

# ASSESSING RELEVANCE OF TWEETS IN NATURAL DISASTERS USING A MULTI-MODEL APPROACH

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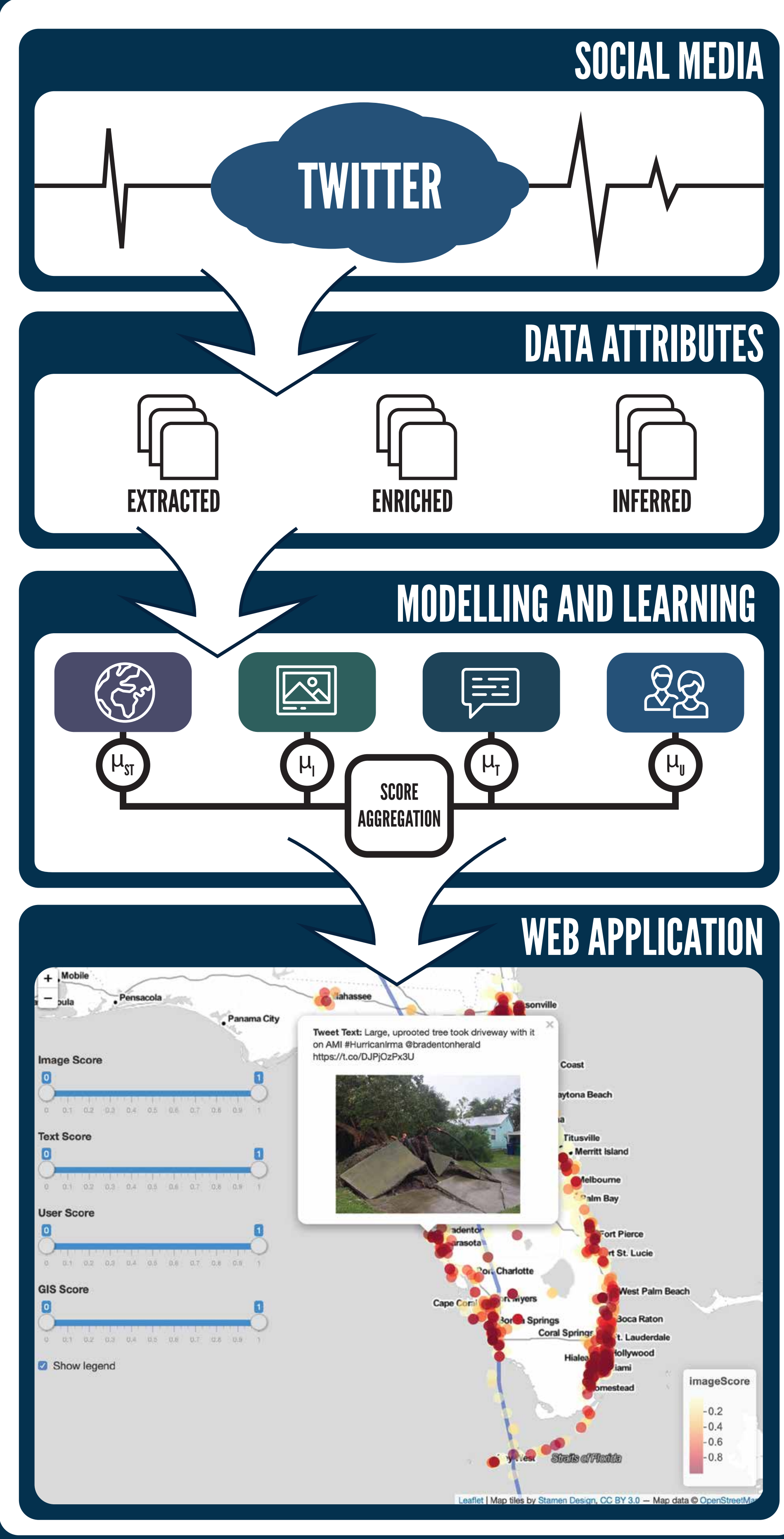
## INTRODUCTION

- Coastal communities are at a higher risk of flooding and consequent damages due to climate change.
- Providing emergency managers with relevant and high-quality information is crucial to ensuring immediate mitigation actions.
- The use of multiple modalities in social media for volunteered geographic information (VGI) has not been investigated for disaster response.

## AIM & OBJECTIVES

- RO1:** Extract multidimensional attributes from streaming social media data.
- RO2:** Develop statistical and machine learning approaches to infer patterns.
- RO3:** Design and develop a generalizable architecture applicable to different disaster events with minimal performance degradation.
- RO4:** Evaluate performance at scale for high velocity streaming data.

## METHODOLOGY



Another downed Palm tree. S. Fort Harrison St in Clearwater. Stay off the roads while crews clean up @BN9 #Irma

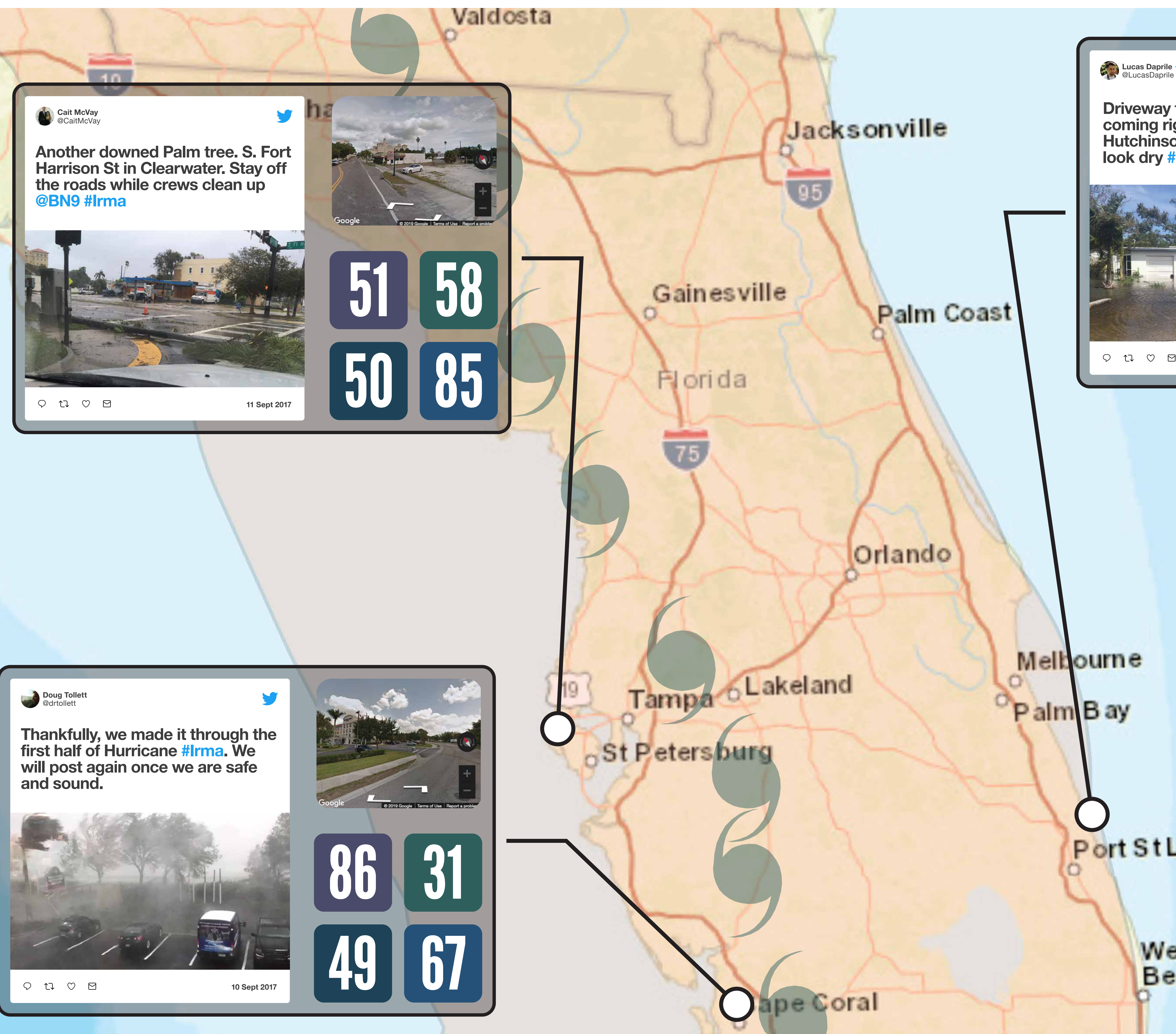
51 58  
50 85

Thankfully, we made it through the first half of Hurricane #Irma. We will post again once we are safe and sound.

86 31  
49 67

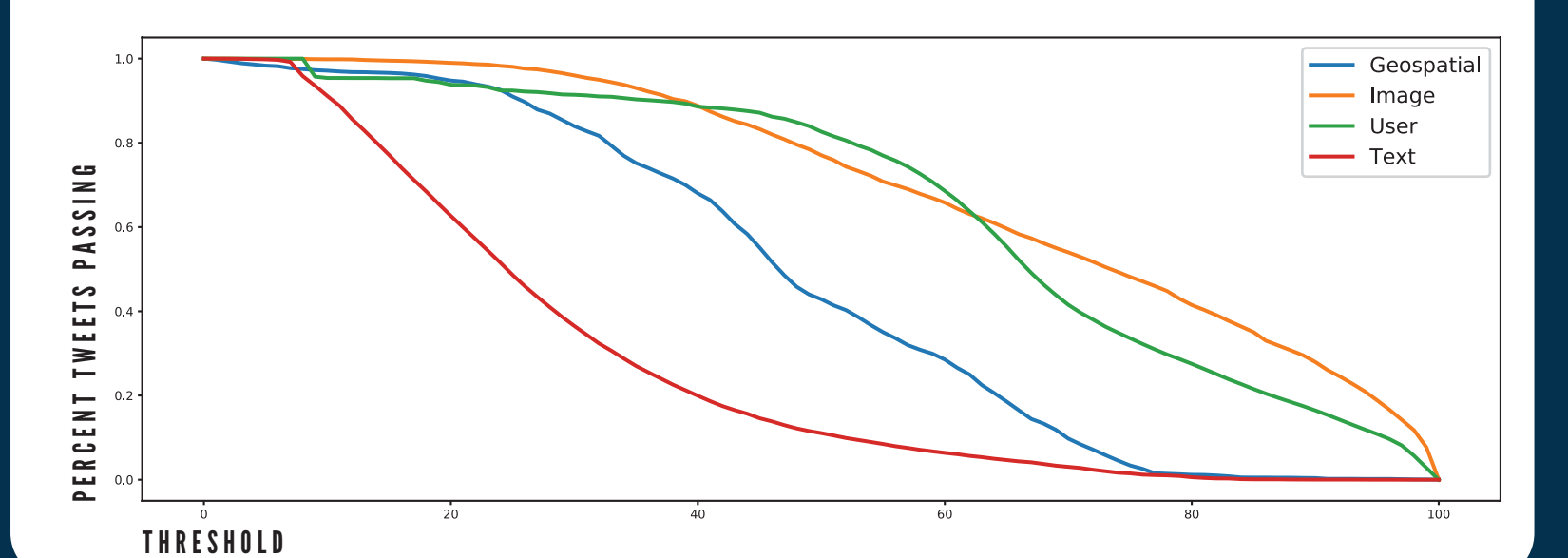
Driveway flooded out. Water coming right up to house on N Hutchinson. Other houses in area look dry #Irma

46 97  
55 93



## RESULTS

- A decrease in the percentage of tweets passing higher thresholds.
- High thresholds are representative of more reliable sources and related contents.



## CONCLUSIONS & FUTURE WORK

- The model shows high accuracy representing its potential application in emergencies.
- Disaster management agencies can utilize the model for various natural disasters such as fires, earthquakes, floods, etc. to extract relevant incidents during such events.
- Generalizability of our approach will be evaluated in future research by applying our model to other occurrences of natural disasters.

## ACKNOWLEDGMENTS

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## RESEARCH COMPONENTS

### SUPERVISED LEARNING MODELS

$$x \xrightarrow{f(x)} y$$

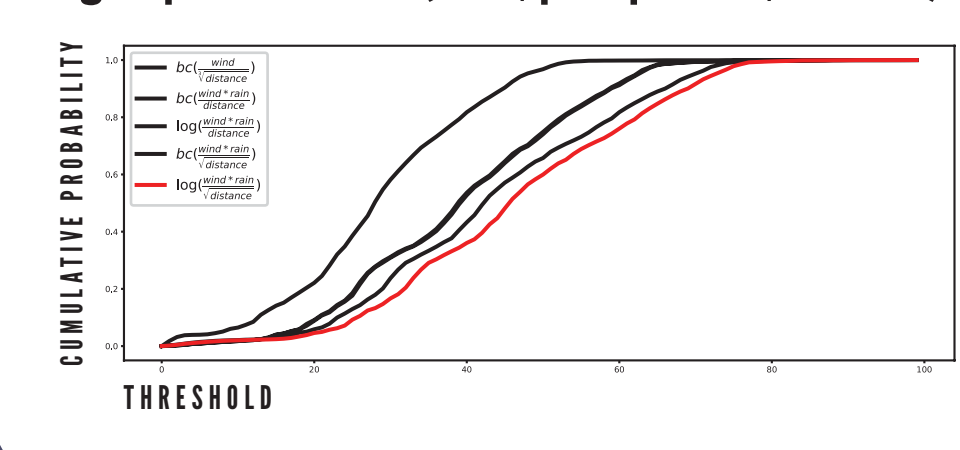
$f(x_{img}) \rightarrow$  CNN/Inception  
 $x_{img} \rightarrow$  Images  
 $y_{img} \rightarrow$  Binary - Physical/Non-Physical Images  
 Multi-label (Destruction, Wind, Flooding)

$f(x_{text}) \rightarrow$  Word2Vec  
 $x_{text} \rightarrow$  Unigrams  
 $y_{text} \rightarrow$  Seed Term

$f(x_{user}) \rightarrow$  Random Forest  
 $x_{user} \rightarrow$  User Features  
 $y_{user} \rightarrow$  Verified/Non-verified users

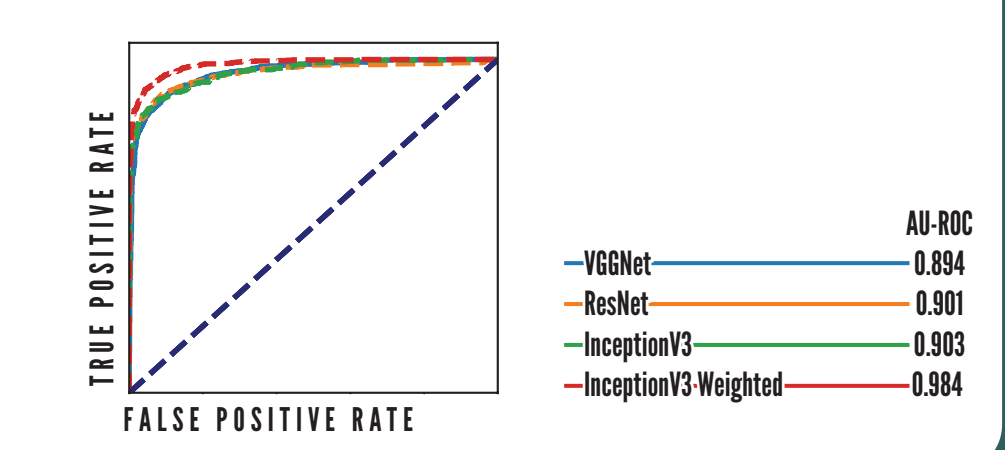
### SPATIO-TEMPORAL ANALYSIS

- Evaluating various formulas to combine the three geospatial metrics (wind, precipitation, distance)



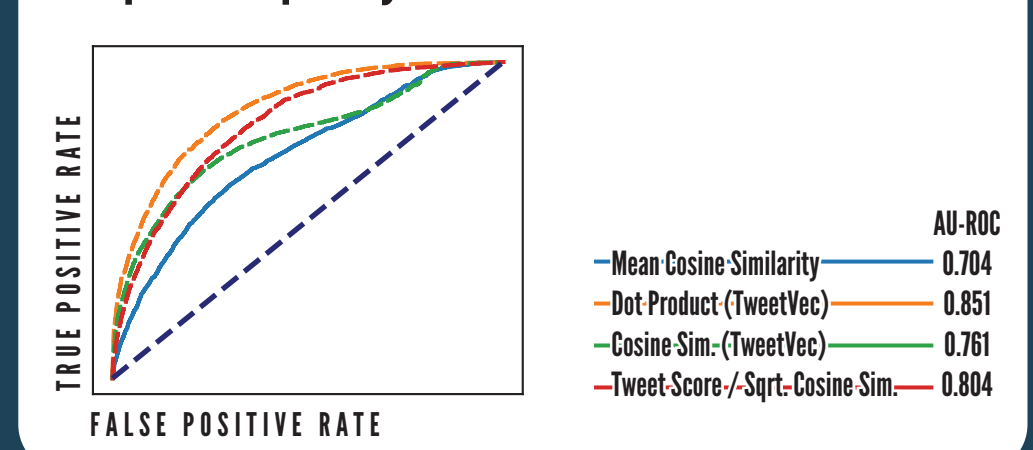
### IMAGE ANALYSIS

- Hurricane-related image classification and incident detection via CNN:



### TEXT ANALYSIS

- Word Embeddings created via NN trained on spatiotemporally relevant tweets.



### USER ANALYSIS

- User verification via SVM, Random Forest, Gradient Boosting, and Logistic Regression:

