

### #FluxFlow: Visual Analysis of Anomalous

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### What: SOCIAL MEDIA



### Why: Abnormal conversational threads





London Eye set on fire



Rioters attack a children's hospital in Birmingham



Army deployed in Bank



Miss Selfridge set on fire

### How: FluxFlow



### Abnormal Retweet Threads Detection: A Data mining approach

- One-Class Conditional Random Fields Model (OCCRF)
  - temporal dependency, due to mechanism in RT time series data
  - one-class nature. There is little to no example (or even a clear definition) of true anomalies
  - contains a set of hidden variables to capture the underlying sub-structure of the sequential data
- Extracted Feature for each single retweet
  - User profile features: counts of followers, friends, status
  - User network features: in-degree and out-degree
  - Temporal features: intervals between two adjacent tweets in the sequence

### Data mining pipeline



### RT Thread Visualization: RT Thread Glyph



### RT Thread Visualization: RT Thread Timeline



#### System interface



# Hierarchical cluster of RT threads by topics



# MDS view of threads from high dimensional feature space



# User social connections at the intra- or inter-thread level



## Deep-Level Information for Input feature vectors, model hidden states, raw tweets

Clus	Features View S	tates View	Feature vectors
	Features	S View States View Tweets View Sum	mary of hidden states
	x-axis:		
HDO		Features View     States View     Tweets View       "I really hope the storm doesn't damage the really really really nice houses." -Romney on Hurricane Sandy (5) score: 0.93; sentiment: 0.39; 2012-10-29 03:09:12-2012-10-30 00:37:38     Sandy's gonna h (6) score: 0.92;       Gets blown by a girl. Sandy.     Tops them all. R	ave us living like this pretty soon http:// sentiment: 0.33; 2012-10-29 14:23:48-2
mbo		(7) score: 0.92; sentiment: 0.58; 2012-10-29 19:45:54-2012-10-30 01:35:54     from me blowing (8) score: 0.88;       [If hurricane Sandy is blowing trees so should we (9) score: 0.84; sentiment: 0.45; 2012-10-29 10:01:17-2012-10-29 23:27:11     We should name anything. #Gott	a out: http://t.co/V4qnzeAR via @JukayHsu sentiment: 0.99; 2012-10-29 21:34:36-2012-10-29 23:15:19 name the next hurricane A-Rod so there's no chance of it hitting EEEEEEEEEEEEEMI
•	score: 0.18 sentment: 0.51 users: 915 start: 2012-10-29 00 nd: 2012-10-30 02 keywords: hurrisan wind, blowing, real, blow, making, stop, fuck, p lowk	127 sure. o.or, senantek: 0.05, 202-10-25 10:01.17-2012-10-25 23:27:21	

### Visualization techniques summary

How:Encode	Glyph, Thread Timelines
How–Facet	Multiform, Overview/ Detail. linked highlighting.
How: Reduce	Item filtering, Item aggregation, Attribute aggregation, Elide, Superimpose
How: Manipulate	Highlighting, Project, Zoom

### Task Summary

- T1 Summarizing and aggregating important features of retweeting threads.
  - Glyph, Cluster View, MDS View
- T2 Indicating characteristics and connections of involving users.
  - User relationship graphs
- T3 Revealing temporal patterns of information spreading.
  - Thread Timeline
- T4 Facilitating visual data comparisons and correlations.
  Cluster View, MDS View
- T5 Accessing deep-level information of the model and input.
  - Thread Timeline, Features View, Status View, Tweets View

### Evaluation

- Datasets: two 10% Twitter feed datasets collected during two significant events:
  - 2012 Hurricane Sandy(52 million tweets)
  - 2013 Boston Marathon Bombing(242 million tweets)
- Baseline: One-Class SVM (OCSVM) [Scholkopf et al., 2001]
- Ground truth: manually labeled by three annotators to based on reports after the events

#### **Comparison Results**



Accuracies of OCCRF and OCSVM in correctly detecting rumors in the top-K retweeting threads ranked by the models in datasets: a) Hurricane Sandy, and b) Boston Bombing.

### Case Study of Hurricane Sandy







### Critiques

- Data
  - Incorporate further content attribute(e.g., topics, tags, deeper semantic analysis)
- Data mining algorithm
  - Improve on algorithm scalability and response time
  - Decouple with specific models
  - More insights about the model beyond hidden states, e.g. interactions of model parameters
- Visualization
  - Timeline visualization need better reducing techniques to be scalable for real social network data
  - Better to show the "chain" of retweeting, and influence between users
- Evaluations
  - Stronger ground truth for quantitative evaluation

### Thank you