Developing a Chatbot for Emergency Calls

Data Science Institute
COLUMBIA UNIVERSITY

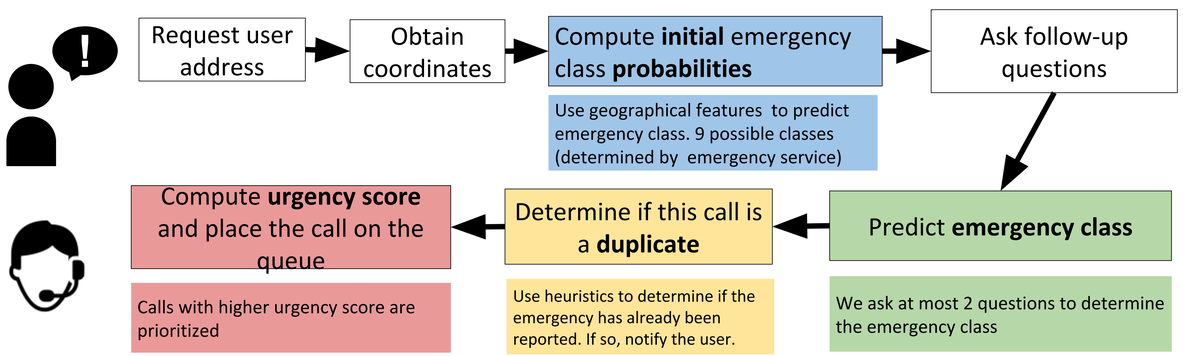
Eduardo Blancas, Chin-Wen Chang, Jack Wang, Wenting Su, Xuewei Du, Ikya Jupudy, Divya Hindupur, Togzhan Sultan

Kriste Krstovski (Faculty mentor), Santiago González (Industry mentor)

Data Science Capstone Project with Synergic Partners

Overview

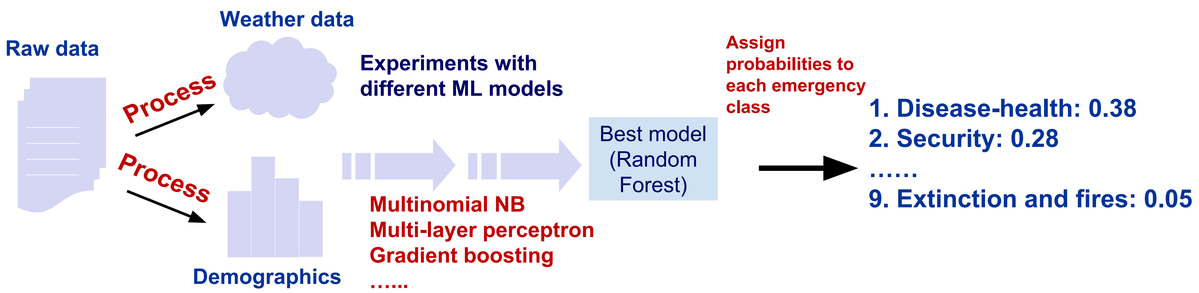
The emergency service on the Canary Islands (Spain), has limited human operators for attending emergency calls. When a critical emergency is reported (e.g. fatal car crash), it can happen that no operators are available to attend the call. In this project we aim to address this issue by developing a system to automatically prioritize emergency calls so that urgent calls are attended faster.



Initial Emergency Class Probabilities

Goal: Provide chatbot with the initial probabilities of the emergency classes

- **Chatbot passes location and time to the prediction model**
- **Model computes the probability of each emergency class**
- **Assigned probabilities help the chatbot decide which questions to ask**



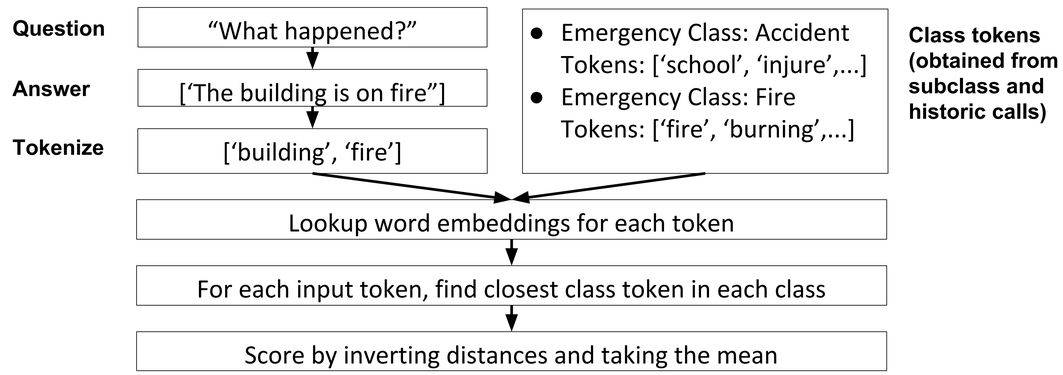
Emergency Class Prediction

Challenges:

- **Lack of training data for building a model to predict emergency class from an input sentence**
- **Dataset contains the subclasses (names) of each emergency class and short text generated from a form that the operator fills out when attending a call**
- **Text does not contain proper syntactic structure found in a real call**

Approach:

- **Algorithm that uses word embeddings to match input tokens and class tokens to find the closest emergency class**
- **Accuracy of 70.4% over 9 emergency classes**



Duplicate Detection

To prevent operators from attending the same emergency more than once (e.g. many people reporting the same car crash), we maintain a log of previous calls for detecting duplicate emergency reports using the following rules:

- **60 minute window between new and previous emergencies**
- **Same class for the new and previous emergencies**
- **Distance rules between new and previous emergency locations**

Urgency Score

The urgency score is used for ranking the emergency calls by severity which is quantified using:

- **Resources dispatched historically**
- **Urgency labels historically assigned to calls**

$$Urgency\ Score = U_r(U_s - \mu)$$

μ (mean of U_s)

$$U_r = \frac{\sum r_i n_i}{\sum n_i}$$

- r_i (importance weight of resource i)
- n_i (median number of units of resource sent for the given emergency historically)

$$U_s = \frac{100U_i + 50E_i + C_i}{U_i + E_i + C_i}$$

- U_i (number of times emergency class was labeled as Priority Urgency)
- E_i (number of times emergency class was labeled as Emergency)
- C_i (number of times emergency class was labeled as Consultation)

Conclusions

- **We developed a proof of concept for a chatbot system to prioritize emergency calls**
- **The limited amount or relevant data available posed a major challenge**
- **Our models were developed using machine learning approaches and heuristics which require further field validation**
- **The emergency class prediction could potentially be improved if transcriptions for the calls are obtained**

Acknowledgments

We would like to thank Santiago González and Kriste Krstovski for their discussion and guidance during the development of this project.

References

References are included in the final report and can be provided upon request.