

Analyzing and Visualizing Disaster Phases from Social Media Streams

Group VizDisasters:

Liangzhe Chen, Xiaio Lin, Andrew Wood

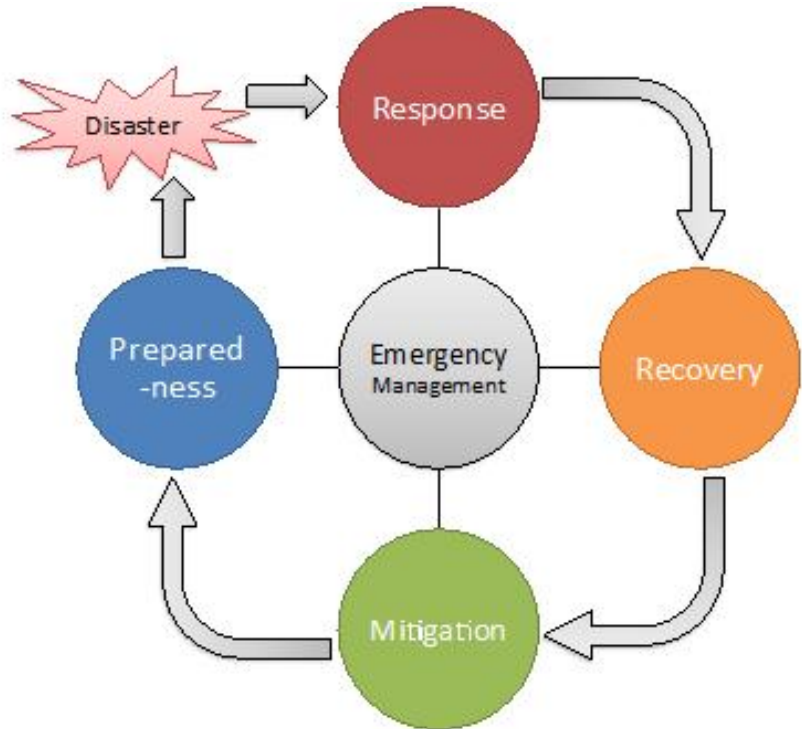
Client: Seungwon Yang

Motivation

- CTRnet: archiving disaster-related online data in collaboration with the Internet Archive
- Tweets during disasters: quick alternative to cell phones
 - Large dataset to pull from for researchers & responders

Four Phases of Emergency Management

- Four phases:
 - Response
 - Recovery
 - Mitigation
 - Preparedness



- Professional and personal activities

Four Phases in Tweets

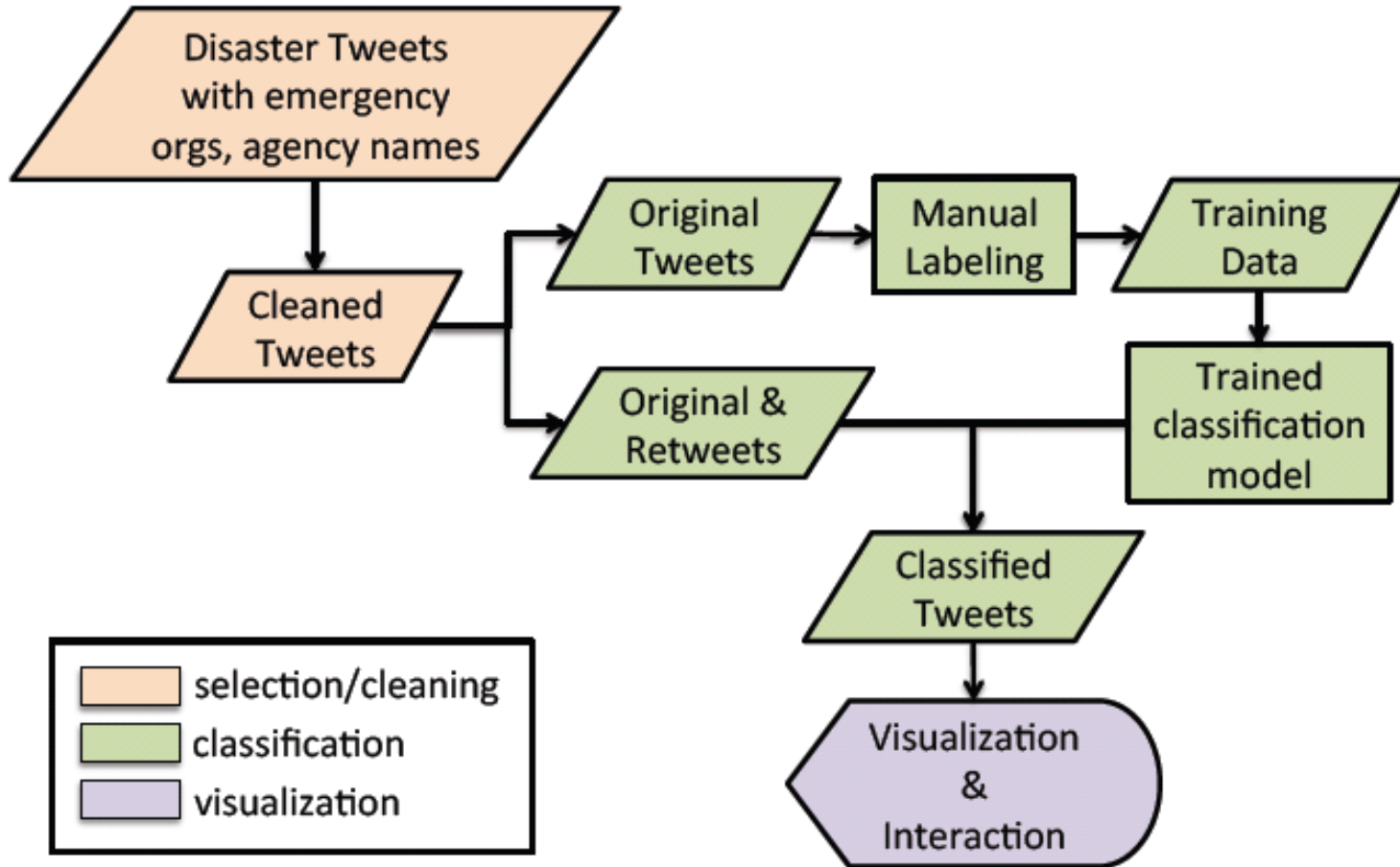
- Reporting situation / sharing information
 - Majority
 - For hurricane: rain, flood, wind, cloud, weather forecast
 - Photographs (Instagram)
- Reporting personal activities
 - Very few

Four Phases in Tweets

- Reporting professional activities

Response	More than 4,700 people in as many as 80 shelters in 7 states overnight; more than 3,000 #RedCross workers (37 from KC region) at #Isaac
Recovery	FEMA announces that federal aid has been made available for the state of Louisiana. #Isaac
Mitigation	FEMA mitigations advisers to offer rebuilding tips in St. Bernard and Ascension Parishes. http://t.co/ZziRGOGw #Isaac
Preparedness	Very cool app! MT @redcross: Our hurricane app has info on #RedCross shelters, a toolkit w flashlight, alarm http://t.co/E7o1rtJK #Isaac

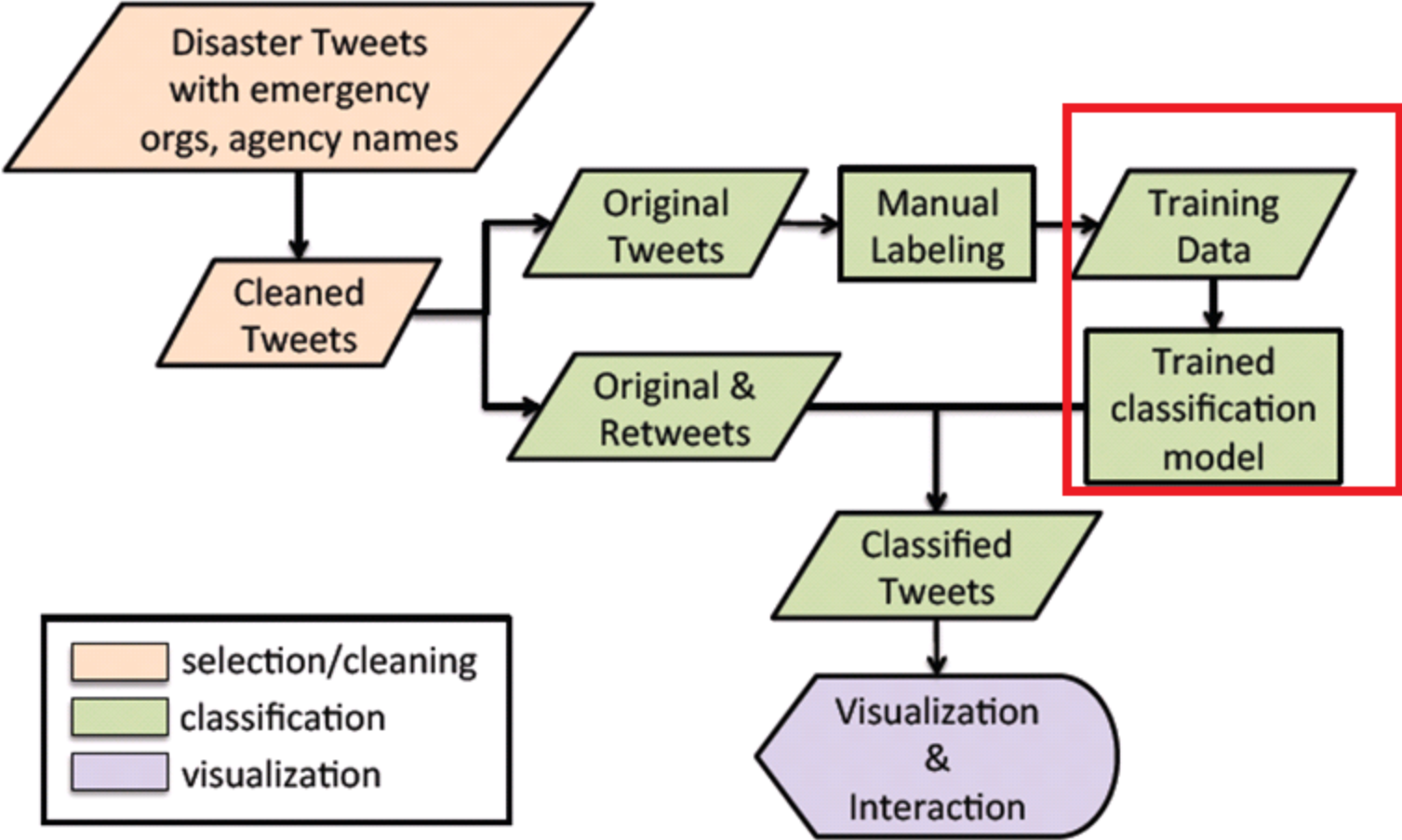
Our Approach



Our Approach

- Machine learning
 - Extract professional activities
 - Classify professional activities into four phases
- Visualization
 - Phase view, tweet view, social network view, map view
- Use case / Demo

Learning Professional Activities in Four Phases



Learning Professional Activities in Four Phases

Preprocessing

- Building dataset
- Vectorization

Classification

- Algorithms
- Evaluation

Building dataset

- Focus on tweets about professional activities
- Based on keywords of known organizations
 - FEMA
 - Red Cross (RedCross)
 - Salvation Army (SalvationArmy)

Building dataset

- Combining tweet and resource title



Mitigation specialists are offering free rebuilding tips in five parishes.
<http://t.co/hwXajm6X> #Isaac

FEMA Advisers Offer Home Repair Tips at Local Stores

Release date: SEPTEMBER 18, 2012

Release Number: DR-4080-059

BATON ROUGE, La. – Teams of hazard mitigation specialists with the Federal Emergency Management Agency (FEMA) are available at home improvement centers in several parishes to offer free consultations to survivors who are rebuilding after Hurricane Isaac.

The FEMA advisers can offer tips and techniques on how to protect homes from future disaster-related damage and other measures to make homes stronger and safer; they also have advice on topics such as:

- emergency preparedness
- roof repair
- rebuilding flooded homes

Building dataset

- Overview of Issac dataset
 - About 56,000 English tweets during hurricane Issac
 - 5,677 tweets with reference to FEMA, Red Cross or Salvation Army
 - 1,453 without re-tweets
 - 1,121 manually labeled explicitly with one of the four phases, response, recovery, mitigation or preparedness

Vectorization

- tf transform
- idf transform
- Normalization
- Stemming (Porter stemmer)

Algorithms

- Naïve Bayes
- Naïve Bayes Multinomial
- Random Forest
- SVM Multiclass

Evaluation

- Tuned classifier, 10 fold cross-validation

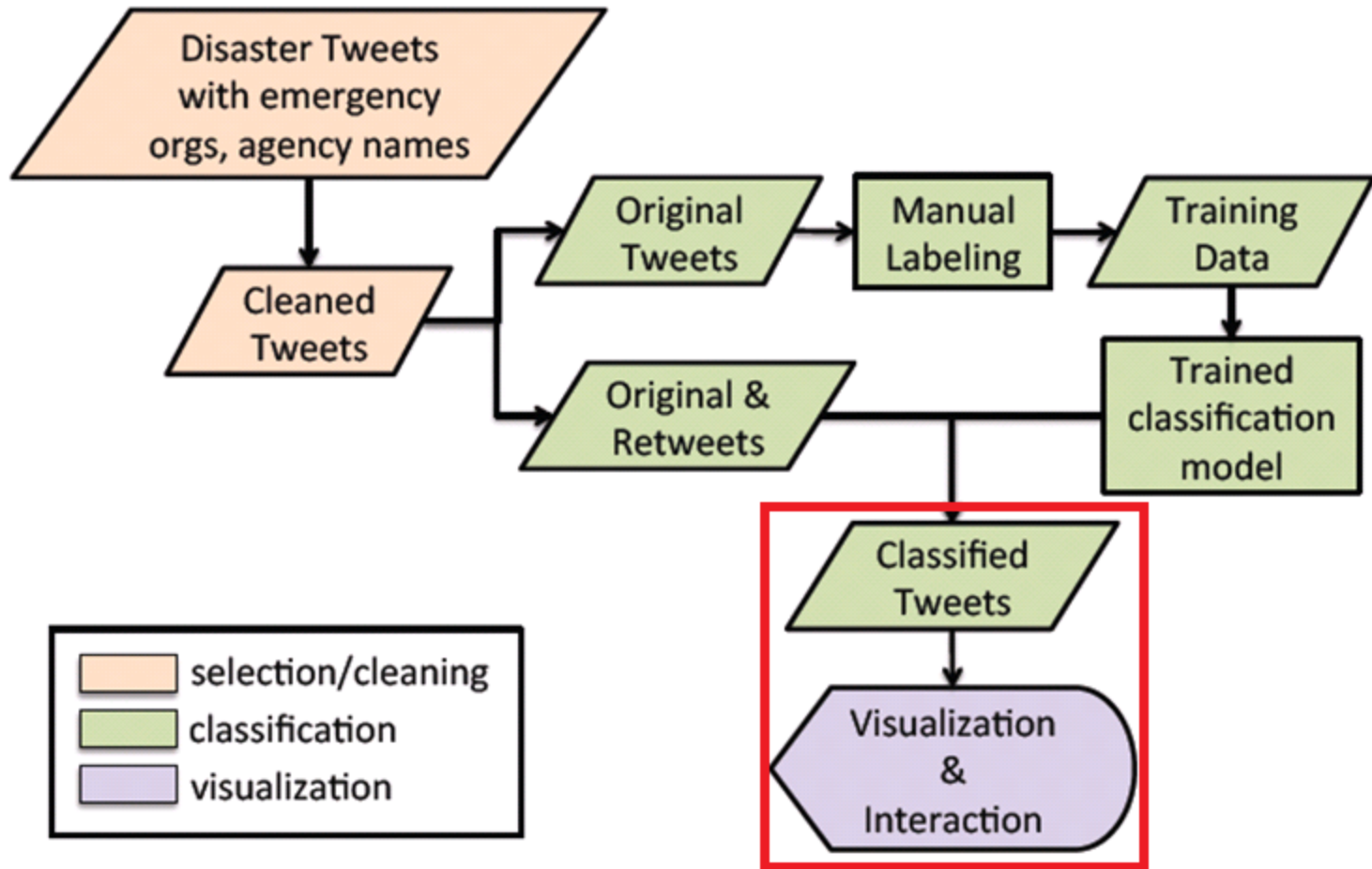
	Accuracy	Weighted F Measure
Naïve Bayes	70.47%	0.723
Naïve Bayes Multinomial	77.87%	0.782
Random Forest	76.27%	0.754
SVM Multiclass	80.82%	Reported slightly lower than naïve bayes multinomial

Evaluation

- Preprocessing v.s. Accuracy

TF	IDF	Normaliz ation	Naïve Bayes Multinomial	SVM Multiclass
			76%	80.1%
		X	77%	80.4%
	X		60%	78.8%
	X	X		78.1%
X			75%	80.4%
X		X	78%	80.8%
X	X		63%	78.9%
X	X	X		79.0%

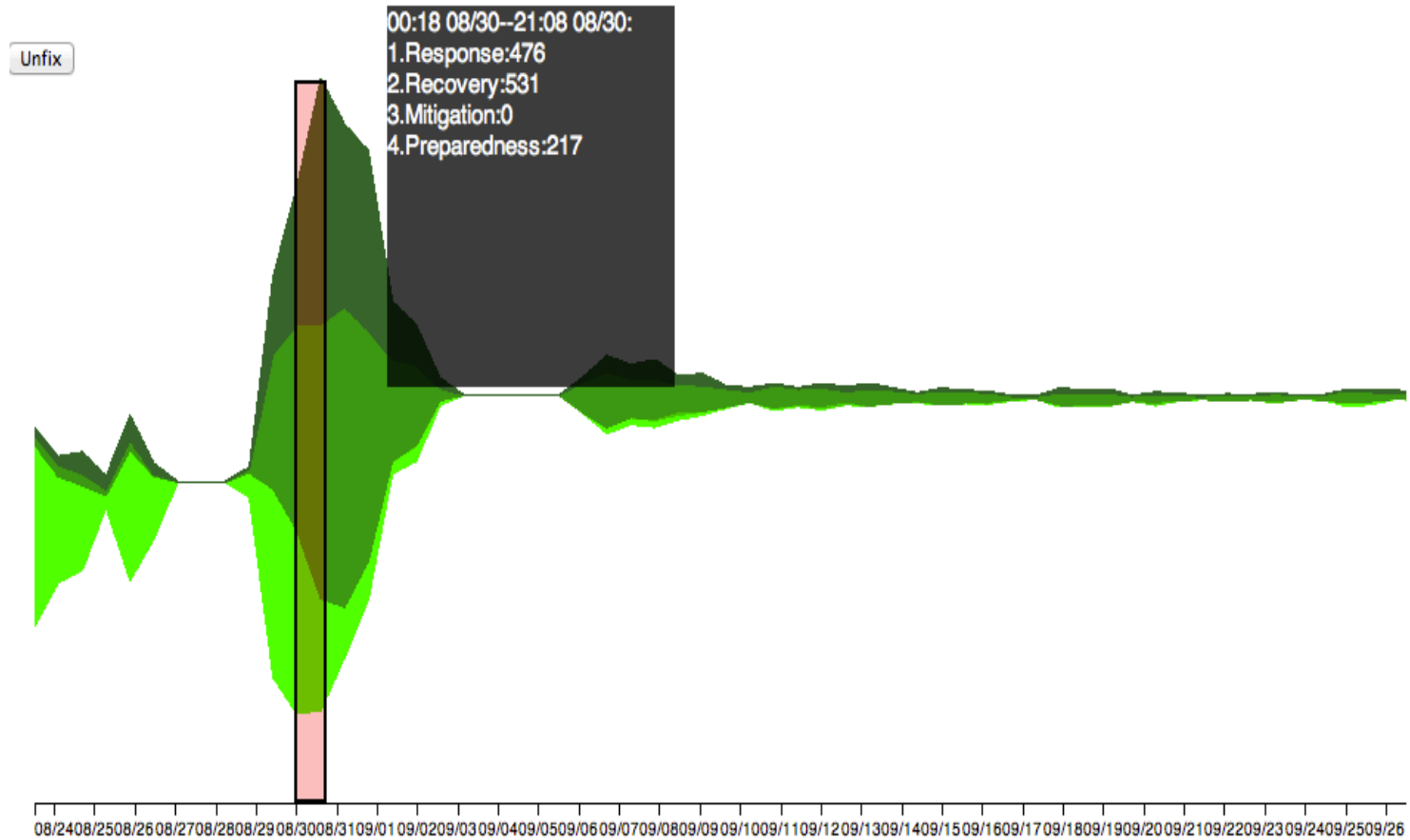
Visualizing Four Phases



Visualizing Four Phases

- Phase view
 - ThemeRiver, D3 library
- Tweet view
 - JqGrid Library
- Social Network View
 - Gephi
- Map View
 - Google Geocoding API

Phase view

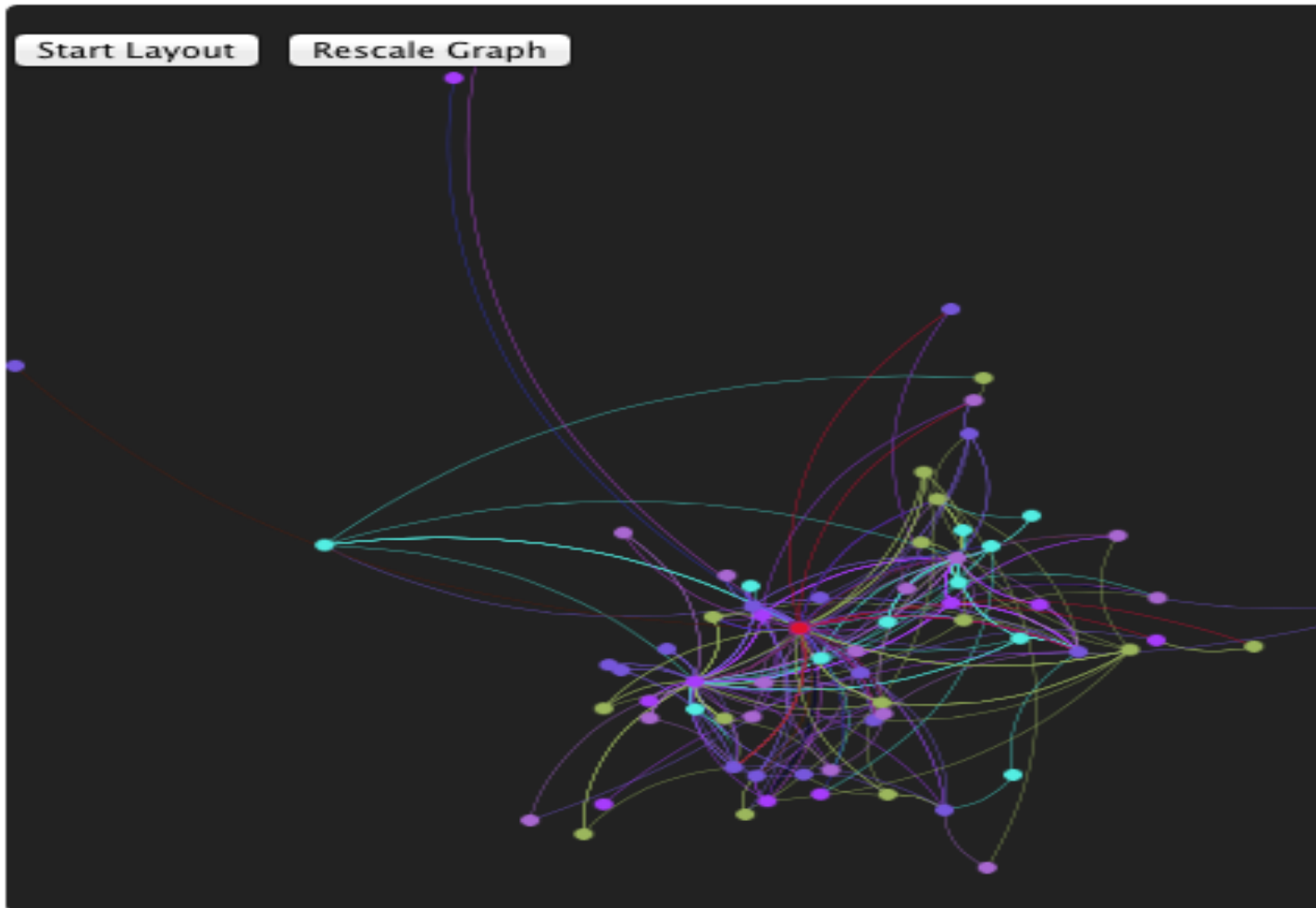


Tweet view

Tweets in Selected Region					
No. :	is_R	Text	Class	Date	Timestamp
12958	0	http://t.co/b0yc3Br0 , LA. state agencies have spent over \$100 M preparing for and responding to #Isaac. FEMA	4	Thu, 06 Sep 2	1346956810
12956	1	RT @femaregion4: Use Caution When Returning Areas Flooded by #Isaac in Mississippi. See http://t.co/u2gEnA	4	Thu, 06 Sep 2	1346957025
12955	1	RT @femaregion4: Use Caution When Returning Areas Flooded by #Isaac in Mississippi. See http://t.co/u2gEnA	4	Thu, 06 Sep 2	1346957281
12955	1	RT @femaregion4: Use Caution When Returning Areas Flooded by #Isaac in Mississippi. See http://t.co/u2gEnA	4	Thu, 06 Sep 2	1346957498
12953	1	RT @femaregion4: Use Caution When Returning Areas Flooded by #Isaac. See http://t.co/4Ek535FR for tips to	4	Thu, 06 Sep 2	1346957865
12964	1	RT @femaregion4: Use Caution When Returning Areas Flooded by #Isaac in Mississippi. See http://t.co/u2gEnA	4	Thu, 06 Sep 2	1346958282
12962	1	RT @femaregion4: Use Caution When Returning Areas Flooded by #Isaac in Mississippi. See http://t.co/u2gEnA	4	Thu, 06 Sep 2	1346958853
12962	0	Please retweet! #FEMA app for smart phones to register for assistance http://t.co/L7Uuo4JG #Isaac	4	Thu, 06 Sep 2	1346958966
12960	0	#FEMA app for smart phones to register for assistance http://t.co/YmA8TCqE #Isaac #smem	4	Thu, 06 Sep 2	1346959293
12992	0	@SFLRedCross @AAadvantage: Join us in supporting the survivors of #Isaac 💎💎💎 Donate to @RedCross & earn	4	Thu, 06 Sep 2	1346966632
13030	1	RT @femaregion4: Use Caution When Returning Areas Flooded by #Isaac in Mississippi. See http://t.co/u2gEnA	4	Fri, 07 Sep 20	1346977830
13047	1	@SFLRedCross @RedCrossSWFL @JohnMoralesNBC6: RT @nbc2: Collier sustains \$7M in damage from #Isaac h	4	Fri, 07 Sep 20	1346986463
13059	0	Rare female hawksbill sea #turtle, washed up in VI during #Isaac, flown to FL for treatment...& incubation of eg	4	Fri, 07 Sep 20	1347010102

View 1 - 232 of 232

Social Network View

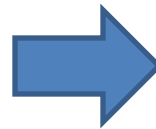


Map view

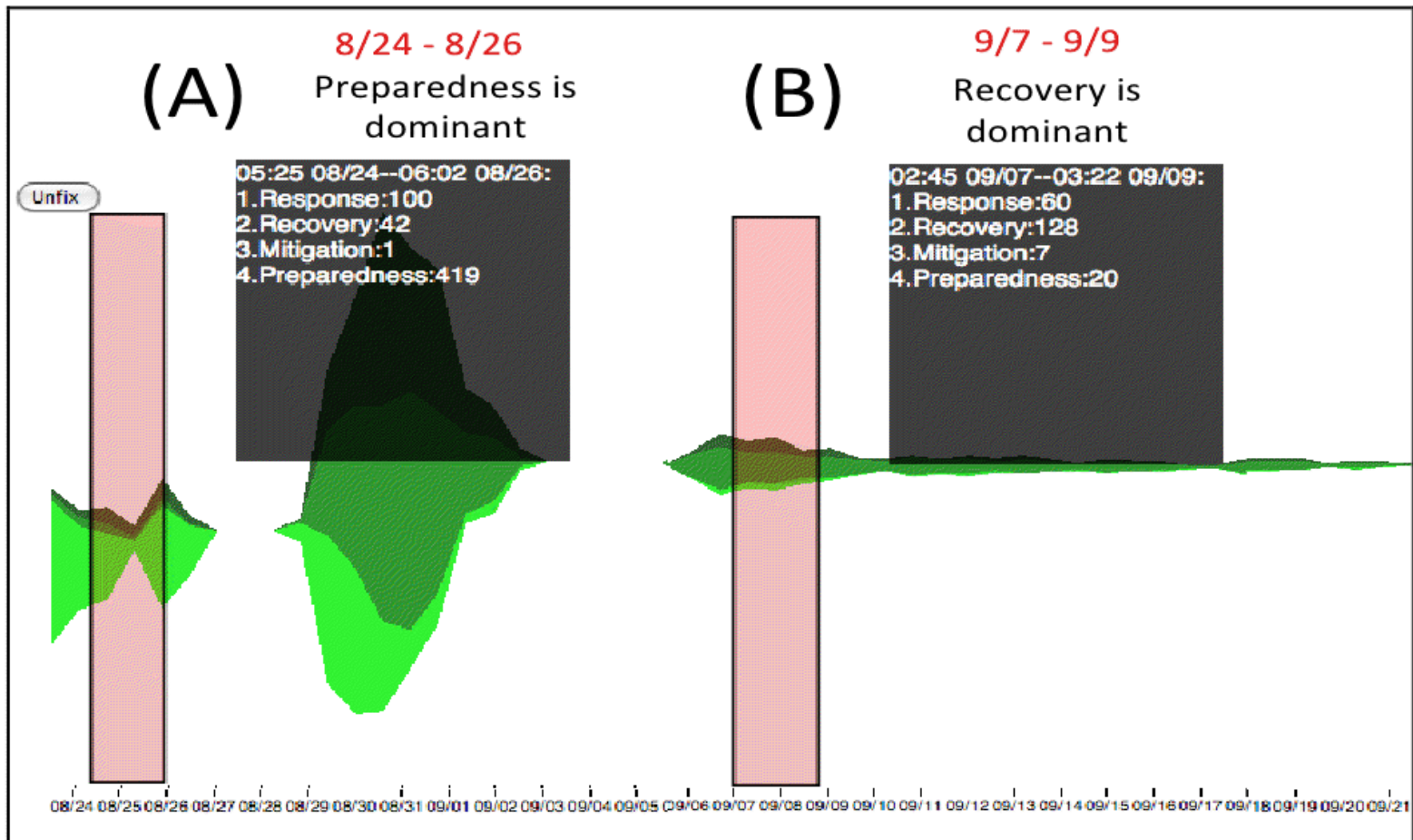


Use Case & Demo

<http://spare05.dlib.vt.edu/~ctrvis/phasevis/>



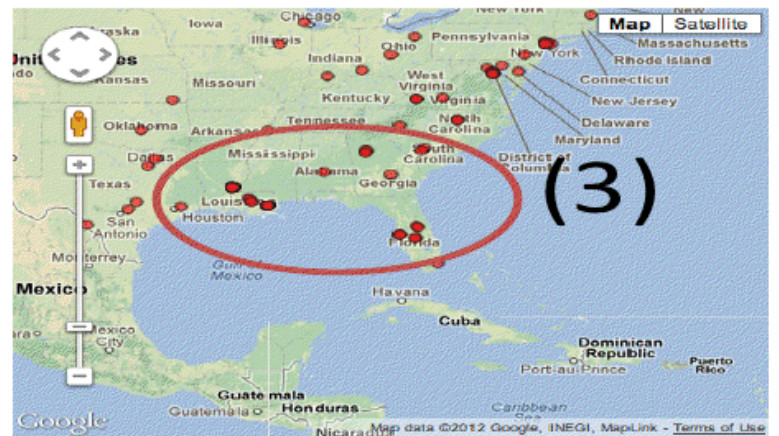
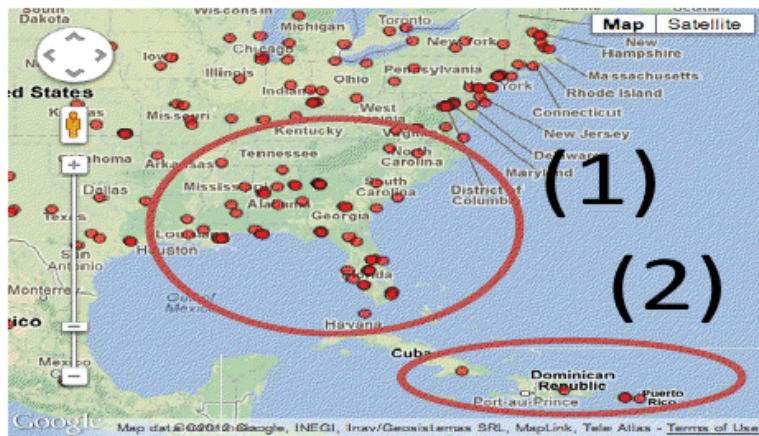
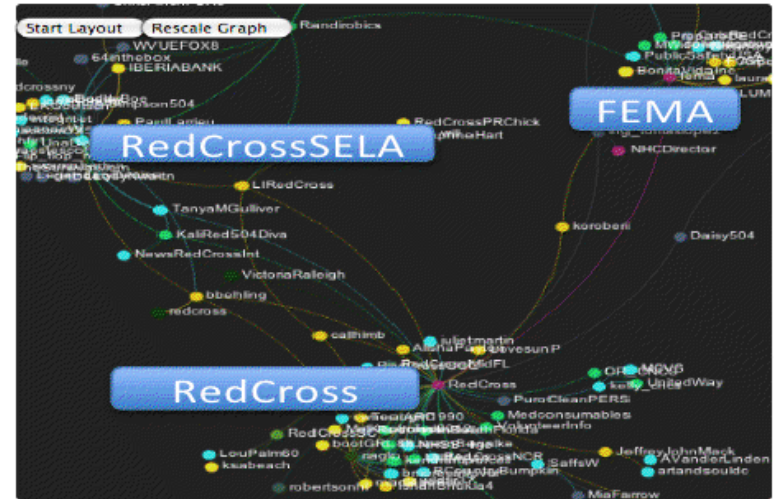
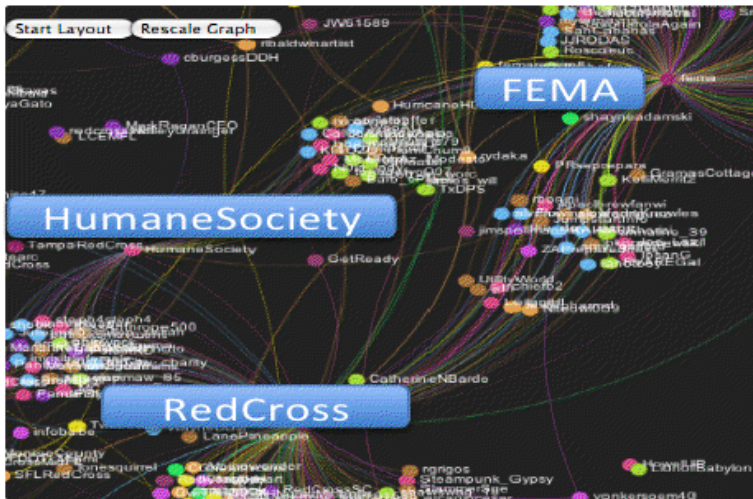
Use Case



Use Case

(A)

(B)



Summary and Future Work

- Summary:
 - Analysis/classification of disaster tweets into phases
 - Multi-view visualization
- Future challenges:
 - Automated professional organization extraction
 - Processing of personal tweets
 - Application to other disasters

Acknowledgements

- Haeyong Chung
- Sunshin Lee