Predicting EMS Calls for Better Ambulance Allocation

Xiaoran Wang, Yujing, Wu | MUSA 507 | Final Project

Business as Usual

- Averaging a small number of historical counts from the same spatial region and over the corresponding hours from previous weeks or years
  - Toronto
  - Charlotte-Mecklenburg, NC
- Average number of calls calculated based on the previous years' data for each time slot for the whole county * population of each geographical grid zone / total population
  - Sweden

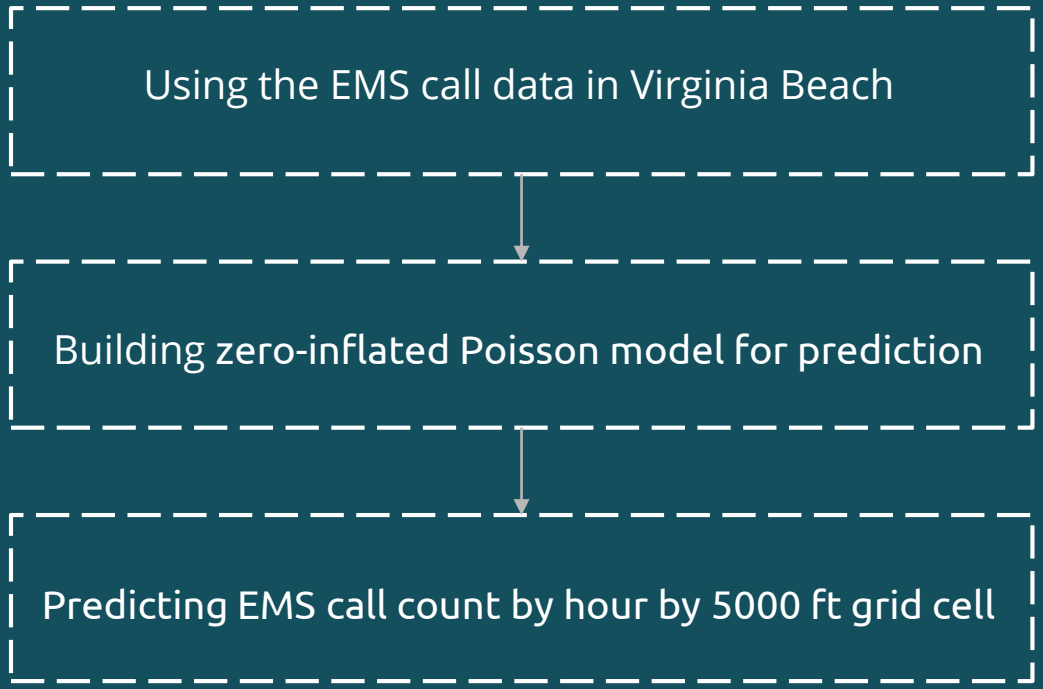
Motivations

- In Virginia Beach, there are 22 volunteer rescue squads, but more than ***10%*** of EMS calls have been delayed in each year
- The responding time kept ***increasing***

Goals

- To predict the number of calls
- To increase transparency and efficiency of EMS dispatch system

Data-Driven Approach



Data

EMS call data in Virginia Beach from 2010 to 2018

June, July, August in 2017

Call priority | Rescue squad number | Call time series | Location

+

Spatial Characteristics
- Census Tract
- Neighborhood

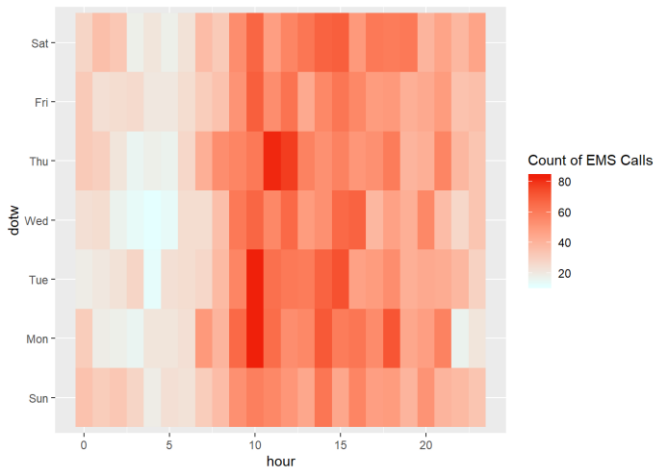
Time Lag
- 1 - 4 h lag
- 12 h lag
- 1 day lag

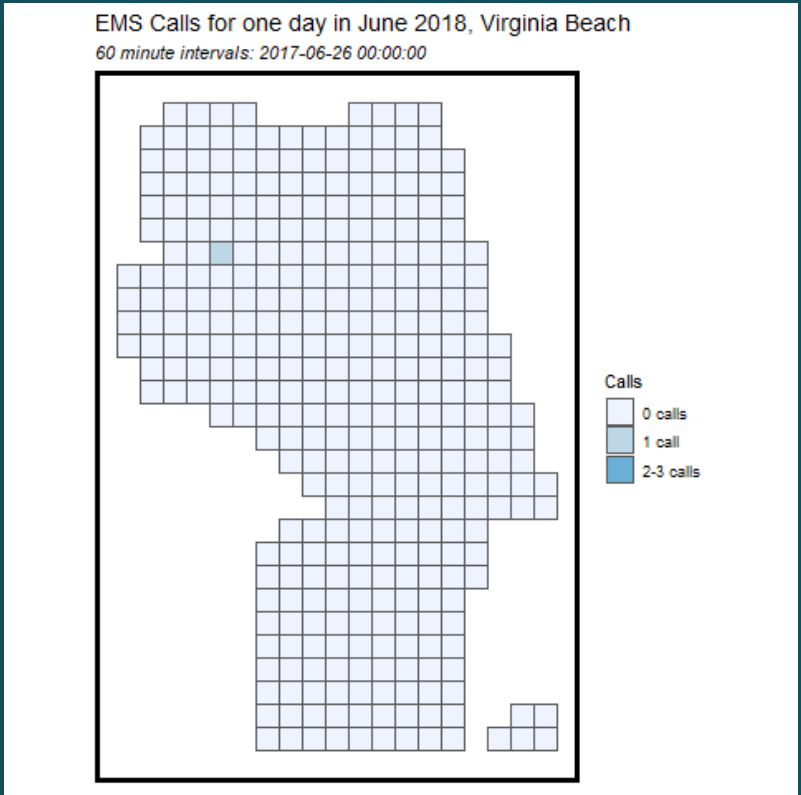
Demographic Features
- Aged Population
- Single Male
- Median household inc
- Commuting mode
- ...

External Factors
- Car Accidents
- Precipitation
- High Temperature

Exploratory Analysis: Call counts by time

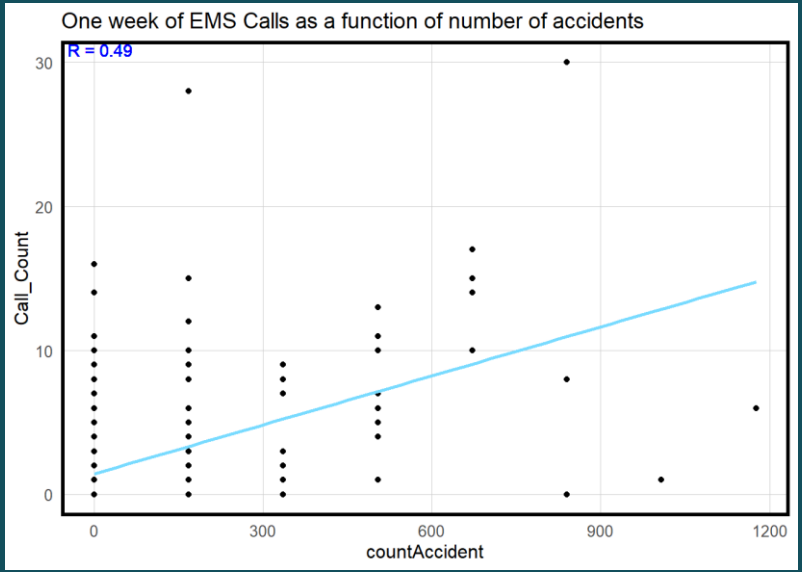
- Fewer calls before 6AM
- 10 AM to 11AM is call peak hour
- Monday, Tuesday and Thursday have more calls at peak hours

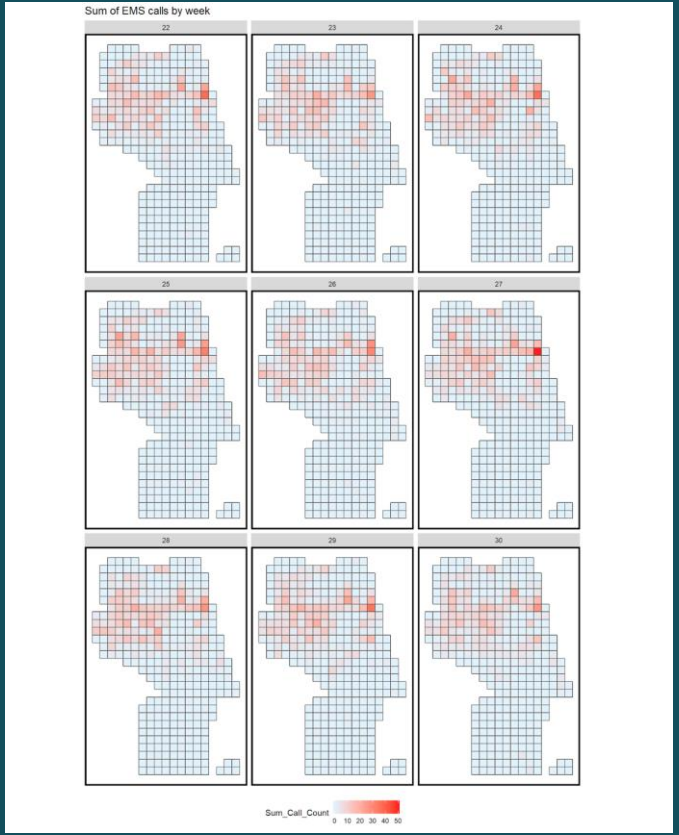




Exploratory Analysis: Call counts by space

- More calls take place in North Virginia Beach
- Follows population distribution
- Around the road networks

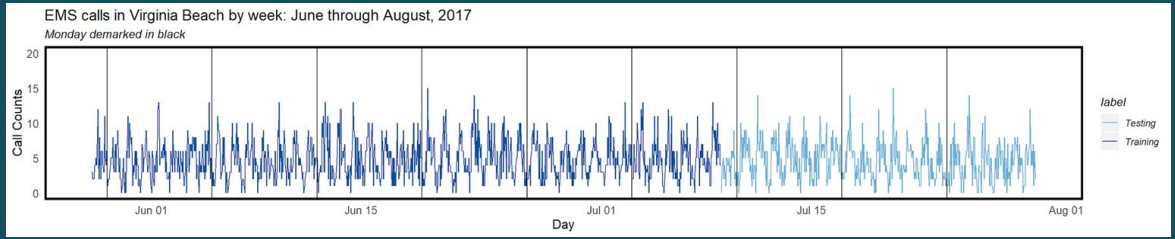




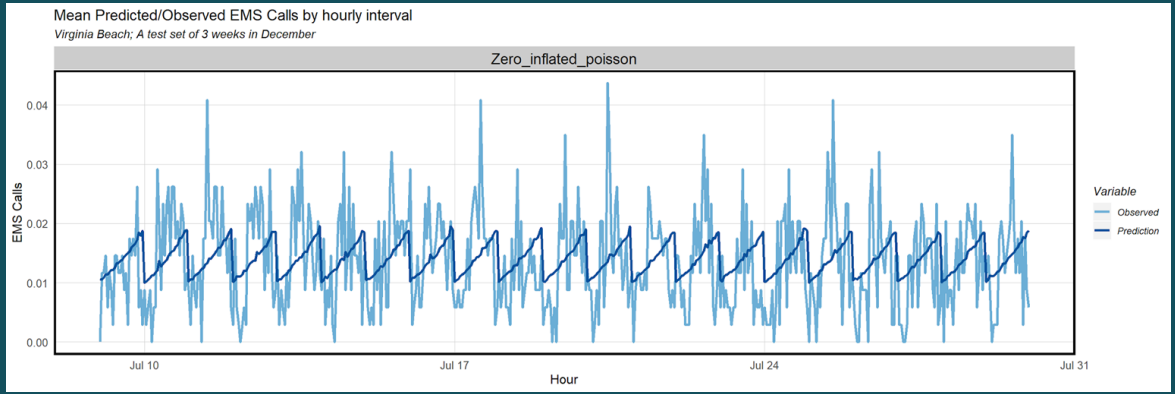
Results

The model is able to predict the general pattern of EMS call counts by hour, but the predicted results missed values at peak and valley.

Observed Counts



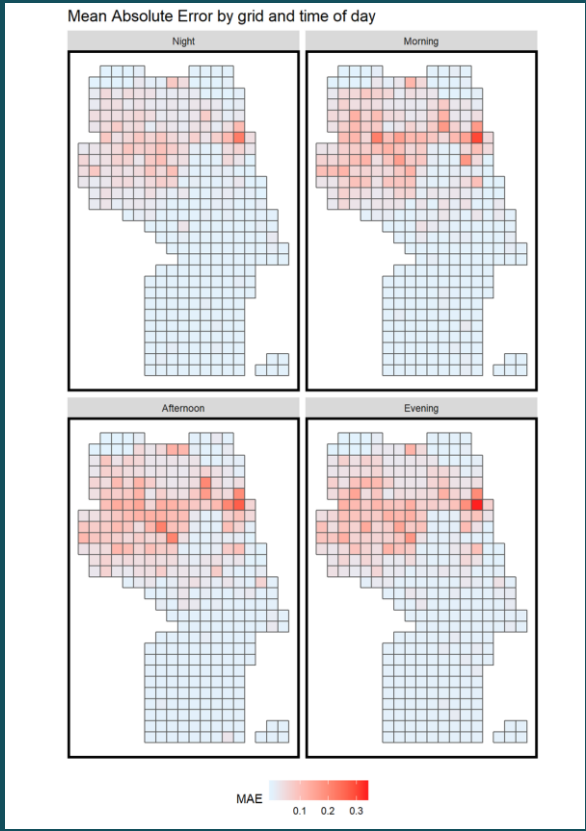
Predicted Counts



Validation

MAE distribution by time and space

- The model generalize well among morning, afternoon and evening
- Slightly lower at night
- Better for fewer calls place (South Virginia Beach)

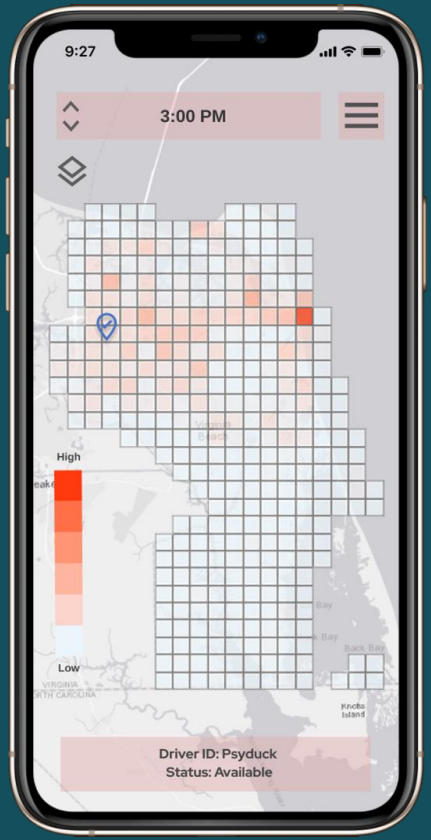


App Wireframe

USE CASE

Target User: Ambulance Driver

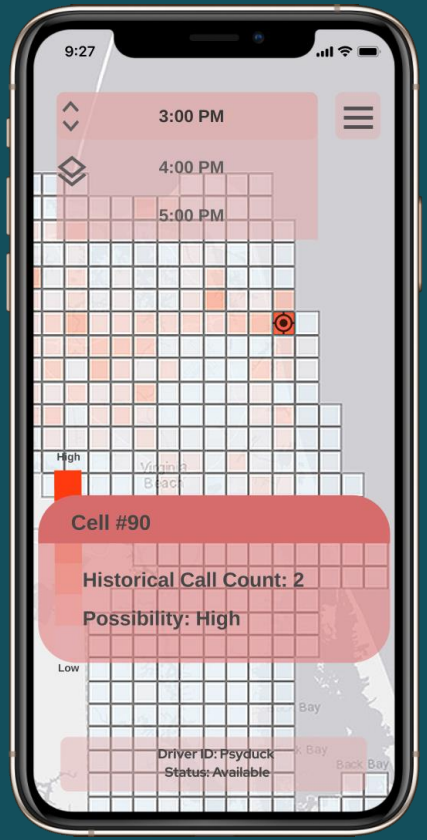
App Wireframe



USE CASE

- Blue label shows the driver's current location
- Time box shows the predicted risk map at current time
- Driver ID is at bottom

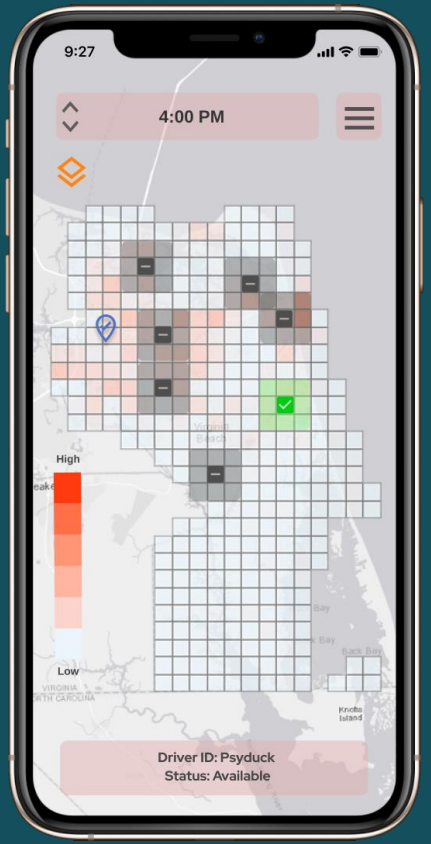
App Wireframe



USE CASE

- Slide time box for risk map at other time interval
- Click grid for historical Info

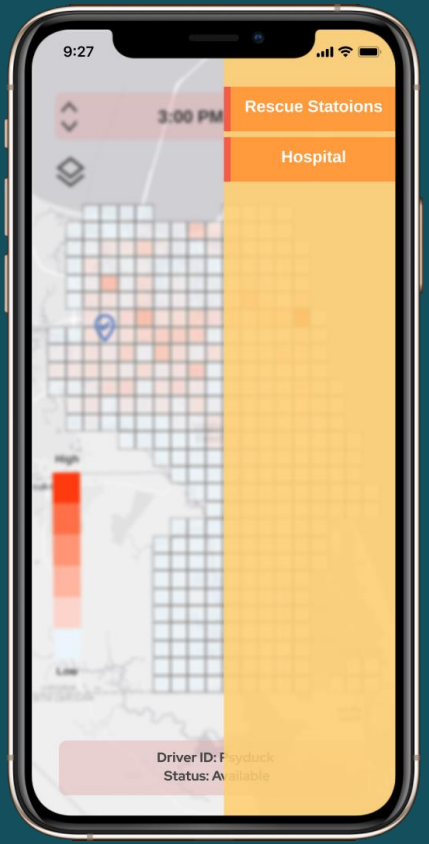
App Wireframe



USE CASE

- Turn on Sign up panel to view other drivers' locations at selected time interval
- Check unselected box tell others your location at that time

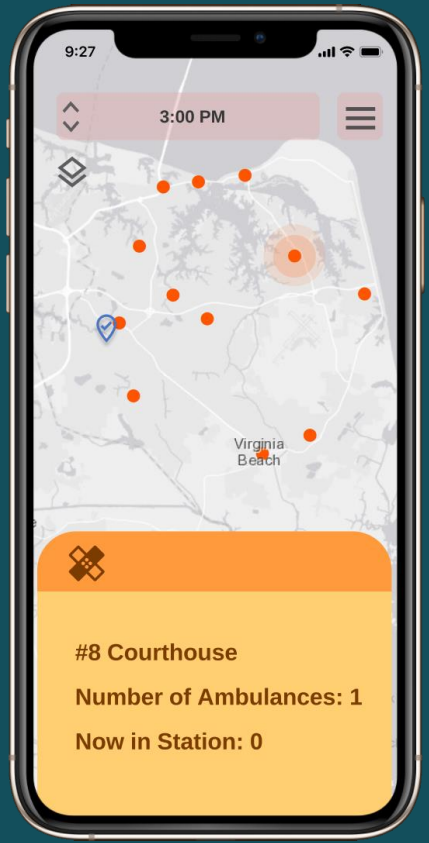
App Wireframe

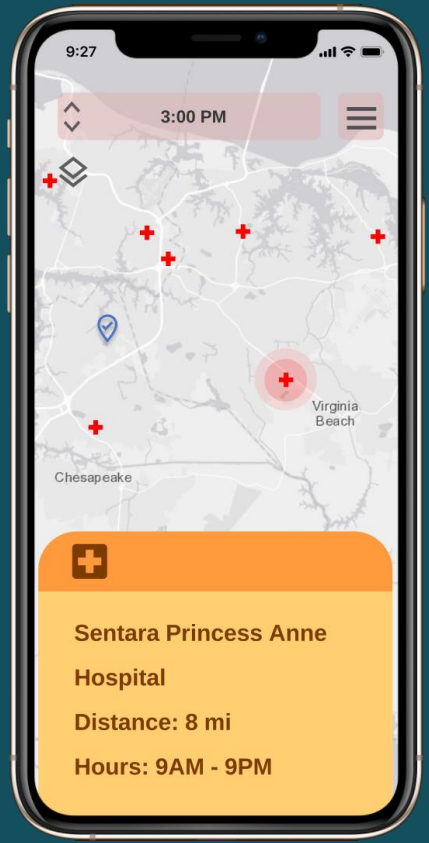


USE CASE

- Click menu to view rescue stations and hospitals.

App Wireframe

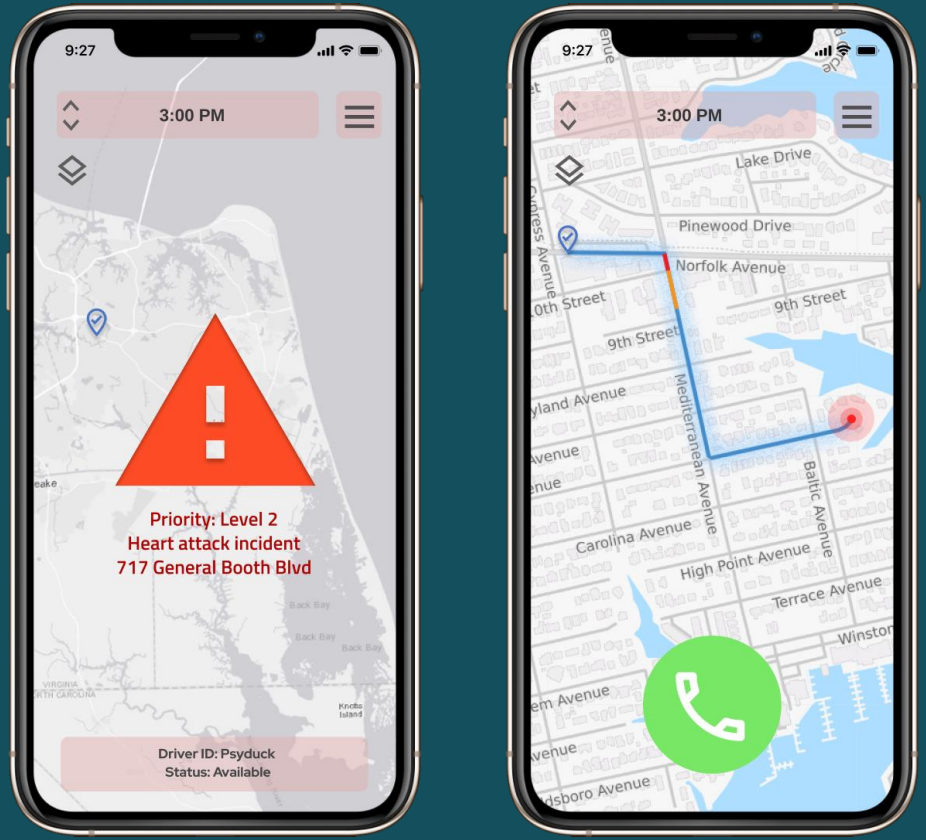




USE CASE

- Click menu to view rescue station and hospital
- Pop-up box for name, distance, availability of stations and hospitals.

App Wireframe



USE CASE

- Warning message would pop up when dispatch center send new task
- Routing for driver to destination
- Directly contact to caller

Contact

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