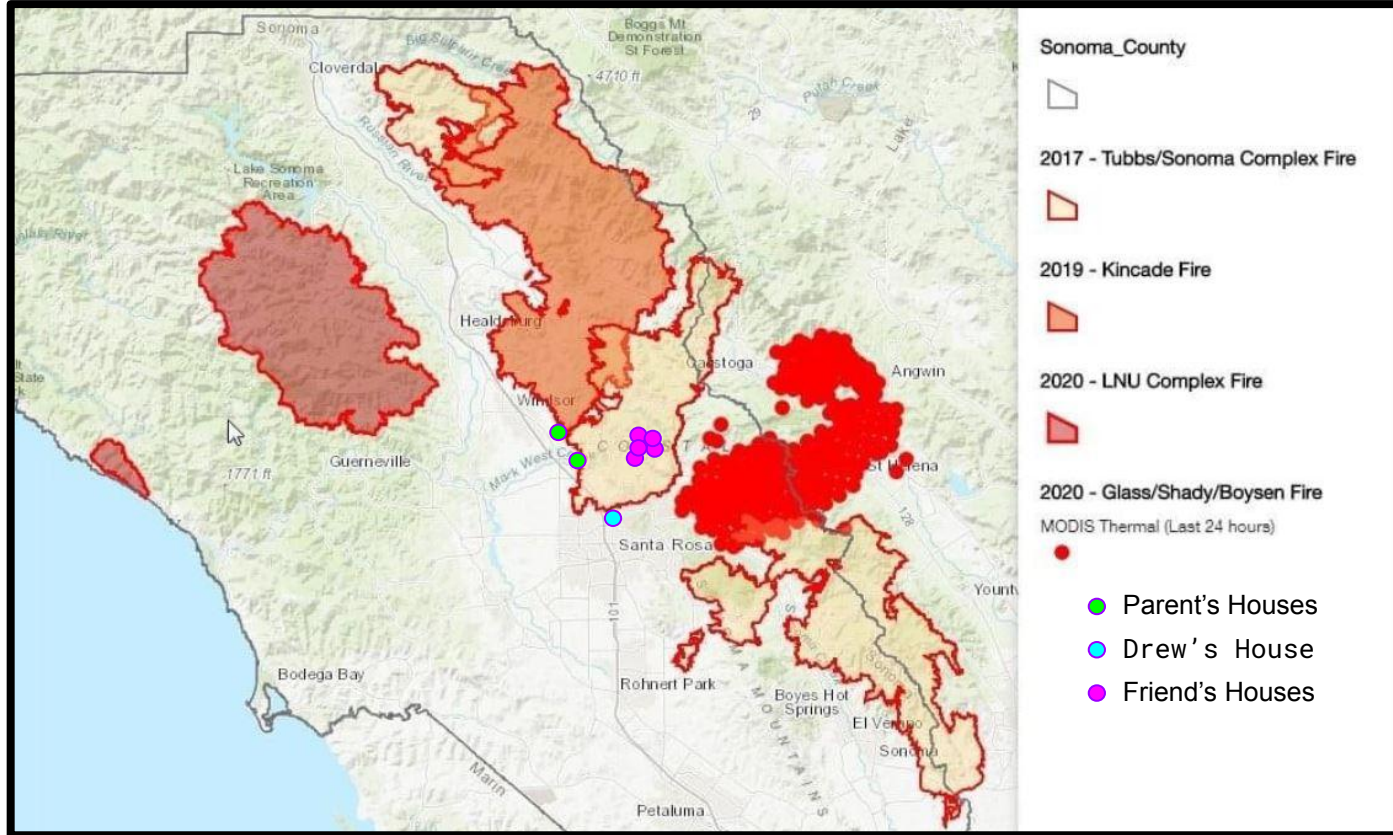




# **Extinguishing Bottlenecks:** Optimizing Fire Evacuation Routes

**Nick Crawford // Drew Horton**

# Motivation

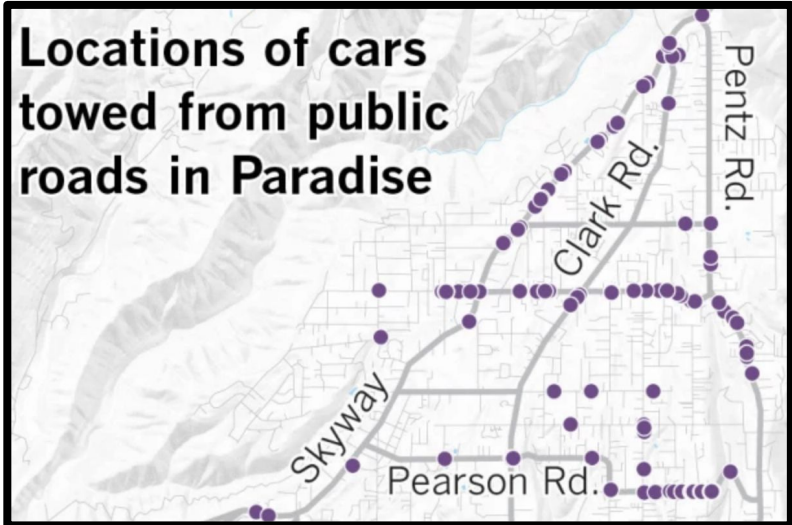


# The Camp Fire

- Paradise, CA
- Caused by downed power lines
- Deadliest Fire in California's History
  - 85 total deaths
  - 7 died in vehicles
- Fire spread 80 football fields a minute (at its peak).
- Only one way out of Paradise (Skyway, 4 lanes)
- Traffic jams caused people to abandon cars and flee by foot



## Locations of cars towed from public roads in Paradise



# Colorado Fires

## Top 3 Fires in Colorado History:

- *Cameron Peak (2020)*: 208,913 acres
- *East Troublesome (2020)*: 193,812 acres
- *Pine Gulch (2020)*: 139,007 acres

## This Year:

- Marshall Fire
- NCAR Fire
- & more

20 of 20 largest wildfires have occurred in the last 20 years (since 2001)

16 of the top 20 largest wildfires have occurred in the last 13 years (since 2008)

15 of top 20 largest wildfires have occurred in the last 9 years (since 2012)

11 of top 20 largest wildfires have occurred in the last 5 years (since 2016)

9 of top 20 largest wildfires have occurred in the last 3 years (2018 and 2020)

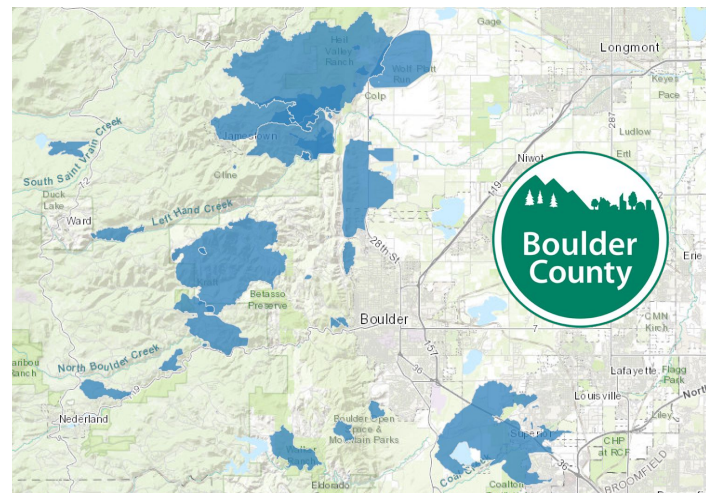
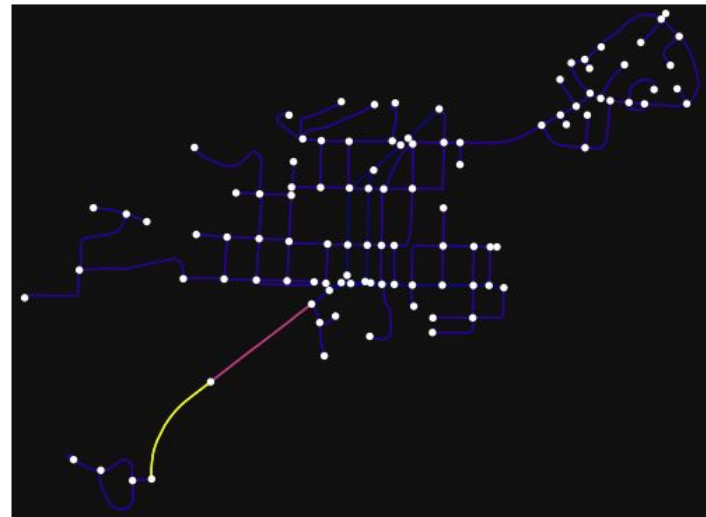
4 of top 5 largest wildfires have occurred in the last 3 years (2018 and 2020)





# Data

- OSM (Open Street Maps)
  - All driving routes of any neighborhood, city, state, or area.
  - Speed limits of roads
- Boulder County Geospatial Open Data
  - **Boulder County Fire Maps**
    - provide historical fire perimeters
- IPUMS (Integrated Public Use Microdata Series) National Historical GIS
  - Colorado census tract **population data**

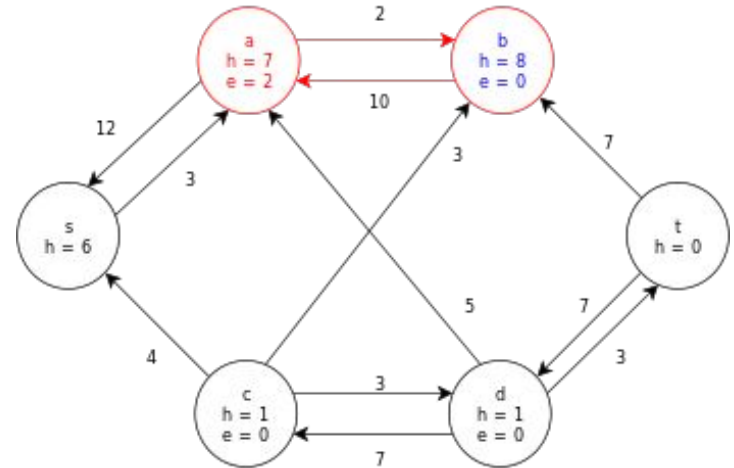


# Algorithms

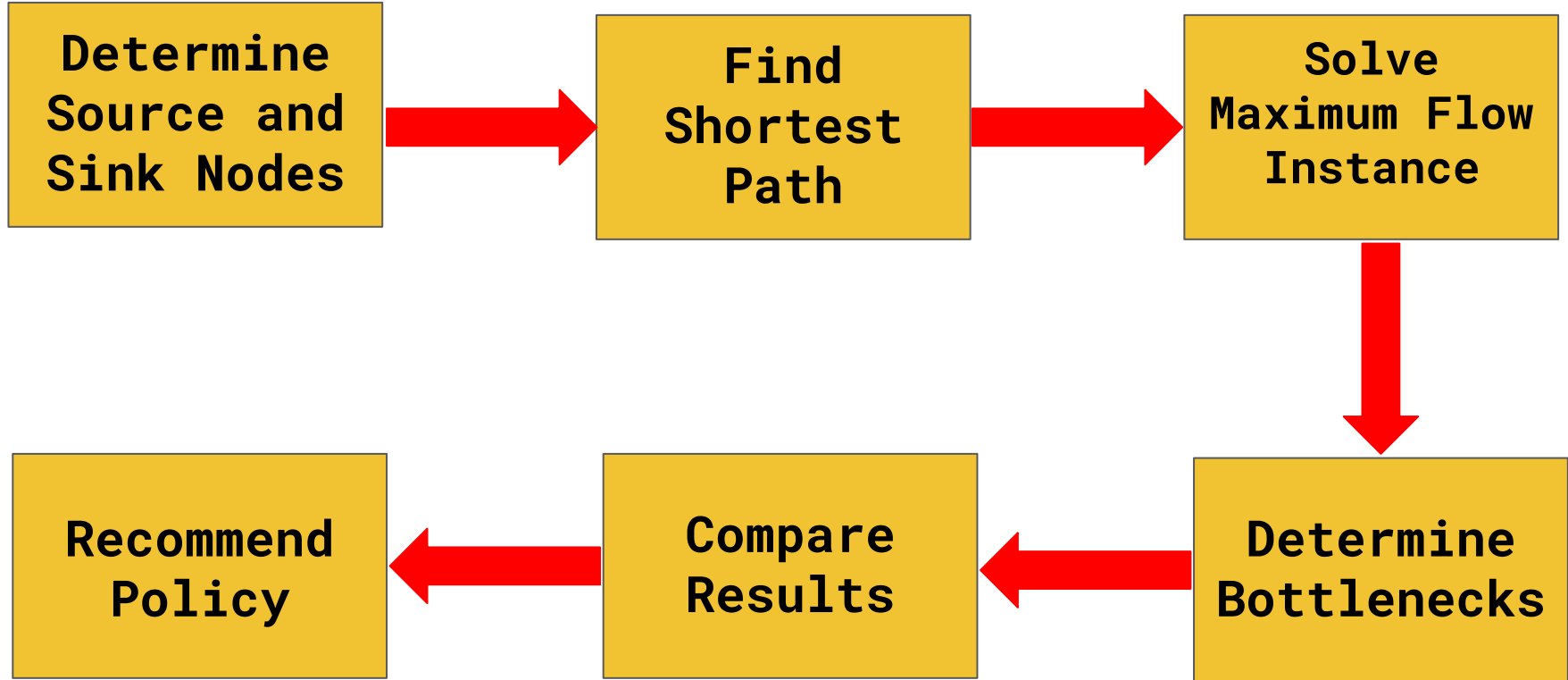
- Dijkstra's algorithm
  - find shortest evacuation routes



- Augmenting Path Labeling Algorithm
  - find maximum flow along routes



# Finding evacuation routes



# Sources

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