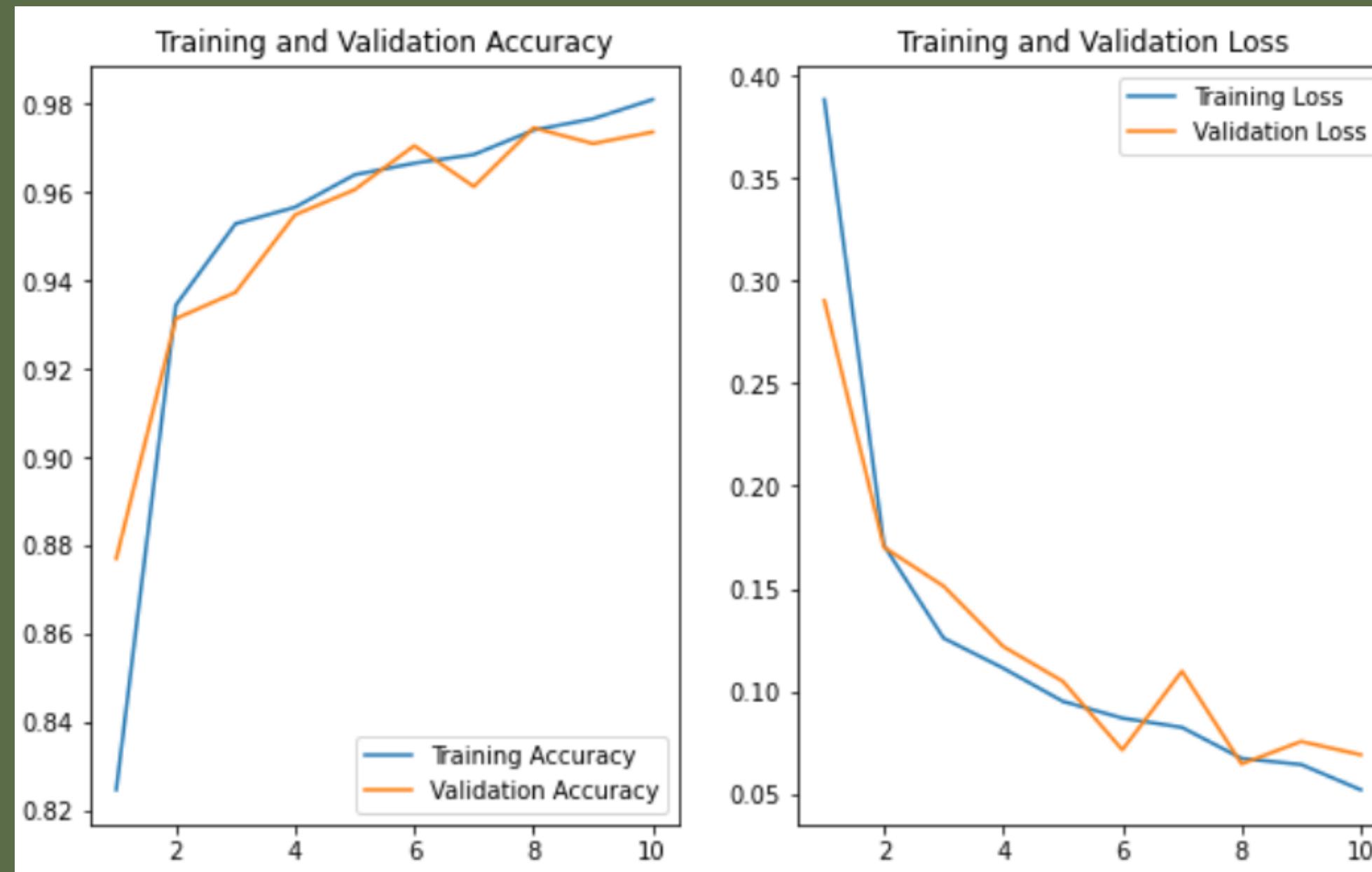
66%

99%

# CNN ARCHITECTURE



# CNN MODELLING



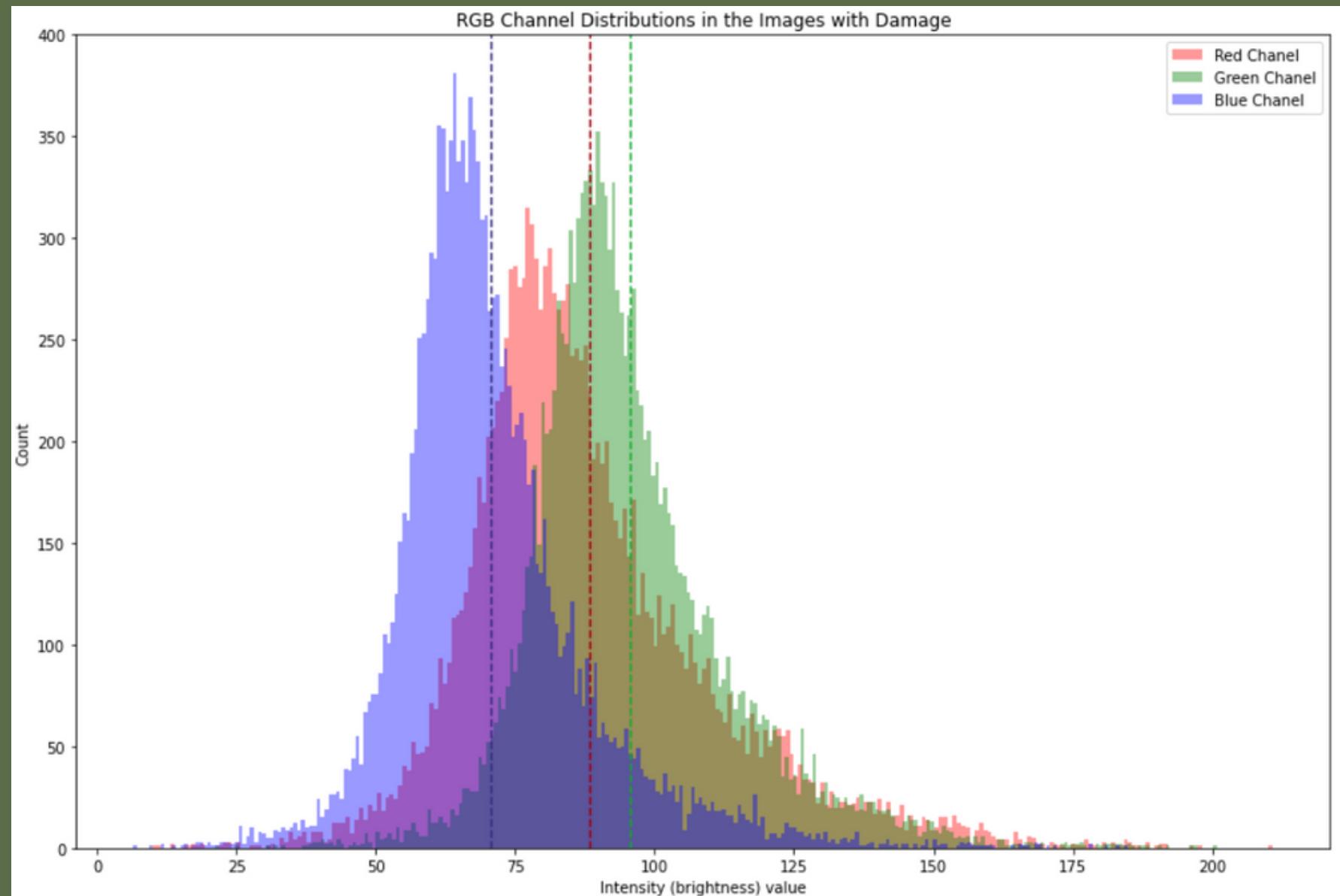
## CNN Parameters:

- 16 Hidden layers
- 20 epochs of training
- 25 minutes of training

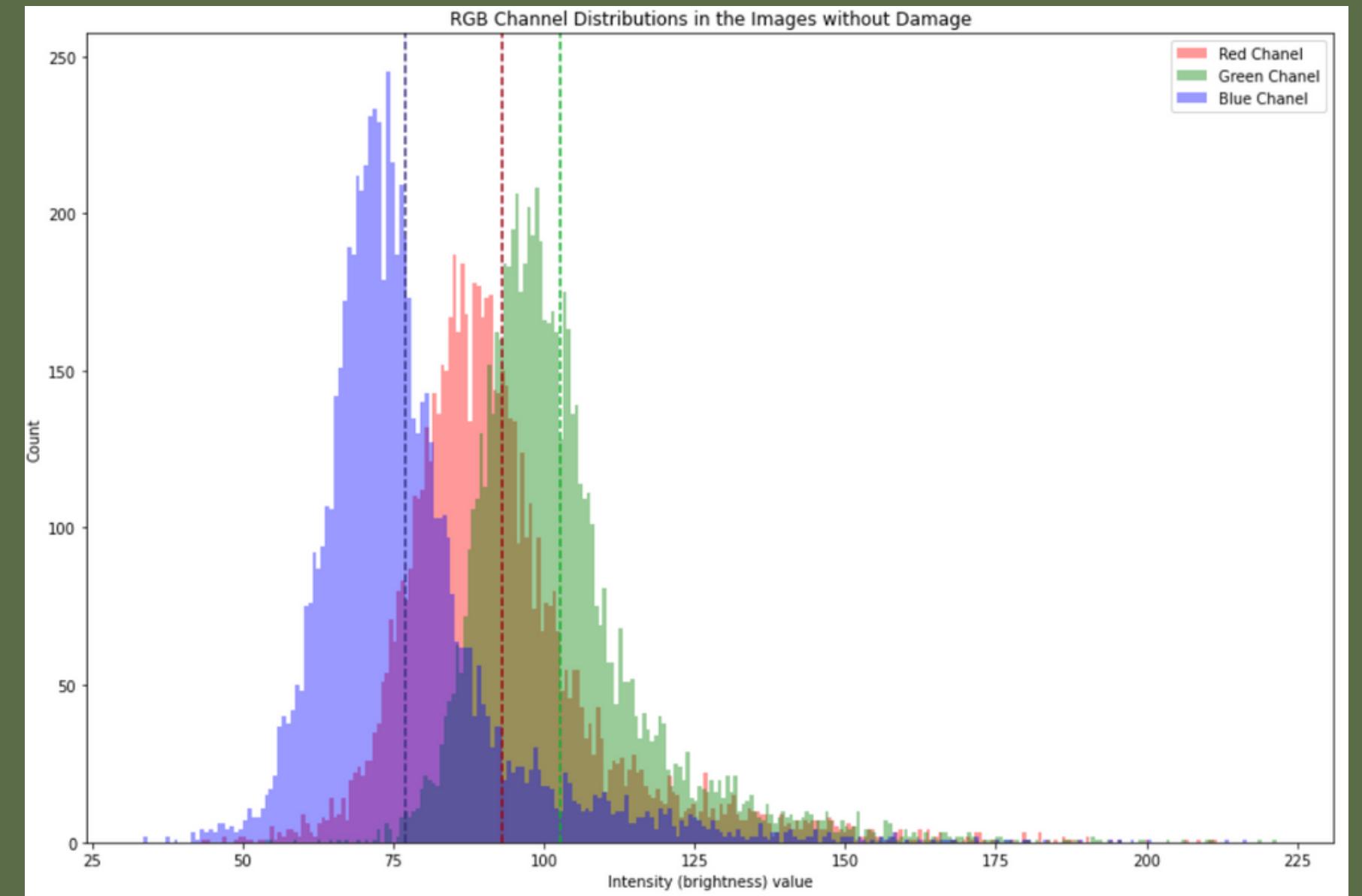
## CNN Test Accuracy

97%

# CNN EXPLORATION



Mean R: 88  
Mean G: 95  
Mean B: 70



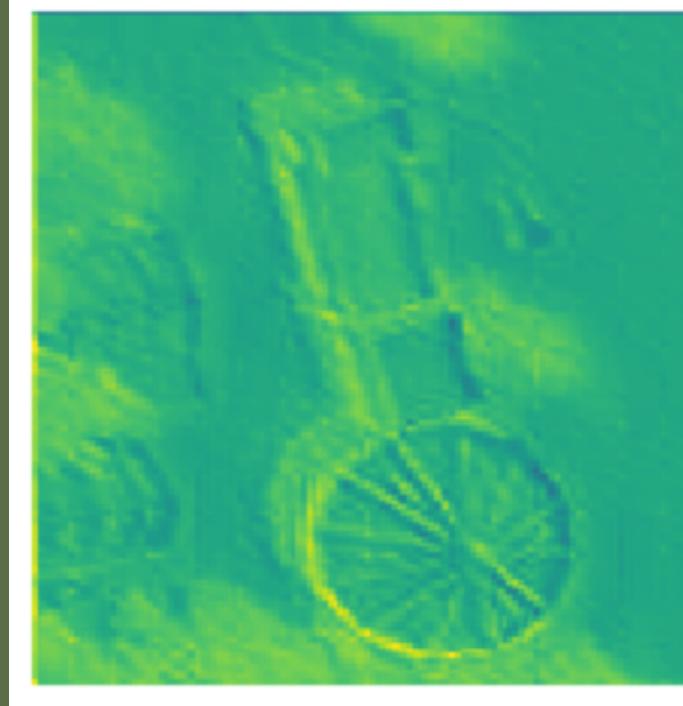
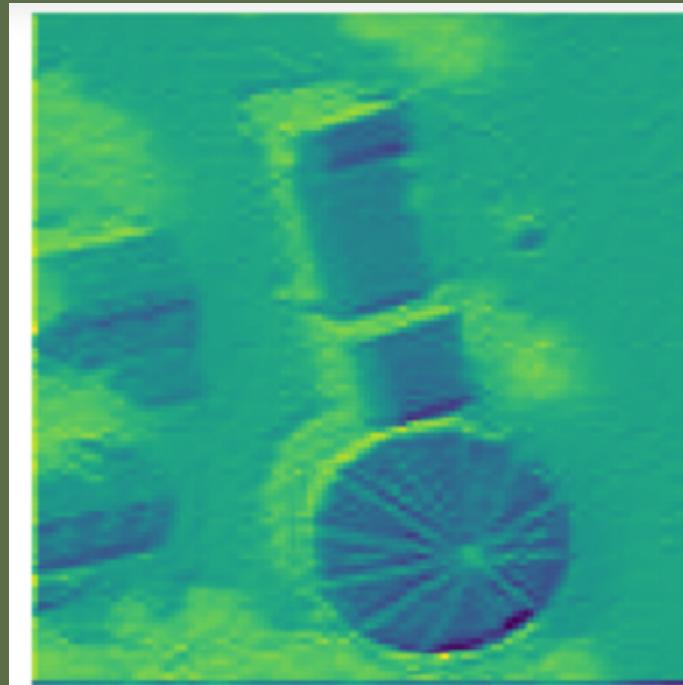
Mean R: 92  
Mean G: 102  
Mean B: 77

# CNN EXPLORATION

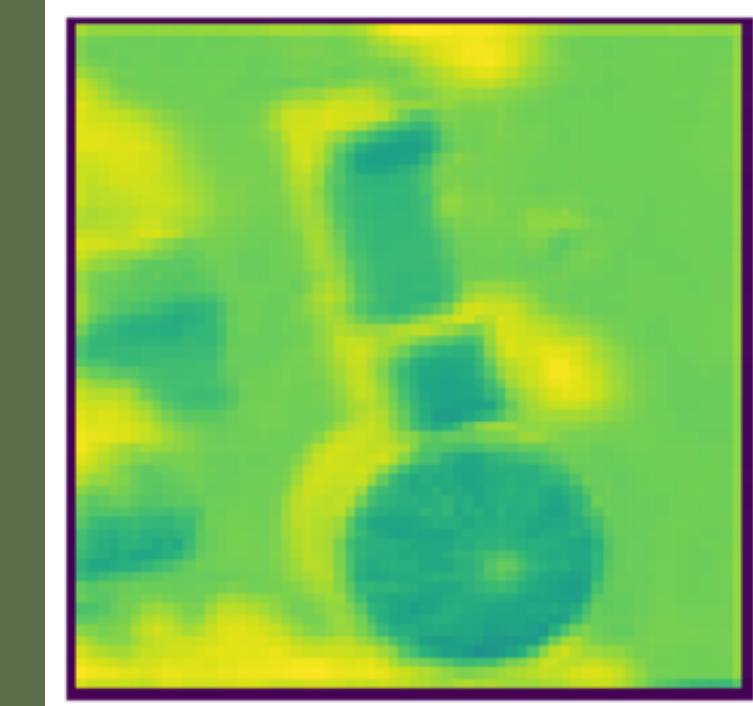
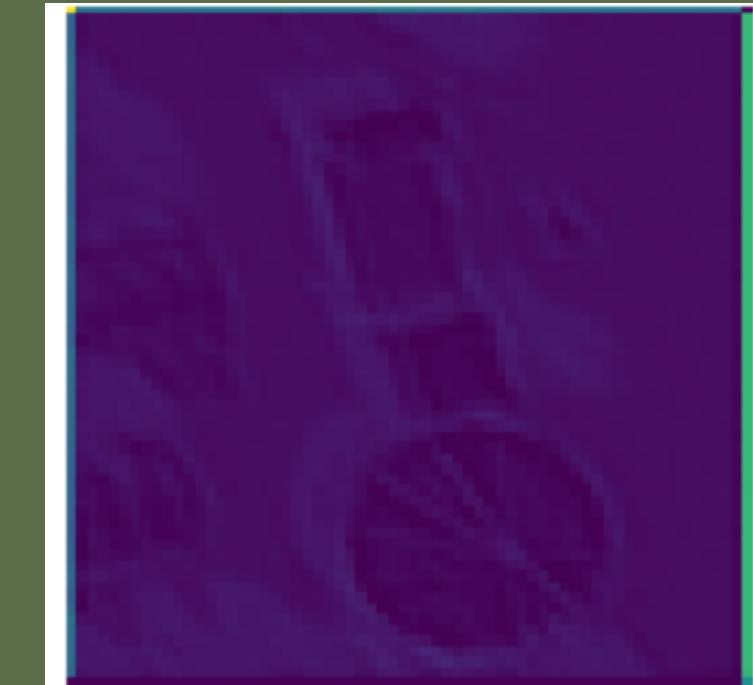
Input image with damage



First convolution layer activation



Second convolution layer activation

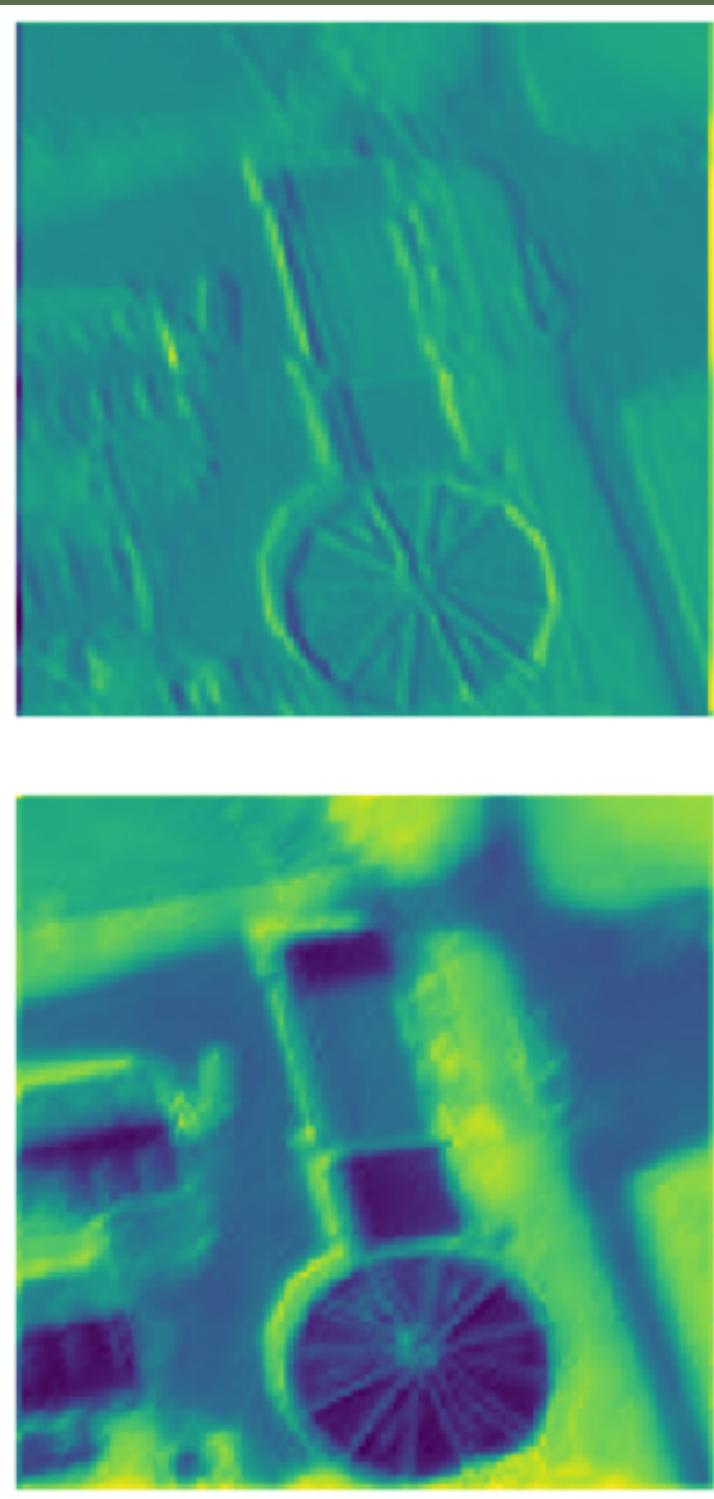


# CNN EXPLORATION

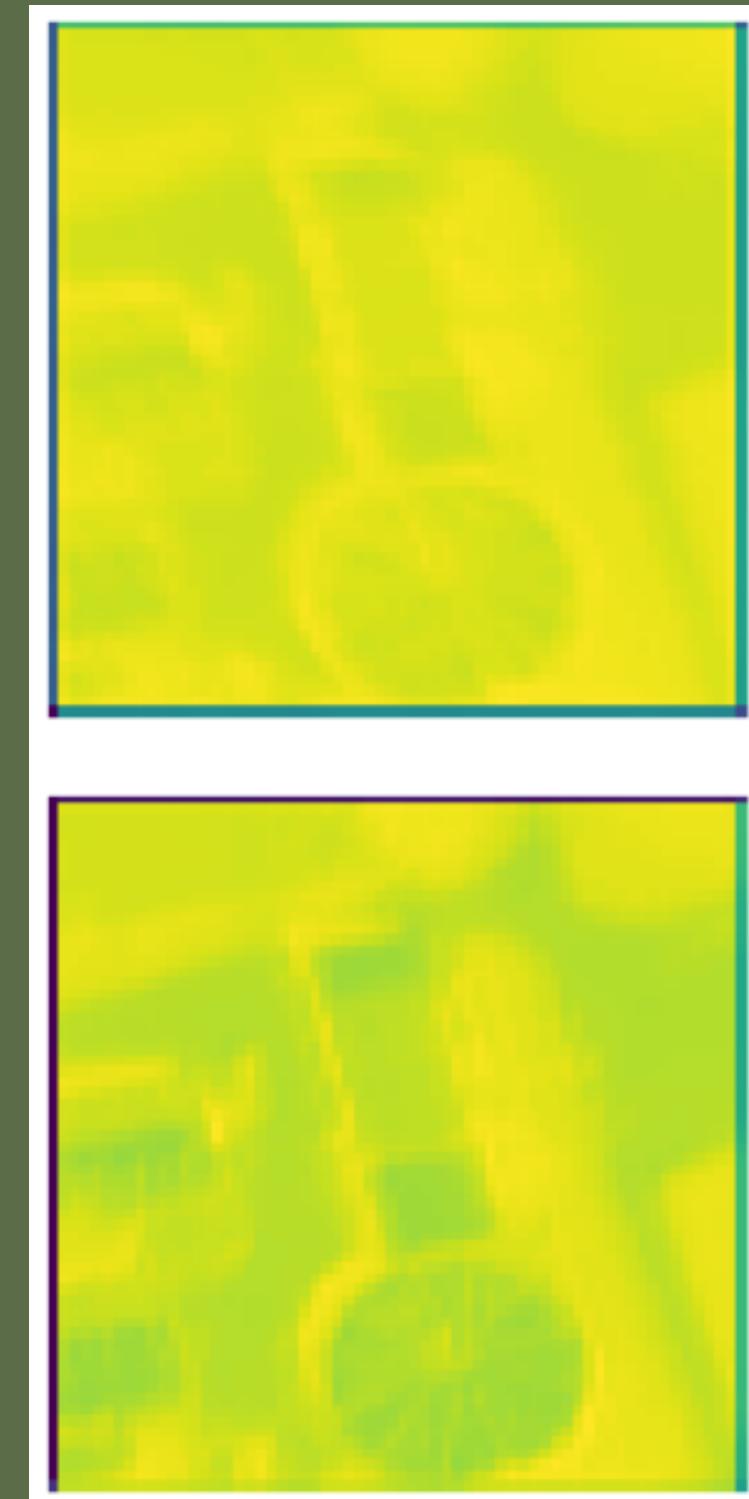
Input image without damage



First convolution layer activation



Second convolution layer activation



# PREDICTIONS



CNN Prediction:  
99.54% - Damage  
0.46% - No Damage



CNN Prediction:  
1.7% - Damage  
98.29% - No Damage

# THANK YOU



**Margarita Popova**  
Senior GIS Analyst | Data Analyst

