Text Analytics:

The One that Introduces Things

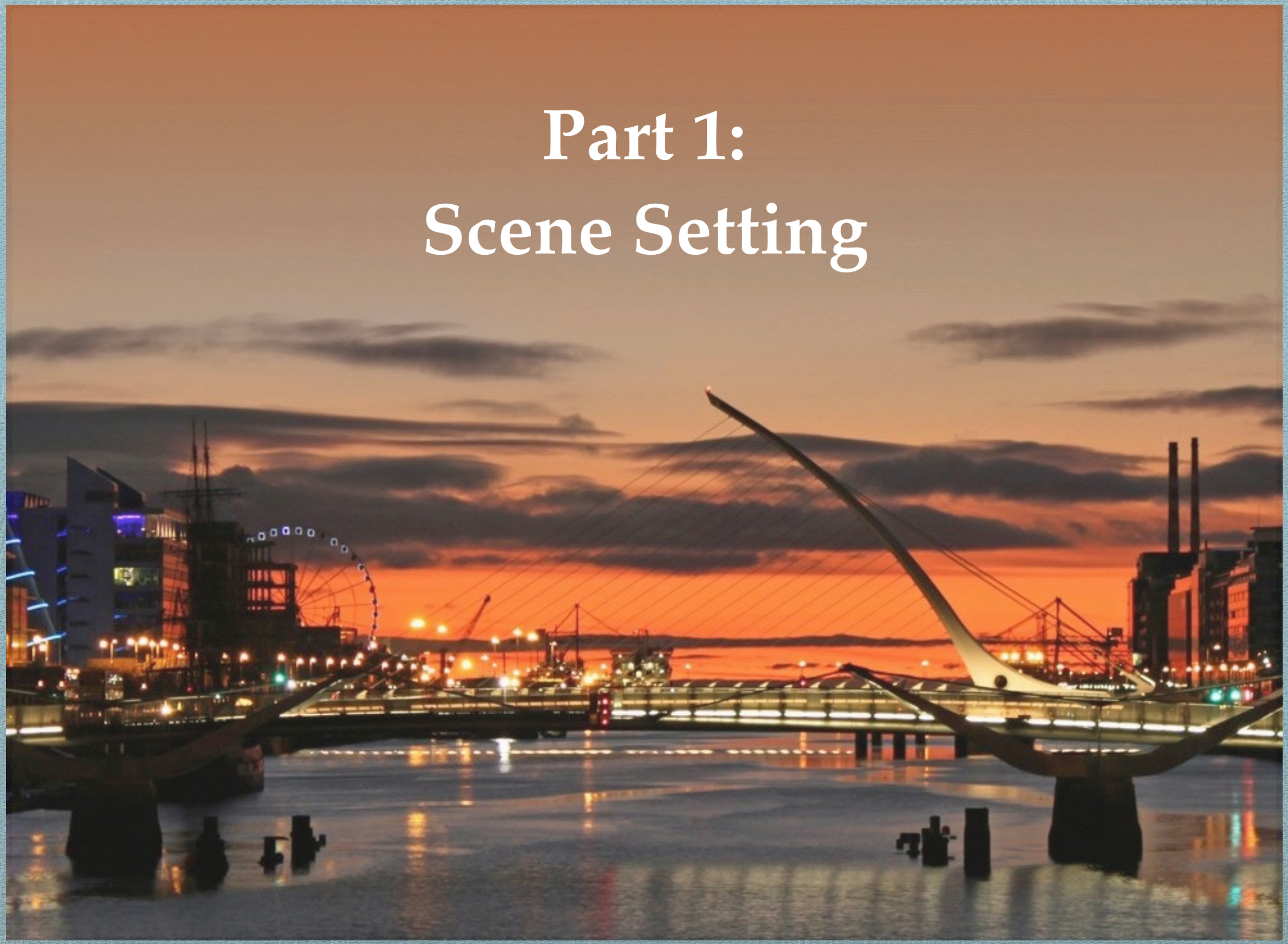
Lecture 1: Text Analytics for Big Data

Mark Keane, Insight/CSI, UCD

Three Things

- **Scene Setting:**
  - What is ? Text Analytics …Big Data…
- **Housekeeping:**
  - Course Structure & Aims
- **Tooling Up:**
  - Installing stuff for Practicals

Part 1:
Scene Setting



De Basics

- What is Text Analysis ?
- What is Big Data?
- What's new about all of this?
- Example of Text Analytics…

Text Analysis: What are you?

- The use of textual data to mine, reflect, understand, and represent what happens in the physical, psychological and social world
- This text comes from books, news, comments, tweets, txts, conversations…whatever is written down…once it is expressed in natural language
- So…duh…it uses a lot of Natural Language Processing (NLP) techniques !

What is Big Data?

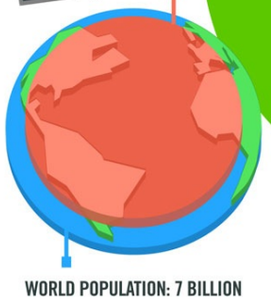
- Data that is BIG !
- Billions of items rather than millions…
  coming at you…at speed…in unstructured forms…
- Which demands new DBs, new data structures, new algorithms for processing
- Size, Speed and Scaleability become Critical

What is Big Data? IBM~ 4Vs

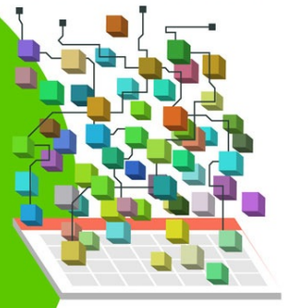
Volume
SCALE OF DATA

40 ZETTABYTES
[43 TRILLION GIGABYTES]
of data will be created by 2020, an increase of 300 times from 2005

6 BILLION PEOPLE
have cell phones



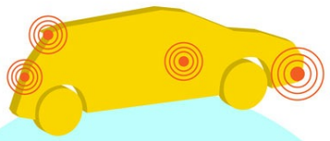
It's estimated that
2.5 QUINTILLION BYTES
[2.3 TRILLION GIGABYTES]
of data are created each day



Most companies in the U.S. have at least
100 TERABYTES
[100,000 GIGABYTES]
of data stored

Velocity
ANALYSIS OF STREAMING DATA

The New York Stock Exchange captures
1 TB OF TRADE INFORMATION
during each trading session



Modern cars have close to
100 SENSORS
that monitor items such as fuel level and tire pressure

By 2016, it is projected there will be
18.9 BILLION NETWORK CONNECTIONS
– almost 2.5 connections per person on earth

The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015
4.4 MILLION IT JOBS
will be created globally to support big data, with 1.9 million in the United States

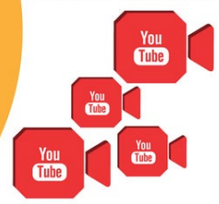
Variety
DIFFERENT FORMS OF DATA

As of 2011, the global size of data in healthcare was estimated to be
150 EXABYTES
[161 BILLION GIGABYTES]

30 BILLION PIECES OF CONTENT
are shared on Facebook every month

By 2014, it's anticipated there will be
420 MILLION WEARABLE, WIRELESS HEALTH MONITORS

4 BILLION+ HOURS OF VIDEO
are watched on YouTube each month



400 MILLION TWEETS
are sent per day by about 200 million monthly active users

Veracity
UNCERTAINTY OF DATA

1 IN 3 BUSINESS LEADERS
don't trust the information they use to make decisions

Poor data quality costs the US economy around
$3.1 TRILLION A YEAR

in one survey were unsure of how much of their data was inaccurate

Sources: McKinsey Global Institute, Twitter, Cisco, Gartner, EMC, SAS, IBM, MEPTEC, QAS

What's New in Big Data?

- ***Who we know,*** says a lot about who we are…
  - Facebook friends, linked-in network, tweet followers
- ***What we write or say,*** says a lot about what we think…
  - Text in books, news, blogs, social media and so on
- ***Where we located***, says a lot about us…
  - location-based sensing, GPS, IP-addresses
- ***What we do***, says a lot about our decisions/interests…
  - what we buy, web-sites visited, youtube videos watched, news re-tweeted, items shared, what we comment on and so on…

What's New in Big Data?

Text Bits

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What's Old in Big Data?

- Good old-fashioned, data analysis
- Many statistical ideas are very familiar
- Many research problems are familiar
- Proper collection of data is important
- Proper treatment of data is critical

What's Really New?

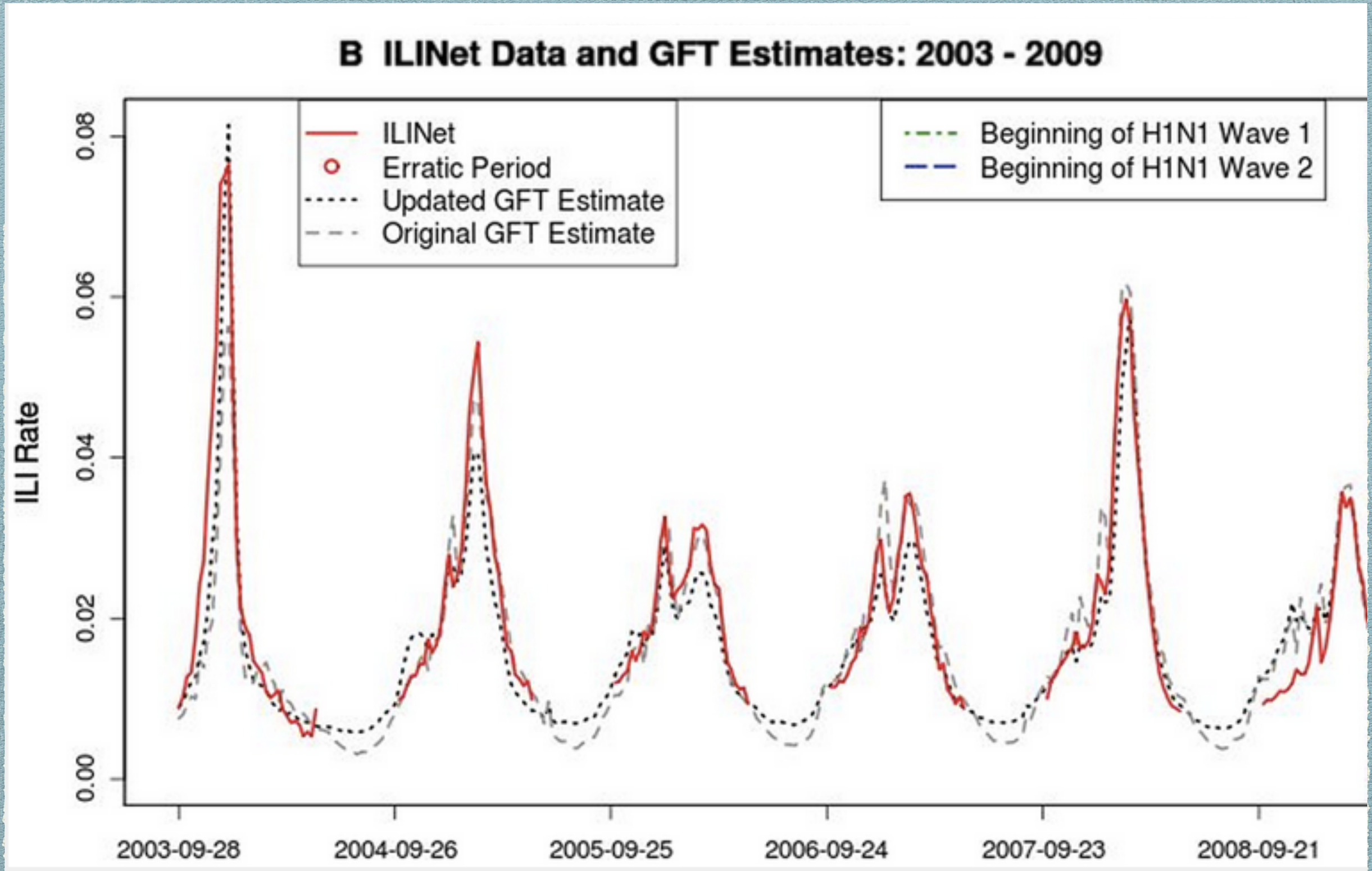
- **Tipping-point with Very Large Data Sets**
  - from 100s to 1,000,000,000s of data points
- **Unusual Types of Data**
  - video, text, thumbs-up, unstructured data
- **Non-standard Data Sources**
  - social media (FB, Tweets), news, phones
- **Data is not gathered conventionally…indirect**
  - the *sensing devices* are doing other things

Text Analytics Examples…

- Flu Epidemic Detection from Search
- Political Orientation from Twitter
- Public Sentiment on Stockmarket
- Predicting Movie Box Office Revenues
- Tracking Earthquakes and Typhoons

Search Terms & Flu Epidemics

- Google Flu Trends (GFT) aggregates search data, count in flu keywords
- US Centre for Disease Control (ILIs) tracks influenza like illnesses in outpatient data
- From 2003-2009 GFT shows high correlation with ILI stats (ILINet)
- GFT (sort of) predicts flu outbreaks & their locations



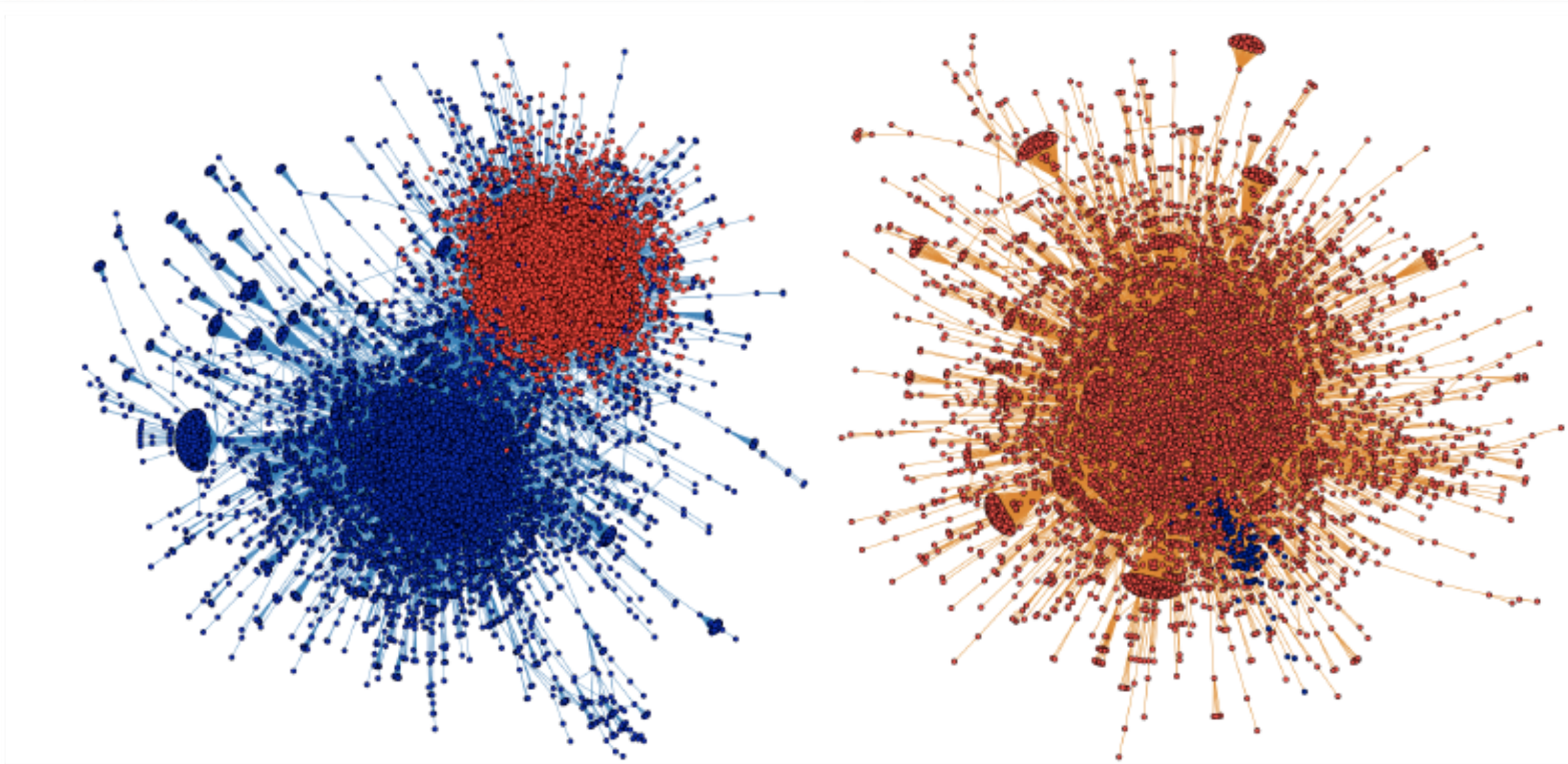
Cook, S., Conrad, C., Fowlkes, A. L., & Mohebbi, M. H. (2011). Assessing Google flu trends performance in the United States during the 2009 influenza virus A (H1N1) pandemic. PloS one, 6, e23610.

Political Views in Twitter

- People with different political biases use different hashtags in tweets (#irishwater, #dontpayforwater)
- 250K Tweets from 2010 US Congress Election
- Political retweets highly segregated, no cross-posting between left- and right-leaning users

Conover, M., Ratkiewicz, J., Francisco, M., Gonçalves, B., Menczer, F., & Flammini, A. (2011, July). Political polarization on twitter. In ICWSM.

Political Polarities



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Sentiment in News

- Words can be classified as positive or negative in their sentiment
- If you look at these over time they can tell you a lot about what people are thinking
- Could be used to predict stock movements

Gerow, A., & Keane, M. T. (2011). Mining the web for the voice of the herd to track stock market bubbles. *IJCAI-11*. AAAI Press.

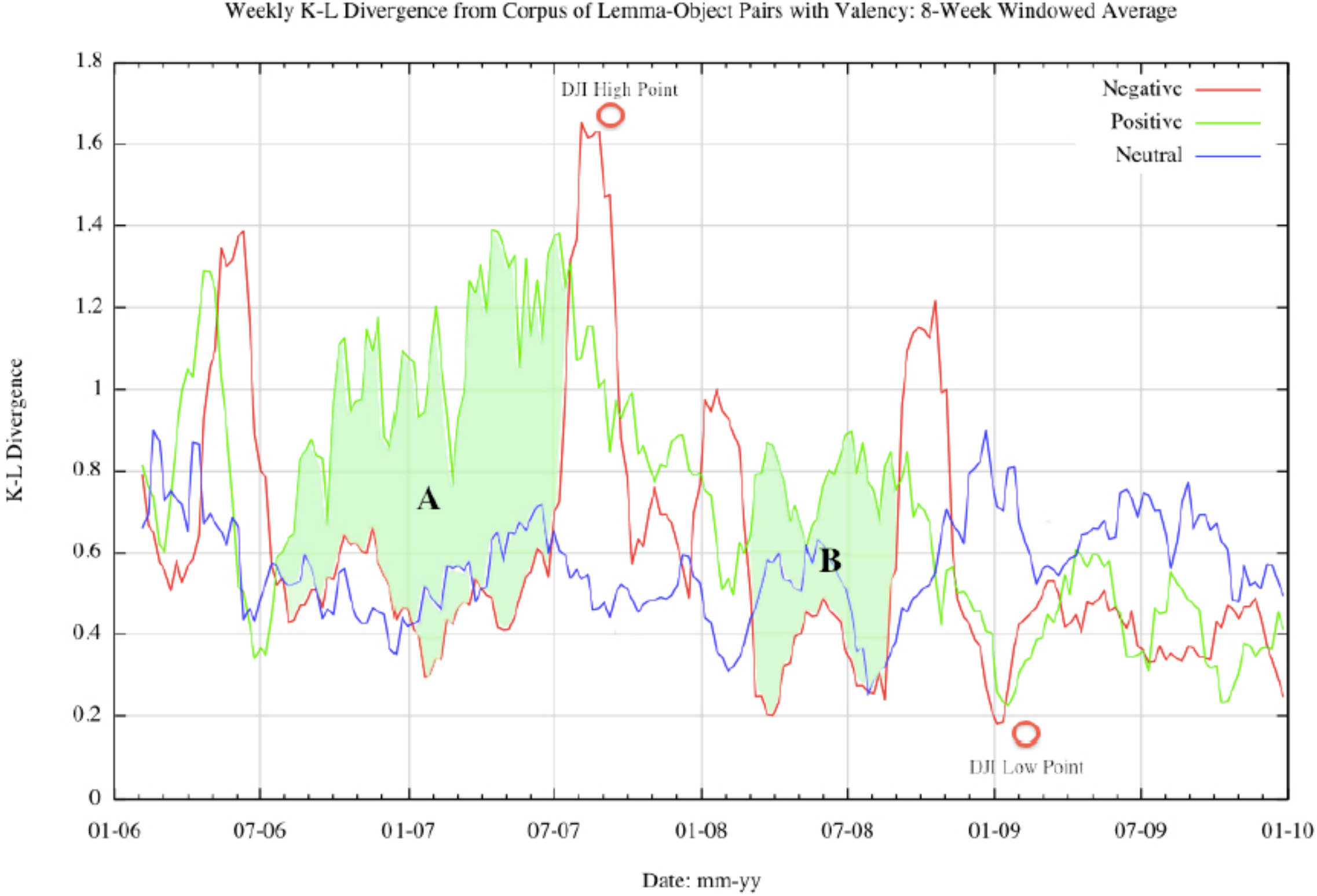
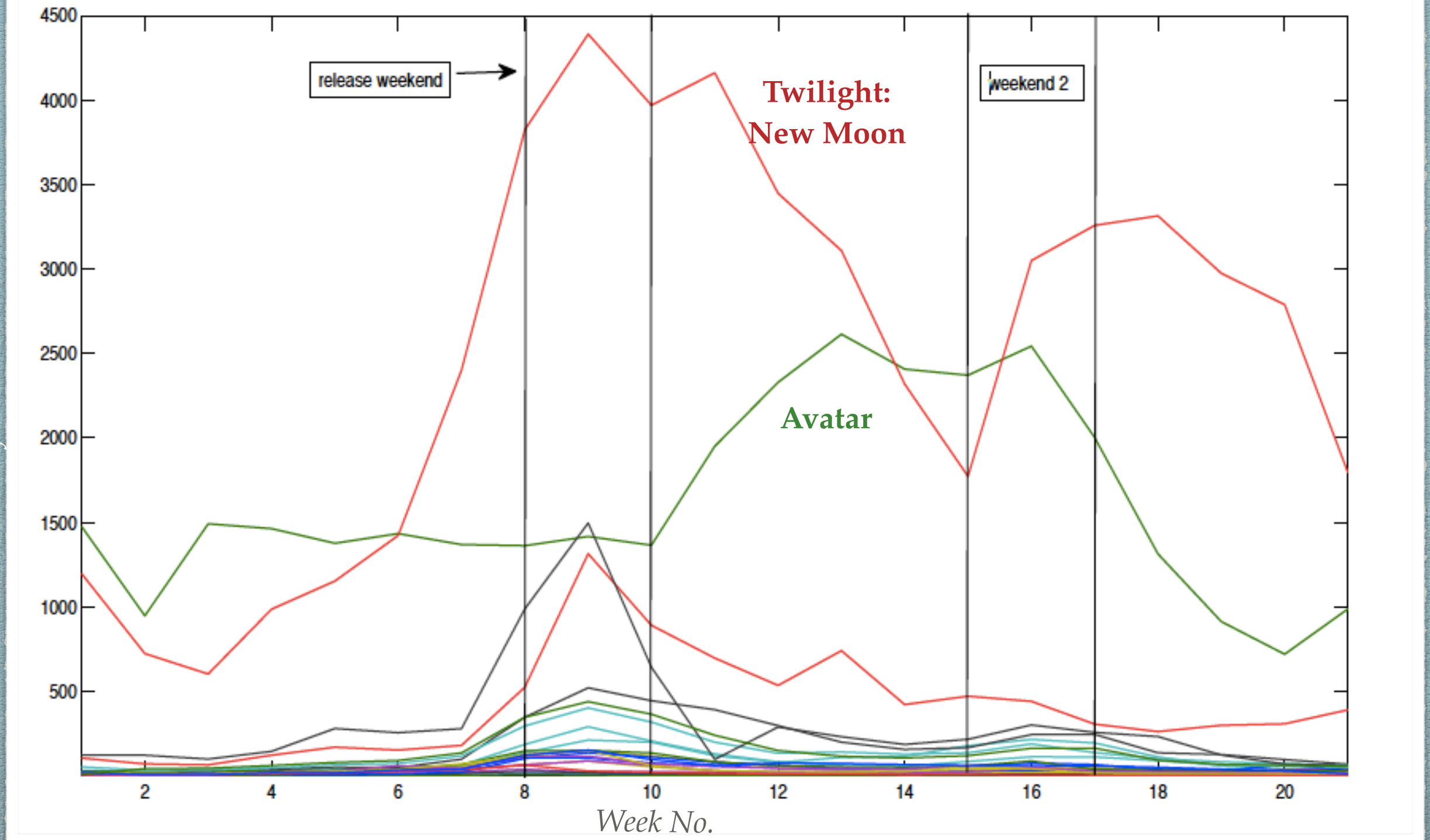


***Figure 2**: Symmetric K-L divergence (8-week windowed mean) of positive, negative, and neutral lemma-object pairs. Note, the two regions, A and B, of distinct positive-negative divergence preceding the 2007 crash and subsequently the beginning of the recovery in 2009.*

Tweet Rate Tracks Attention

- The amount of conversation (in twitter or FB) about something can reflect attention to it, what people are talking about
- This attention can predict movie revenue
- Attention and location can track events

Movies: Shape of Attention



Tweet Rate & Revenue

- The amount of conversation (in twitter or FB) about something can reflect attention to it, what people are talking about
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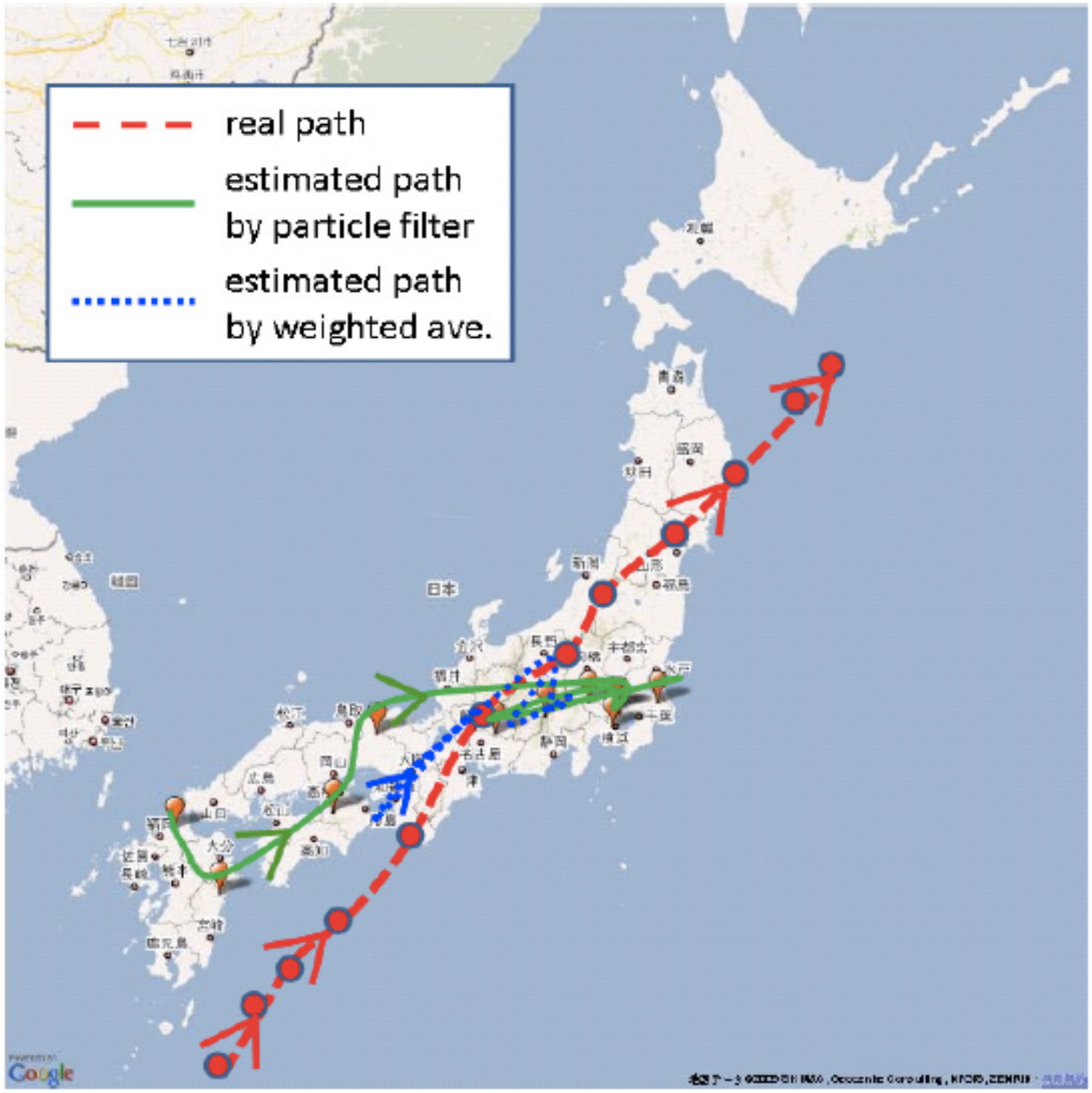

Figure 10: Typhoon trajectory estimation based on tweets.

Part 2:
De Course

Selling Things

stock-markets

social media

science

news

polls

sentiment-id

sentiment-use

time-series

summaries

VSMs

Classifiers

Clustering

cosine

jaccard

dice

levenschtein

TF-IDF

LLR

PMI

Entropy

simple frequencies

pre-processed text items of some sort…

Course Structure

- 12 Weeks of Lectures & Practicals
- Each week 2-hours of lectures, 1-hour practical
- Practical hour is to get advice/help with coursework which you done on your own
- You are expected to **complete** work in your own time; outside of the practical hour

Lectures: 12 Weeks (2 hours)

- Two hours (after the practical on previous week)
- Will explain main techniques cumulatively
- Will give examples from current research papers
- Aim: give you a working knowledge of area; to be able to read most papers and understand them
- Assume no prior knowledge, so you may know some areas already (sleep advised…)

Lectures: Caveats I

- If you have done lots of NLP, this may not be for you but, it could be, if it was just NLP
- If you have done lots of STATS, you may know too much already…but applications may be new
- If you have done a lot of ML, there may not be enough new stuff in this course for you
- If your profile matches, maybe choose another…

Lectures: Caveats II

- Note, this is a developing course, 3nd year, so all descriptions (aims/lectures) are *provisional*
- They may not change a lot, but I reserve the right to modify, as we see how they go
- We may have to make things harder/easier depending on how smart you are…
- If you don't like this uncertainty, choose another…

Lectures: Caveats III

- Course philosophy is, unashamedly, pragmatic: *"I want to text analyse today; how do I do it, what do I use and how do I implement that technique"*
- Less on mathematical/statistical basis for techniques, less on derivations/proofs…
- Sorry, but I am simple soal…sole…soul?
- If this pragmatism does not suit, choose another…

Practicals: 12 Weeks (1 hour)

- One hour practical will precede lecture hours…someone available to answer questions about the practical work; set the week before
- You should use it to clarify any issues problems you have encountered with the practical over the week
- Finish them, in your own time, outside class hours
- Generally, deadline for practicals will be one-week later; submit on moodle day after following week's lecture

Practicals: Wha?

- The practicals will involve a mix of different sorts of activities; programs, problems, puzzles….designed to get practical experience with the techniques
- We will use Excel, R (a bit) and Python in practicals
- NB: I will not be teaching you Python, just using existing programs and packages (nltk)
- Obviously, you can do this, but it is not required to complete the practicals

Assessment

- Assessed on Coursework and Exam
- Coursework (Practicals 10ish): 40%
- Written Exam (2hr, no books) : 60%
- Plagiarism is not tolerated

Coursework

- Coursework is **40%** of total marks
- Coursework made up from **10* weekly** practicals
- Practicals marked on a **pass/fail** basis:
  - **Pass**: all questions answered adequately (≈ 4%)
  - **Fail**: any question answered inadequately (≈ 0%)
- * Unless otherwise advertised during semester.

Begin Rant{

- **Post-Truth World**…No one knows anything and experts are suspect (c.f. climate change)

- **Education Commoditised**…I paid for my degree, where is it?

- **Lets Negotiate this Mark, Mark**…Can appeal procedural defects…but not dislike

}End Rant

Plagiarism

- Two Handouts are given:
  - CSI Plagiarism Procedures
  - UCD Plagiarism Policy & Procedures
- In UCD, plagiarism is not common or accepted; copyier and copyee are both guilty
- Here to learn: cheating on coursework is unfair to others and will undermine your career

Plagiarism & UCD Computer Science

- **Plagiarism is a serious academic offence**
  - [Student Code, section 6.2] or [UCD Registry Plagiarism Policy] or [CS Plagiarism policy and procedures]
- Our staff and demonstrators are **proactive** in looking for possible plagiarism in all submitted work
- Suspected plagiarism is reported to the CS Plagiarism subcommittee for investigation
  - Usually includes an interview with student(s) involved
  - 1st offence: **usually** 0 or NG in the affected components
  - 2nd offence: referred to the **University disciplinary committee**
- Student who enables plagiarism is equally responsible

http://www.ucd.ie/registry/academicsecretariat/docs/plagiarism_po.pdf

http://www.ucd.ie/registry/academicsecretariat/docs/student_code.pdf

http://libguides.ucd.ie/academicintegrity

Part 3:
Tooling Up

This Week

- Establish Your Environment:
  - Install R
  - Install Python and IDLE*
  - Excel (or any spreadsheet app)

* Later we will look at a real IDE

* Consider Anaconda…Jupyter