SPATIOTEMPORAL DIFFUSION AND HOSTILITY DETECTION IN SOCIAL MEDIA: TOWARD AN INTERDISCIPLINARY COLLABORATION

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Overview

- Introduce two of my research team projects :
  (1) Spatiotemporal Diffusion Modeling
  (2) Intergroup hostility detection

- Advocate the needs of interdisciplinary collaboration in social media research

PROJECT 1: SPATIOTEMPORAL DIFFUSION MODELING OF SOCIAL MEDIA-BASED SOCIAL MOVEMENT

Project 1: Spatiotemporal diffusion modeling of social media-based social movement

1. Social movement scholars

- Frequent diffusion theoretic metaphors (esp. online)
- Global, transnational networks matter
- Few studies in dynamic diffusion modeling along with temporal and spatial dimensions

Project 1: Spatiotemporal diffusion modeling of Social media-based social movement

2. Mathematics/Computer Science

- Various online social networks and information diffusion models developed
- Ambiguity how the models could be used to offer insights to social issues

Project 1: Research Purpose

1. Introduce a mathematical spatiotemporal information diffusion model to social movement scholarship
2. Validate the model with tweets
3. Social-theory driven arrangement of spatial proximities

Project 1: A Mathematical Model

- *A rate of change over time and spaces*: Partial Differential Equation (PDE)
- *moving tendency due to a large force*: Advection term (e.g., wind current in disease diffusion)

diffusion-advection model

$$\frac{\partial I}{\partial t} = \frac{\partial}{\partial x}\left(de^{-bx}\frac{\partial I}{\partial x}\right) - g(x)\frac{\partial I}{\partial x} + r(t)I\left(h(x) - \frac{I}{K}\right)$$

Project 1: Data

- Three-week tweets during the 2011 Egypt Revolution
- API streaming + backtracking
- 5% sampled (n = 12,694)
- Geocoding: aggregated to global regions
- 3 message types: ad-hoc reporting, situation verifying information, & collective action supportive messages
- 3 time frames: beginning (1/24~1/31), active protest (2/1~2/7), regime turnover (2/8~ 2/13)

Project 1: Spatial Proximity

- Regions (x): Egypt, MENA, Africa, NA, LA, WE, EE, Asia
- U(x_1, x_2 …x_8), x_1 = the origin (Egypt) fixed
- Spatial order varies contingent on IR criteria.
  - ① Physical proximity
  - ② Migration-based proximity
  - ③ Economic proximity
  - ④ Democracy proximity

Project 1: Results

- Model Accuracy: 70.62% ~ 94.11%
- A composite of g(x) values for spatial spread-ability: Weighted Mean (WM) of g(x)

$$WM = \sum g(x)(MaximumD + 1 - x)$$

Project 1: Results

- **Model Accuracy: 70.62% ~ 94.11%**
- **A composite of g(x) values for spatial spread-ability: Weighted Mean (WM) of g(x)**

$$WM = \sum g(x)(MaximumD + 1 - x)$$

- ***Democracy-based proximity*** **shows the most effective information shift across location points.**
- **Different types of messages show different pattern of spatial information shift**

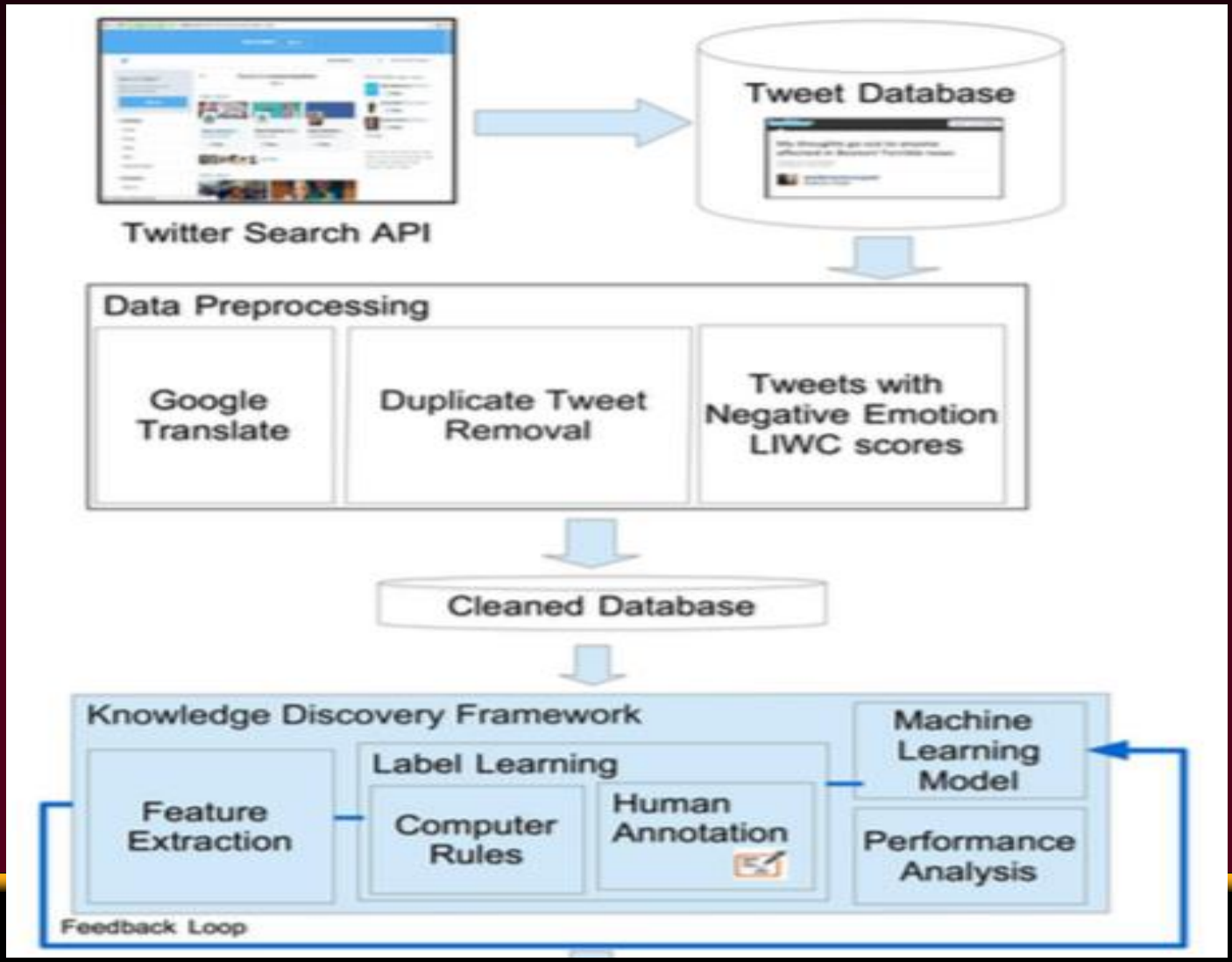
PROJECT 2:
AUTOMATIC DETECTION OF HOSTILITY IN SOCIAL MEDIA

Project 2: Automatic detection of hostility in social media

Intergroup communication problem:

- Diffusion of maladaptive communication during extraordinary events?
- Impact of hostility expression in social media
- Hard to identify it in a large-scale data
- Possibility of automatic identification through collaboration?

Knowledge Discovery and Machine Learning Framework for Hostile Message Detection



Project 2: Knowledge Discovery Framework (Boston Marathon bombing tweets)

Feature Extraction

- **Unigram**
- **URL**
- **News org. twitter handle**
- **Profanity**
- **Emphasis**
- **Kill***
- **Sympathy words** (help*, donat*, sadden*, heart*, thought, praying)
- **Numeric**

Labeling

- **Computer generated (group + swearing): 93.1 % agreement with human**
- **Further human annotation for unlabeled tweets: 81.66% inter-coder agreement**

Project 2: Knowledge Discovery Framework

- High rate of precision and recall with balanced sample.
- Need to improve with unbalanced (=real world distribution) sample.
- Future: towards the online hostility diffusion modeling

To Summarize

- Both began with the identifying social issue based on well-grounded social science literature
- Attempt to leverage collaboration to overcome methodological challenge in contemporary socio-digital environment
- Challenge to go beyond Twitter; Challenge to collect spatial data

Thank You. Questions?

For more comments/questions:

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