

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

Skull icon

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

Snail Icon

# Challenges and opportunities in emergency response

## Challenges

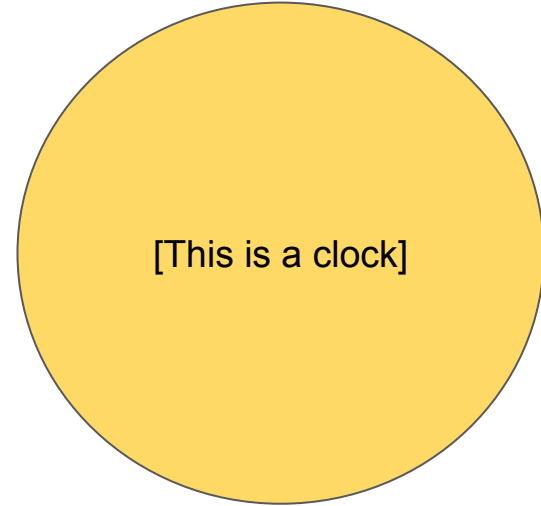
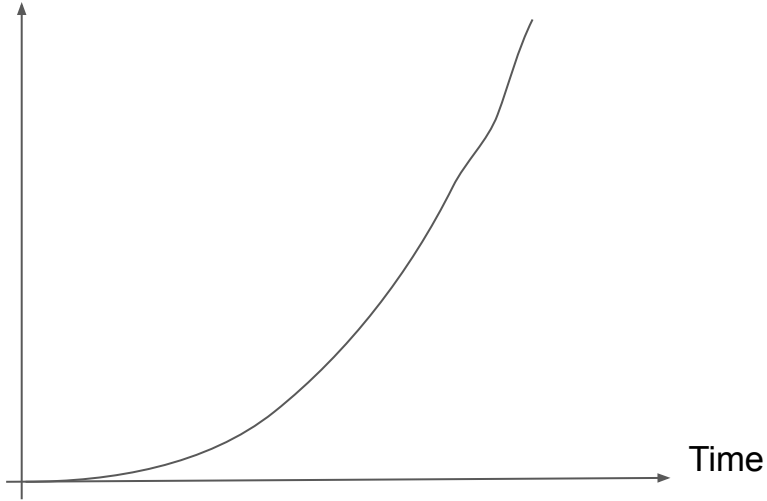
- ❖ Ambulances are a limited resource
- ❖ Accidents are difficult to predict
- ❖ Ambulance response time is critical

## Opportunities

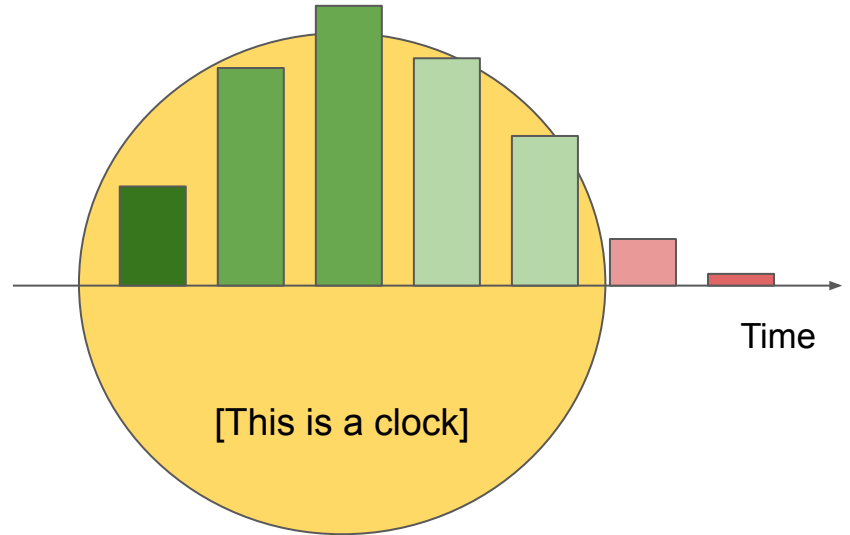
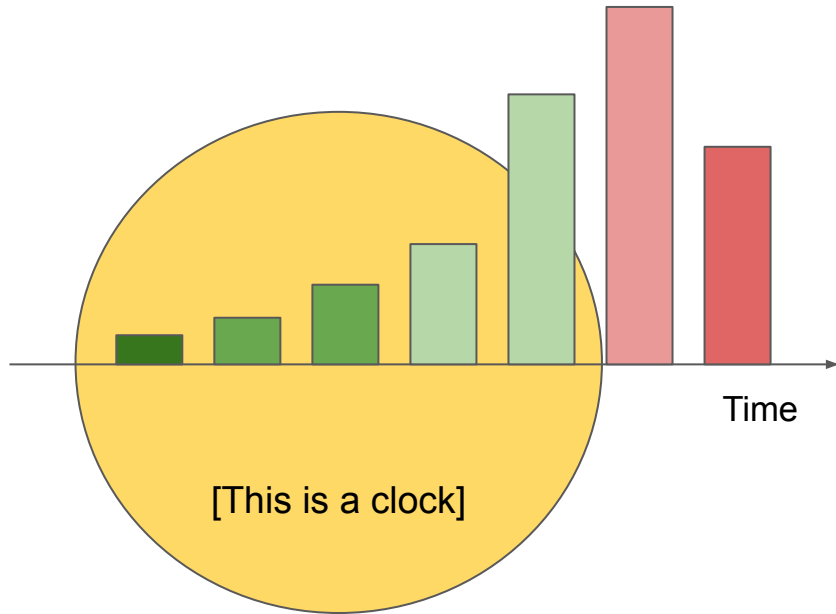
- ❖ Positioning ambulances determines the response time
- ❖ Current positioning of ambulance relies on individuals' knowledge/perception
- ❖ A coordinated placement of ambulances can improve response time

# The “Golden Hour” principle (Explanation)

Death rate



# 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

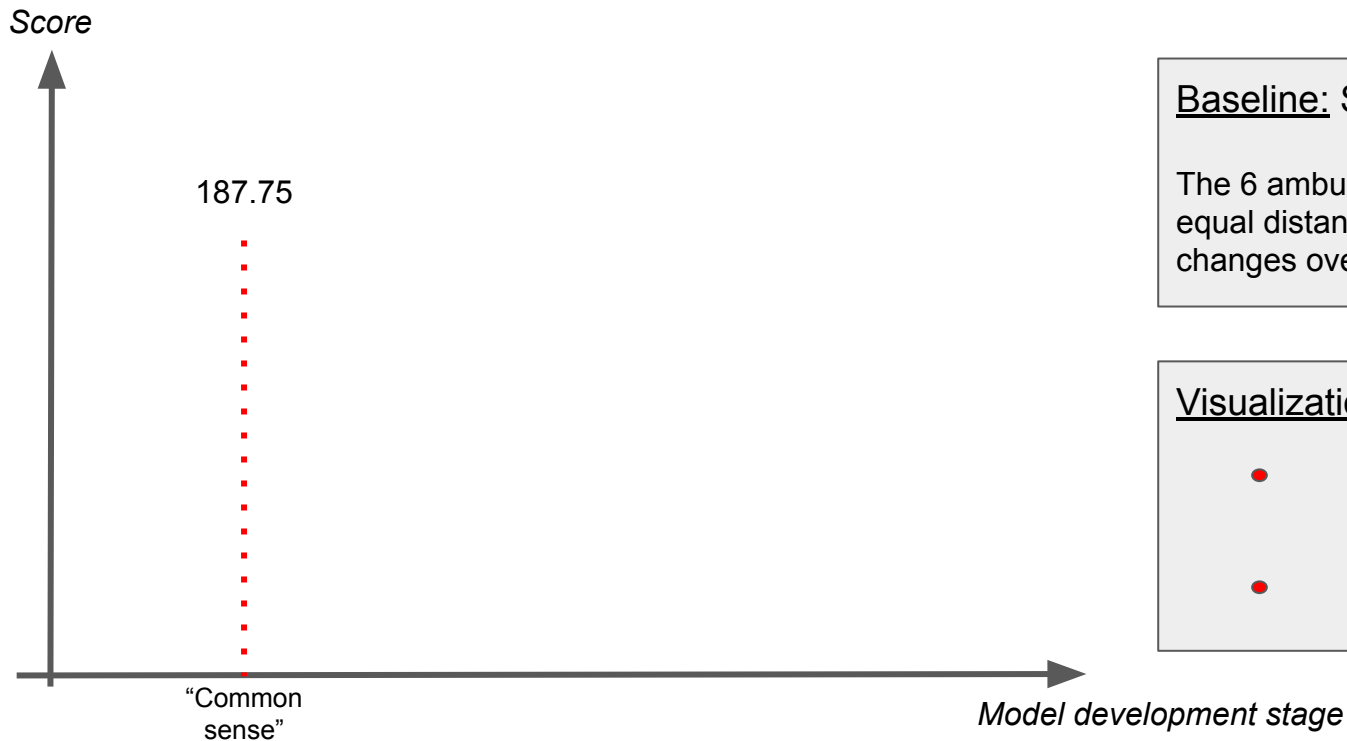
## Task:

- 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)

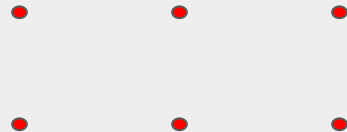
# We start with a simple, common-sense baseline.



## Baseline: Spreading-Out

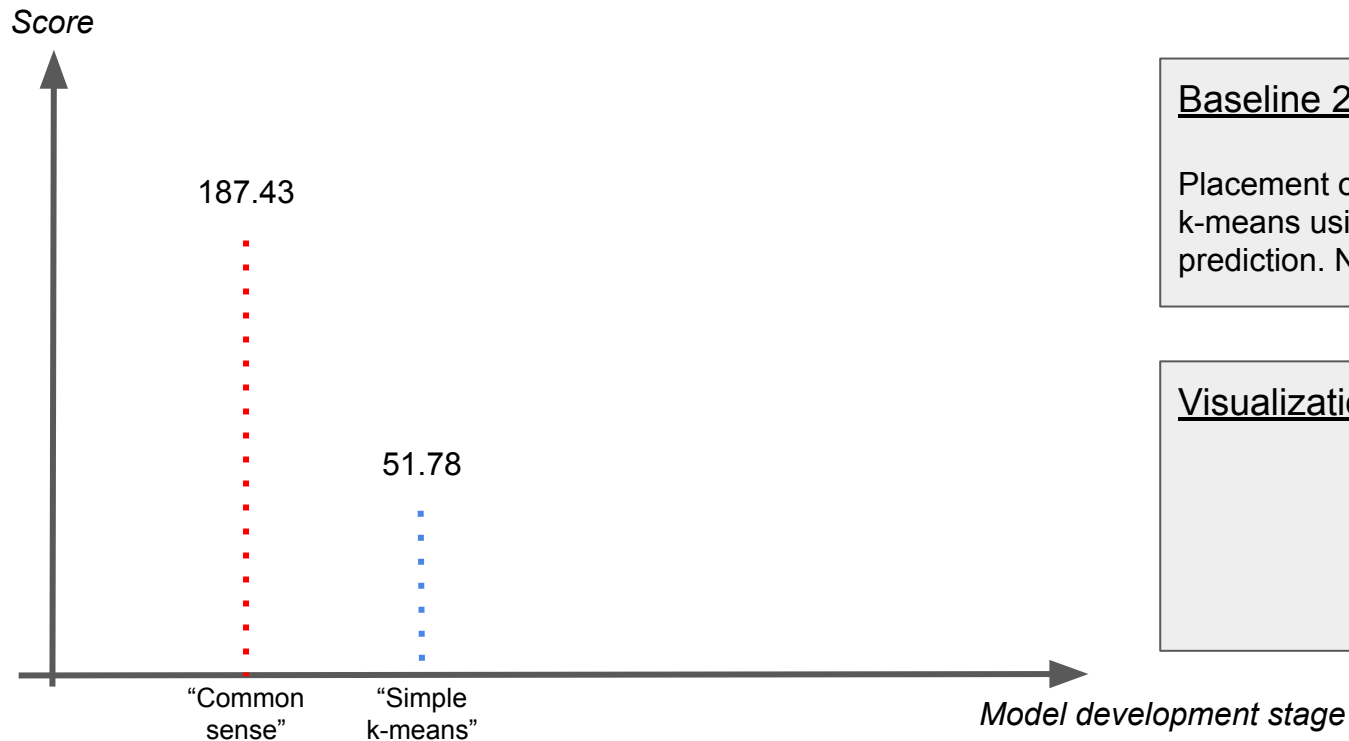
The 6 ambulances are placed at equal distances to each other. No changes over time.

## 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

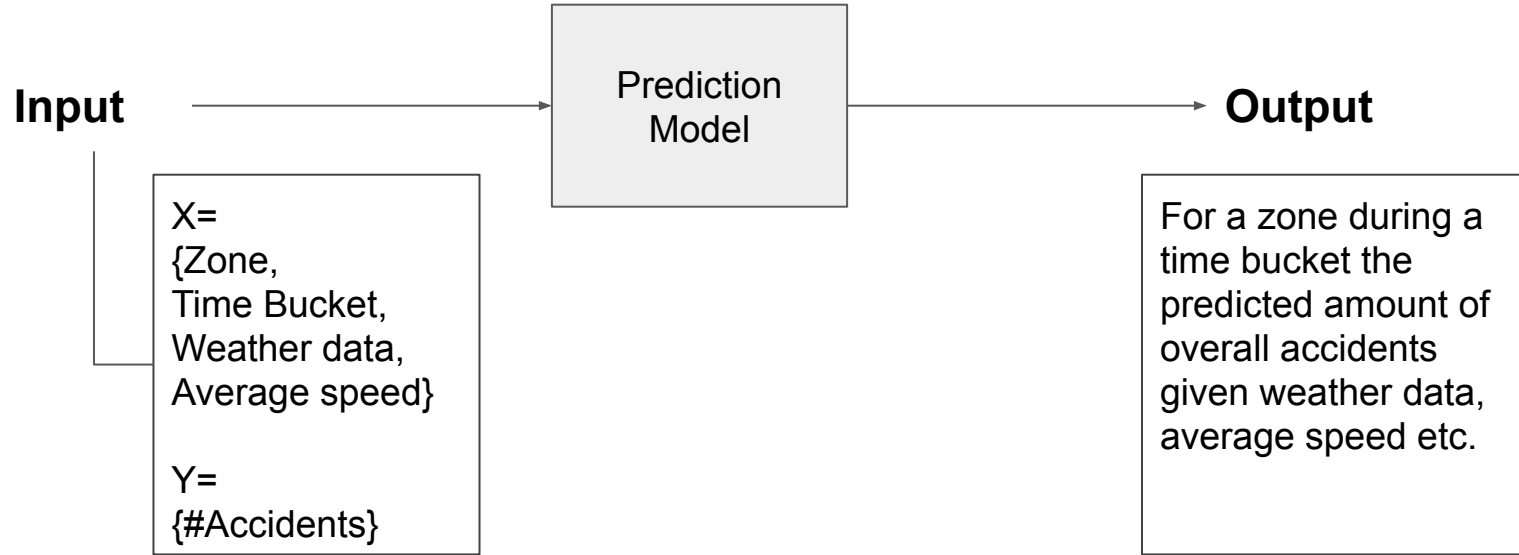
- ❖ Positioning ambulances in a city determines the time needed.
- ❖ Current methods for positioning rely on local knowledge in individuals heads.
- ❖ Placement of each Ambulance is not coordinated to optimize the entire system.

# \*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<br>(interaction with traffic is possible to measure)<br><br>if else:<br>fixed effects model | Zebra Crossings per size unit |  |  | Weather for all zones not for each zone! |  |
|----|--|-------------------------------|--|--|--|--|
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