Wildfire Loss Forecaster

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The Data Incubator – Capstone Project – May 4, 2021

Motivation

- Wildfires in California are getting bigger and causing bigger losses to properties [UCSB report]. Twelve out of twenty of most destructive fires in California history occurred in the past five years [CalFire report].

- One of the challenges this new natural disaster growth situation creates is the danger rating of the insurance for insurance and reinsurance purposes.

- This project aims to create a model to forecast loss estimates of the households in California based on historical records of the fire damages in properties in California.

Input damage inspection data

- Damage Inspection Report data (DINS) of CalFire provides data on damage due to each wildfire on the property level (longitude and latitude of the structure inside each wildfire perimeter with damage percentage).

- The plot shows an example of DINS data for Camp Fire 2018, red line is the perimeter of fire and damage to each properties inside perimeter is presented as per legend.


Camp Fire 2018, CalFire
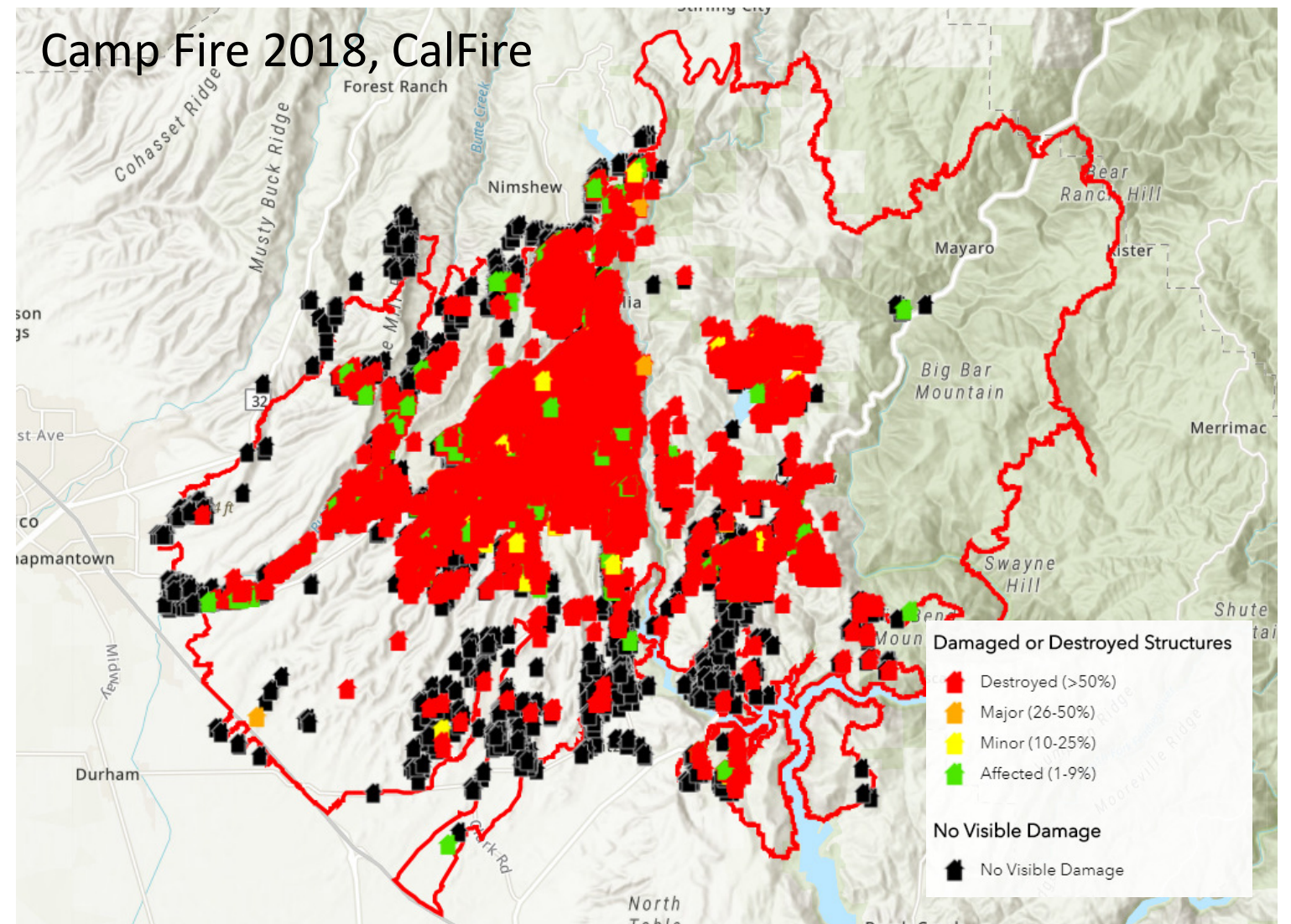
Input damage inspection data

- Analysis of DINS data to estimate the chance of loss for different structures wildfire perimeters.
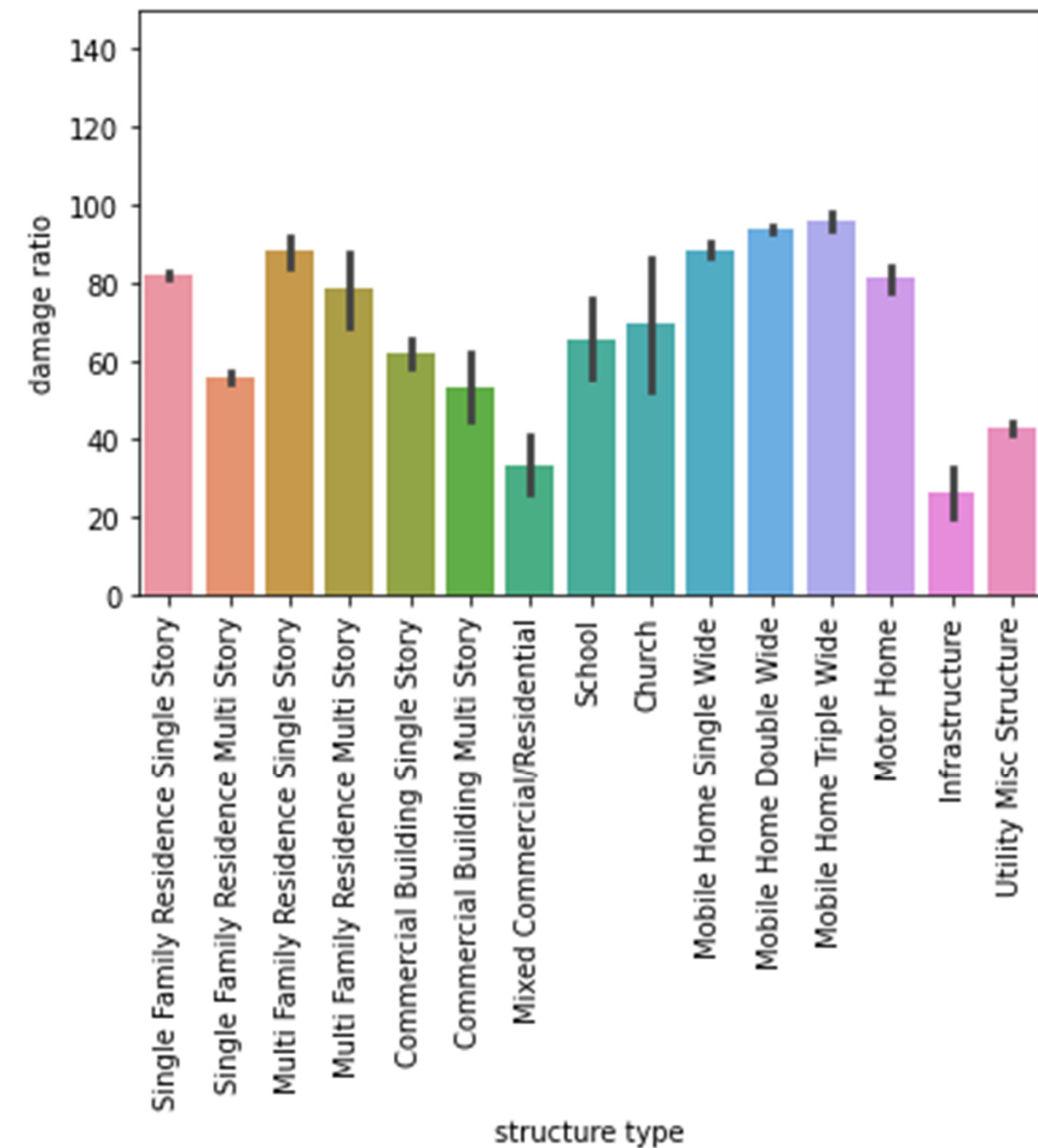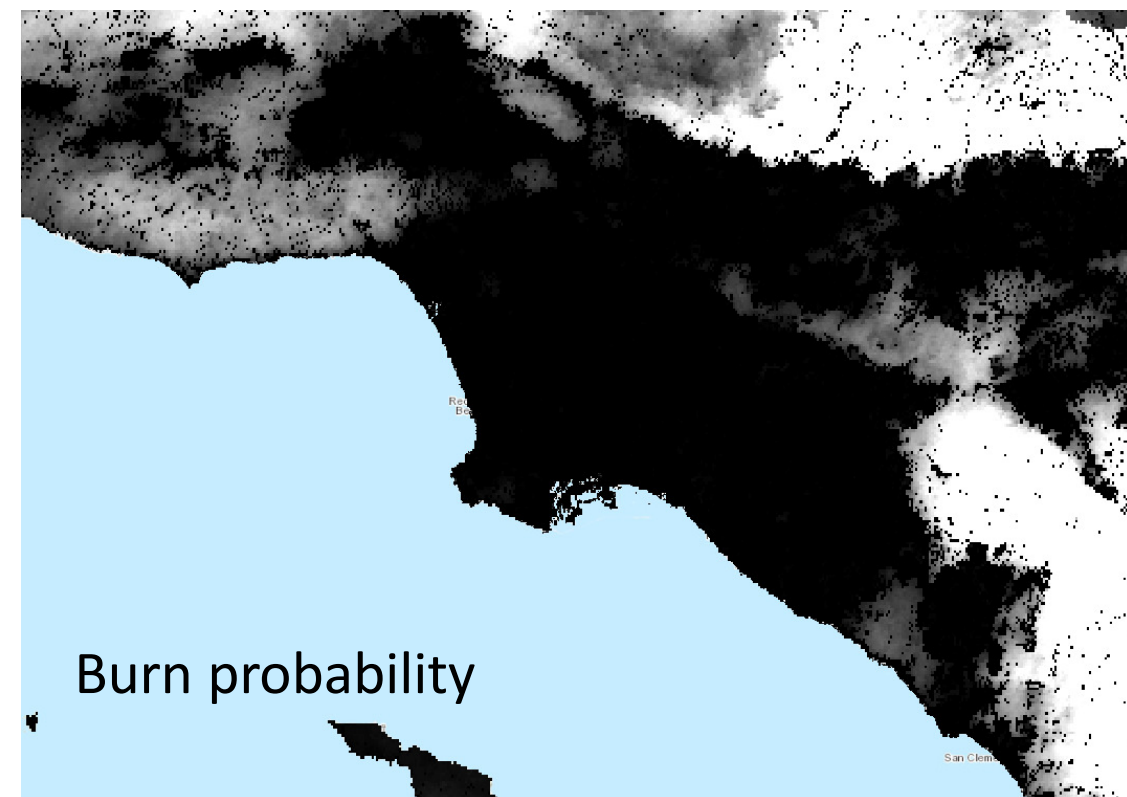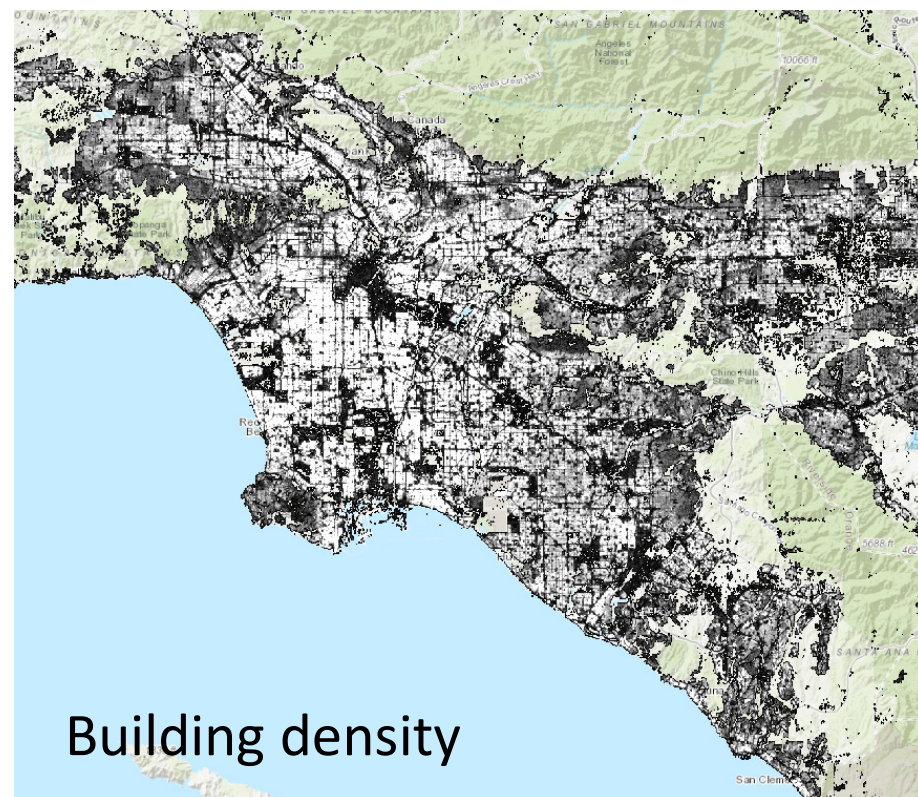
Independent variables

- Height: is the sea level elevation at DINS point

- Aspect: represents the azimuth of the slope

- Slope: is the change of elevation over an area

- Vegetation type: describes the

California
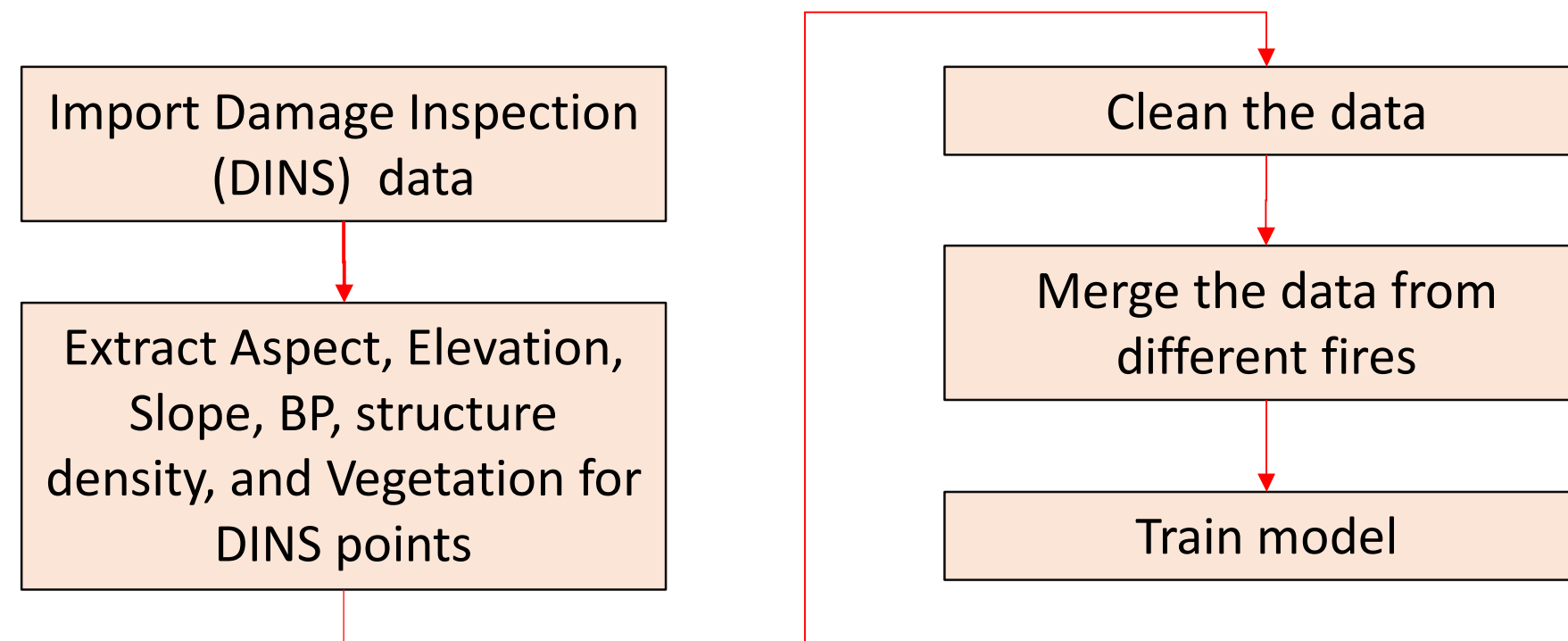

Vegetation

Slope

Aspect

Elevation
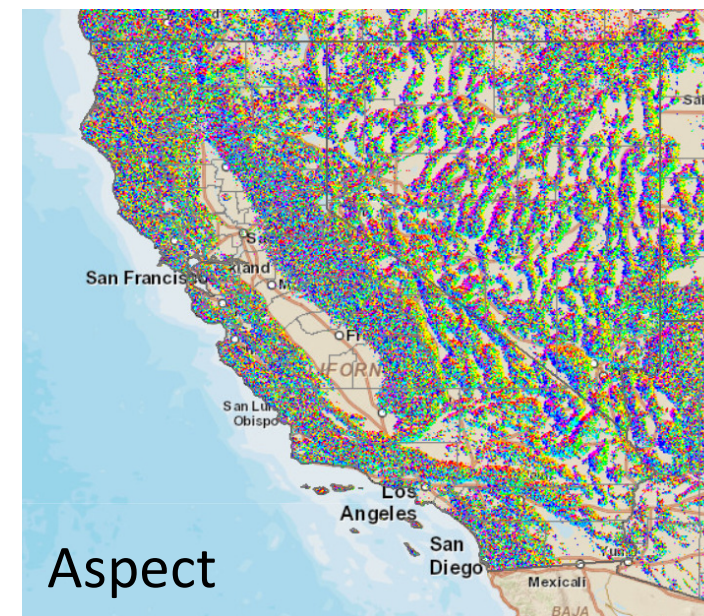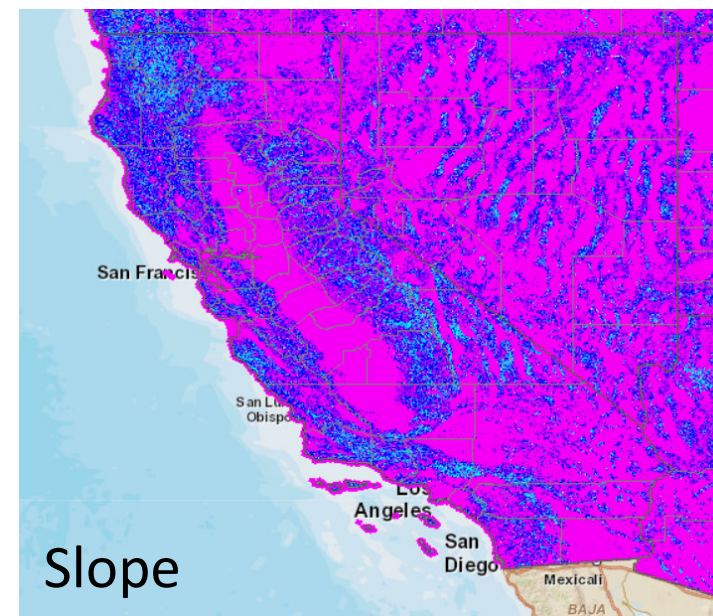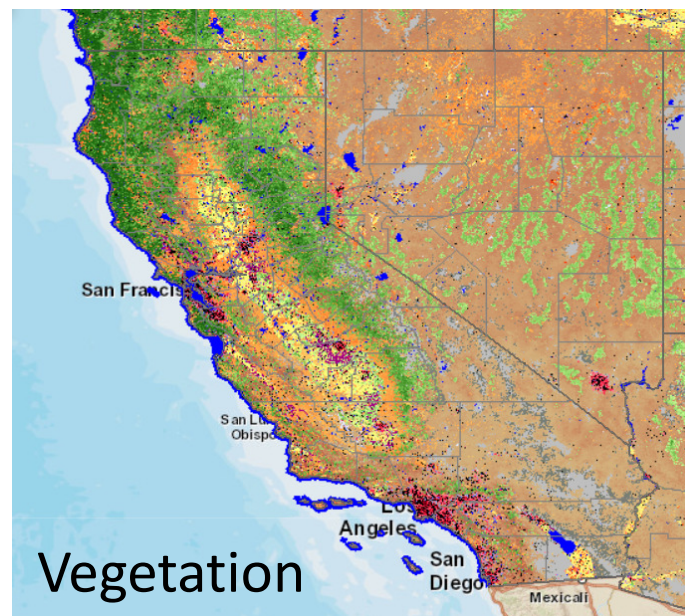
Independent Parameter

- Building density which is number of buildings per square km which is calculated from Microsoft footprint of structure in CA.

- Burn Probability is the stochastic analysis results for possibility of wildfire at the Continental United States (including CA).


Building density

Burn probability

Analysis

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┌─────────────────────────┐                    ┌─────────────────────────┐
│  Import Damage Inspection│                    │      Clean the data      │
│     (DINS)  data         │                    │                          │
└─────────────────────────┘                    └─────────────────────────┘
            │                                                │
            ▼                                                ▼
┌─────────────────────────┐                    ┌─────────────────────────┐
│  Extract Aspect, Elevation,│                 │   Merge the data from    │
│  Slope, BP, structure    │                    │      different fires     │
│  density, and Vegetation for│                └─────────────────────────┘
│      DINS points         │                                │
└─────────────────────────┘                                 ▼
                                                 ┌─────────────────────────┐
                                                 │       Train model        │
                                                 └─────────────────────────┘
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Study of Parameters

- The role of different parameters on wildfire damage is studied for different structure types (the presented results are for Multi Family Single Story structure types).
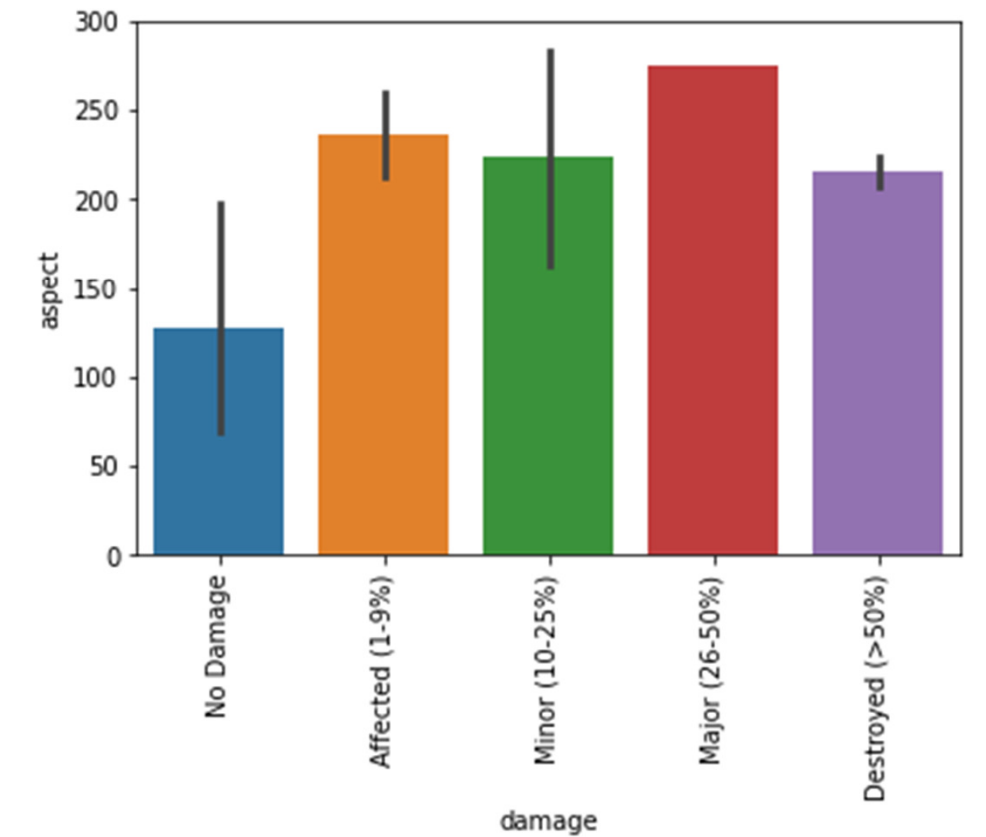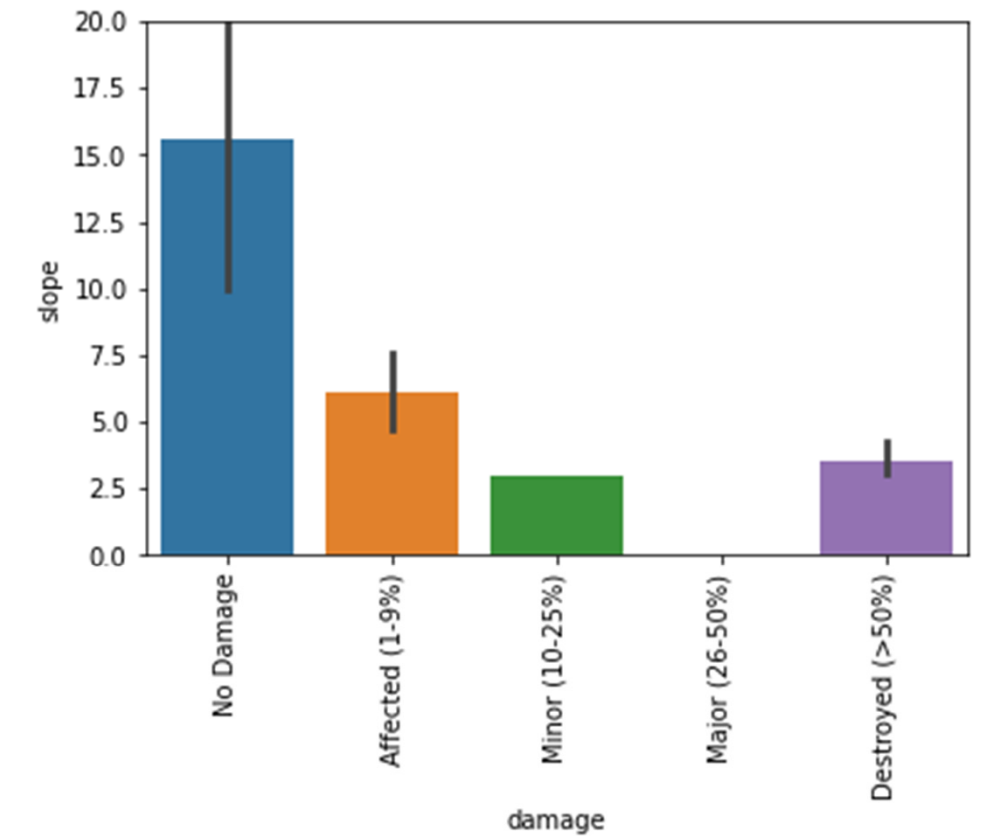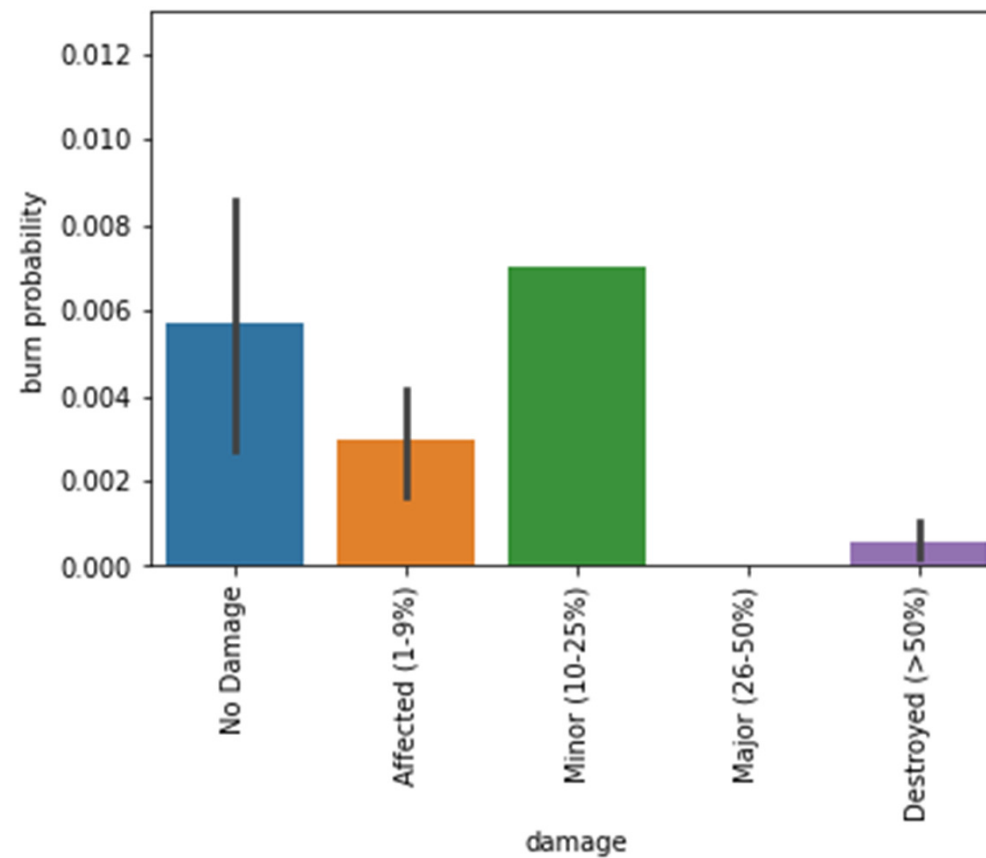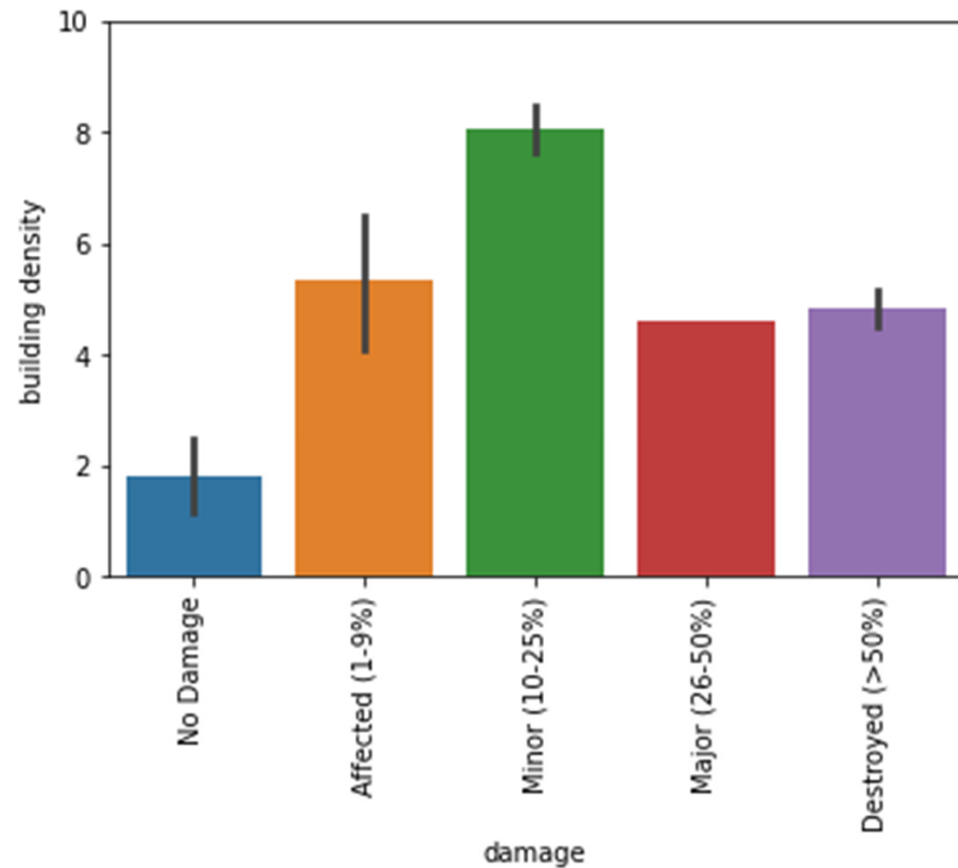
Random Forest

- Random Forest classifier is trained using the available data and a model score of 0.87 is reached with 20 estimators.