Ambulance perambulation

The current situation of emergency response

Road traffic accidents (RTA) are the number one cause of death for people aged 5-29 in Kenya

More than 3.000 lives are lost each year due to RTA's

About 90% of these deaths could be prevented by a faster emergency response

Only 1.4% of road traffic accidents victims are attended to by an ambulance

Challenges and opportunities in emergency response

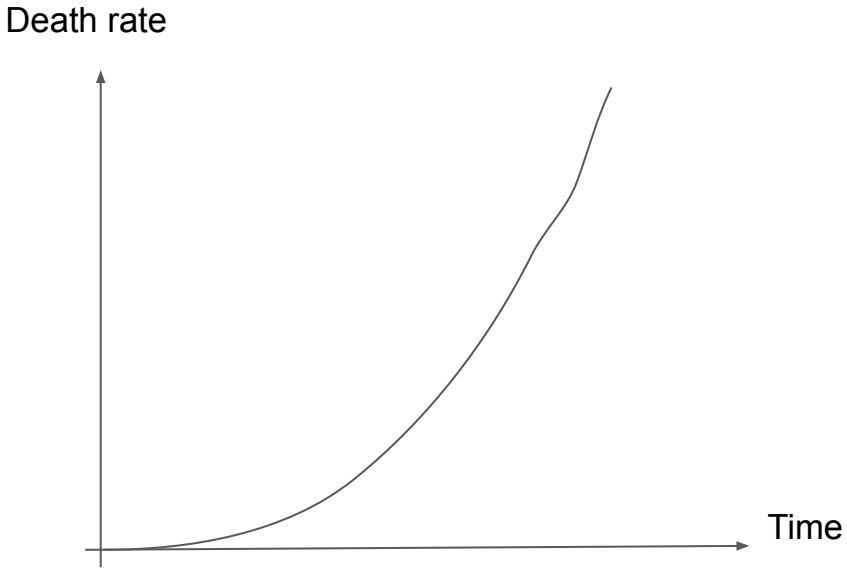
Challenges

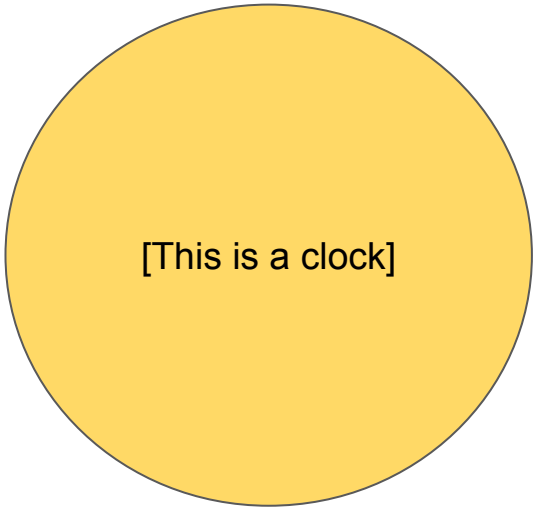
- Ambulances are a limited resource
- Accidents are difficult to predict
- Ambulance response time is critical

Opportunities

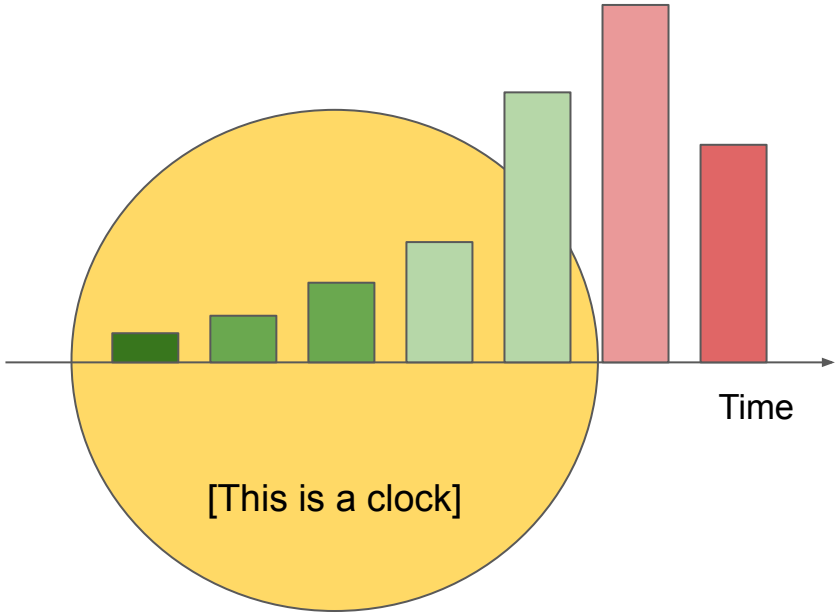
- Positioning ambulances determines the response time
- Current positioning of ambulance relies on individuals' knowledge/perception
- A coordinated placement of ambulances can improve response time

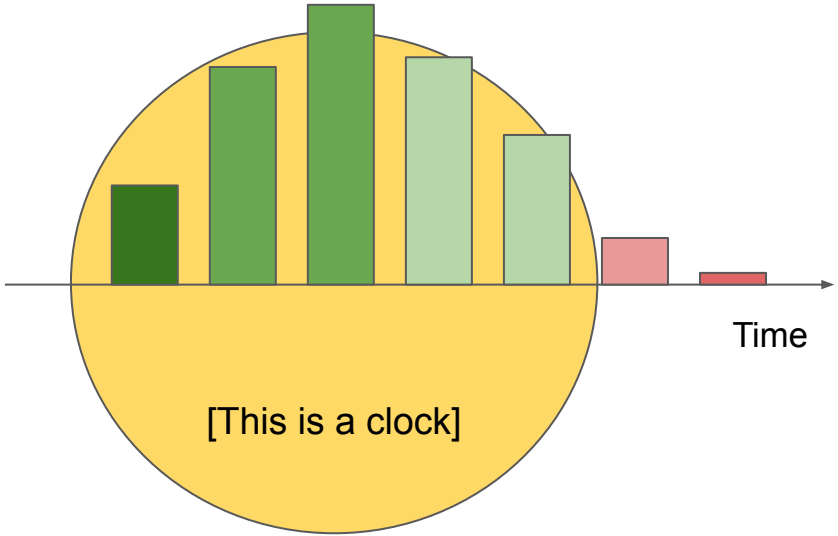
The “Golden Hour” principle (Explanation)





The goal is to reduce the response time to save lives





We capture response time using two measures

Percentage of cases within the “Golden Hour”

- A proxy for “successful” emergency responses
- Improvements within Golden Hour are not as important as getting more cases within that range

Mean response time over all cases:

- Paints an overall picture
- Accounts for “hard cases”

Description of problem

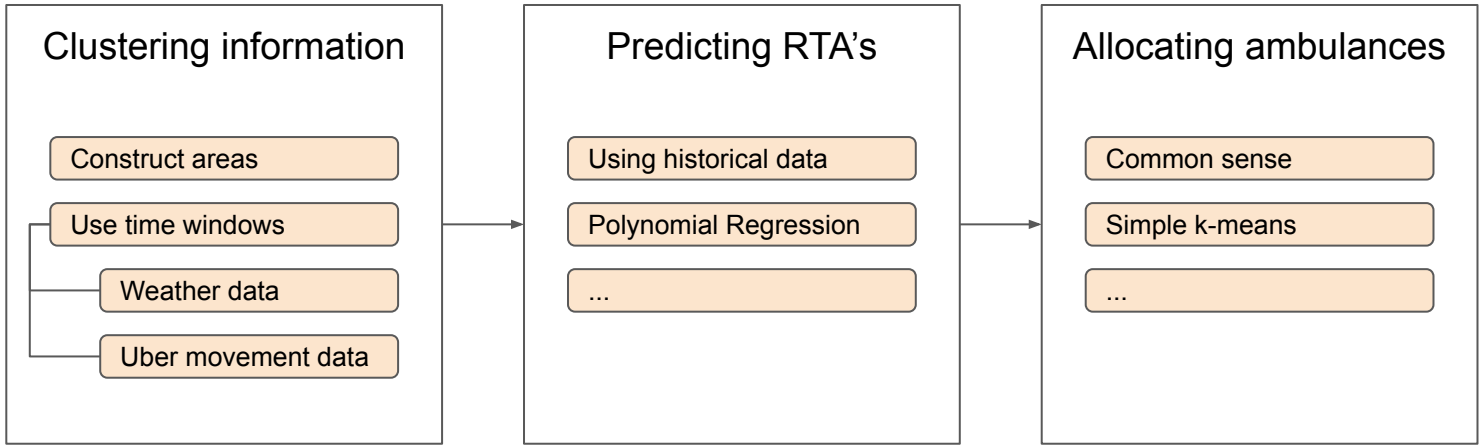
Task:

- Place 6 ambulances (latitude and longitude)
- Placement can be changed every 3 hours (8 time windows per day and ambulance -> 24 placement per day)
- Overall time frame is 6 months (07/2019-12-2019)

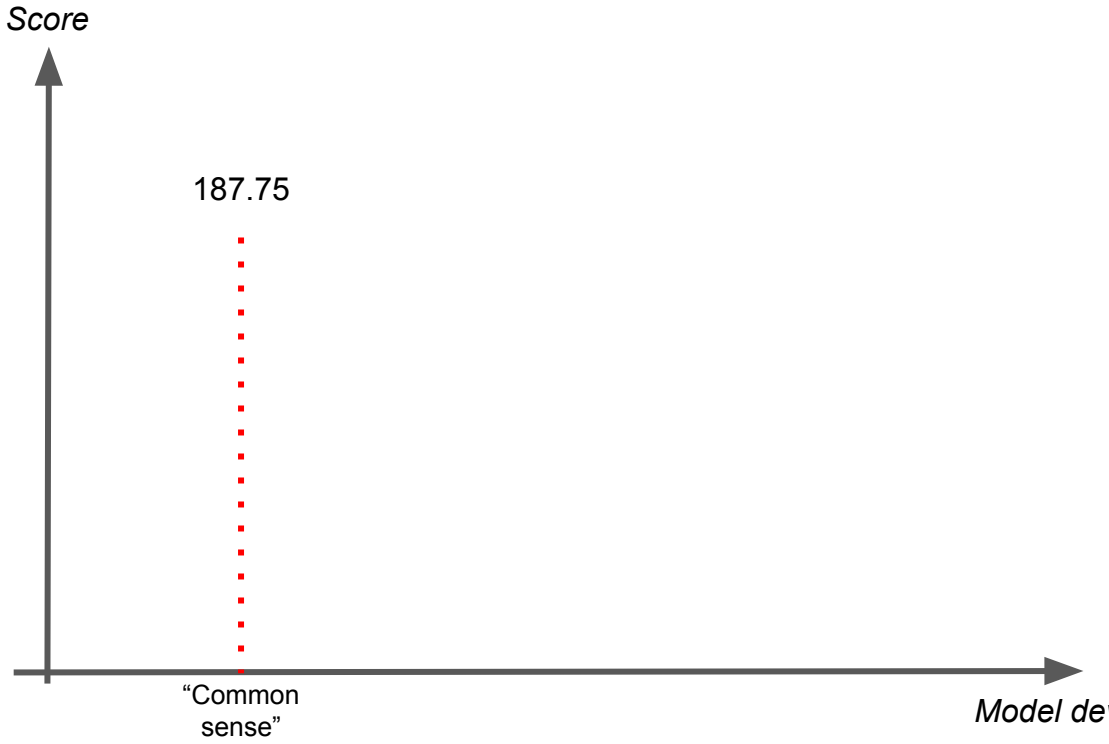
Goal:

- Reduce (LOWER) response time (Score)

Several models are chained together.



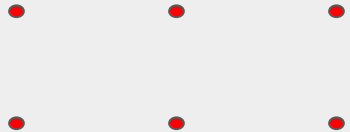
We start with a simple, common-sense baseline.



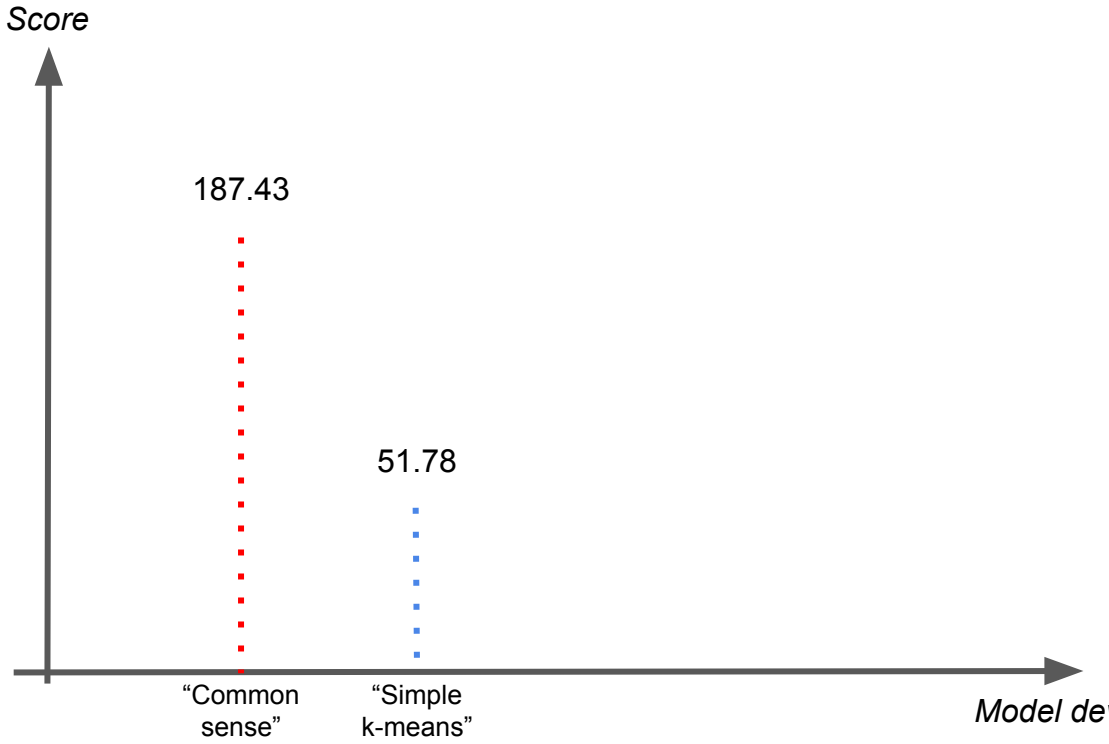
Baseline: Spreading-Out

The 6 ambulances are placed at equal distances to each other. No changes over time.

Visualization:



Simplified k-means clustering will be the ML baseline.



Baseline 2.0: Simple k-means

Placement of ambulances using k-means using historical data as prediction. No changes over time.

Visualization:

RAW Baseline evaluation

(Baseline 0) = One placement for whole timeframe and all are placed at the same spot

Baseline 1.0 = One placement for timeframe but equi-distant placements on grid defined by outmost accident occurrences

Baseline 2.0 = One placement according to k-means clustering

RAW Problem description and motivation

Problem description

- Ambulances are a limited resource
  - only 1.4% of road traffic accidents (RTA) victims are attended to by an ambulance
  - 3.000+ lives are lost each year due to RTA's
  - 90% of these could have been saved with a speedier response
- Accidents are difficult to predict
- Time for an ambulance to reach an accident site is critical to outcome. (every second counts - golden hour)

Motivation

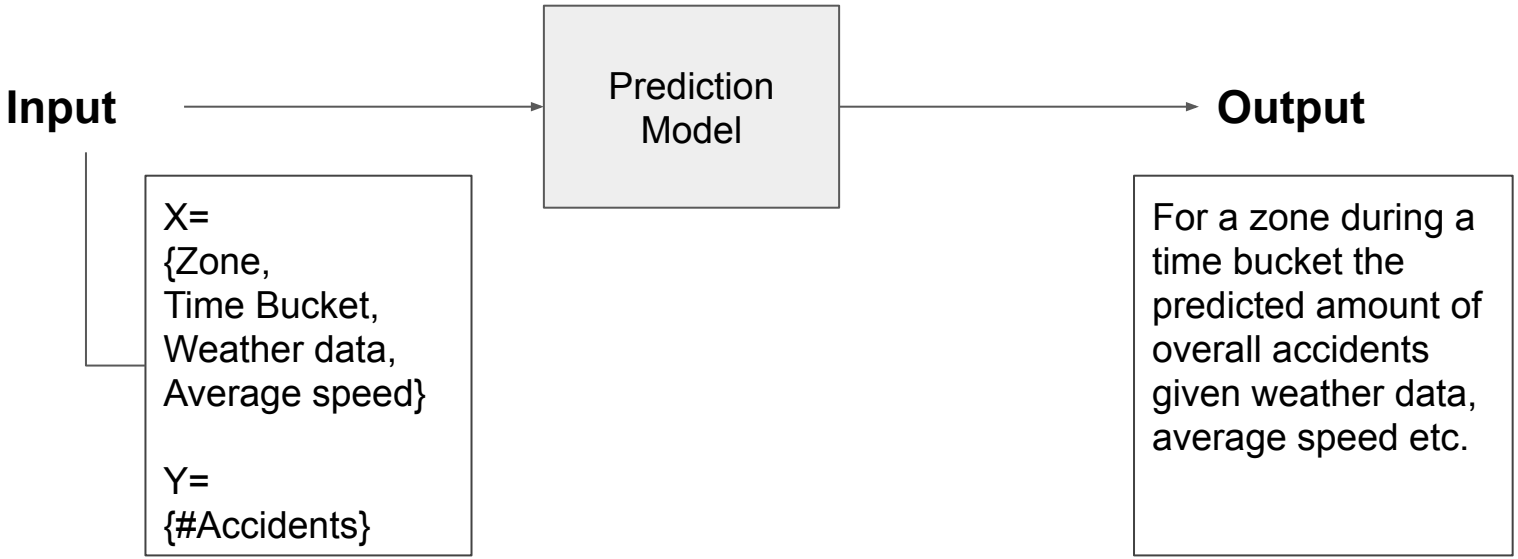
- Positioning ambulances in a city determines the time needed.
- Current methods for positioning rely on local knowledge in individuals heads.
- Placement of each Ambulance is not coordinated to optimize the entire system.

RAW Objective

Reduce time to care

Golden hour principle (priority is to have as few cases as possible outside of the one hour threshold - secondary goal is to have the lowest average/median time response time possible)

Conceptual model



Input for regression (prediction) model

ID	Time Buckets (interaction with traffic is possible to measure) if else: fixed effects model	Zebra Crossings per size unit			Weather for all zones not for each zone!	