# Extracting a Repository of Events and Event References from News Clusters

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# What is an Event?

"An event instance is something that happens at a specific time and place“ (Topic Detection and Tracking, 2002)

**Event**


USAir 427 crash
on 08 September 1994
in Pittsburg

**Topic**


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# Information Extraction (IE)

- Identification in text, of specified classes of:
  - Names / Entities
  - Relations
  - **Events**

- Semi-structured text: typical of web pages, includes markup and limited free text (e.q., XML)
- Unstructured text: extended text with little markup, such as news stories.

# How is event extraction done?

- Define Event Templates

ACE: 33 types of events

| Personnel_End-Position |
| --- |
| Event type |
| Subtype |
| Person |
| Organization |
| Position |
| Time-within |

(Jiand Grishman, 2008)

REES: 61 types of events

| Attack_Target |
| --- |
| Event type |
| Subtype |
| Attacker |
| Target |
| Weapon |
| Time |
| Place |
| Comment |

(Aone and Ramos-Santacruz, 2000)

- Hard to scale-up because it is hand-crafted.
- Mostly domain dependent (e.q., biomedical events, infectious disease outbreaks, and violent and natural disaster events).

# Open Domain Event Extraction from Twitter

- TWICAL
  - Apple to *Announce* iPhone 5 on October 4th?! YES!
  - iPhone 5 *announcement* coming Oct 4th
  - WOOOHOO *NEW* IPHONE TODAY! CAN'T WAIT!


4-tuple representation:

| Entity | Event Phrase | Date | Type |
|---|---|---|---|
| Steve Jobs | died | 10/6/11 | DEATH |
| iPhone | announcement | 10/4/11 | PRODUCTLAUNCH |
| GOP | debate | 9/7/11 | POLITICALEVENT |
| Amanda Knox | verdict | 10/3/11 | TRIAL |

(Ritter et al, 2012)

- Huge amount of labeled data requires human effort and labor.

# Examples of events in our repository

Aim: extract unrestricted set of events and all their possible event mentions



Facebook, on Thursday, agreed to buy mobile messaging service WhatsApp for $19 billion,

Social media giant Facebook has just monopolised the messaging market with its whopping $19 billion cash and stock

MENLO PARK, CALIF. – February 19, 2014 – Facebook today announced that it has reached a definitive agreement to acquire WhatsApp, a rapidly growing cross-platform mobile messaging

| Id | Timestamp | Place | Representative | Textual References |
|---|---|---|---|---|
| 1 | 2014-02-19 | Menlo Park | Facebook buy Whatsapp | social media giant Facebook monopolise messaging market |
| | | | | Facebook acquire WhatsApp |
| | | | | social media company purchase WhatsApp |

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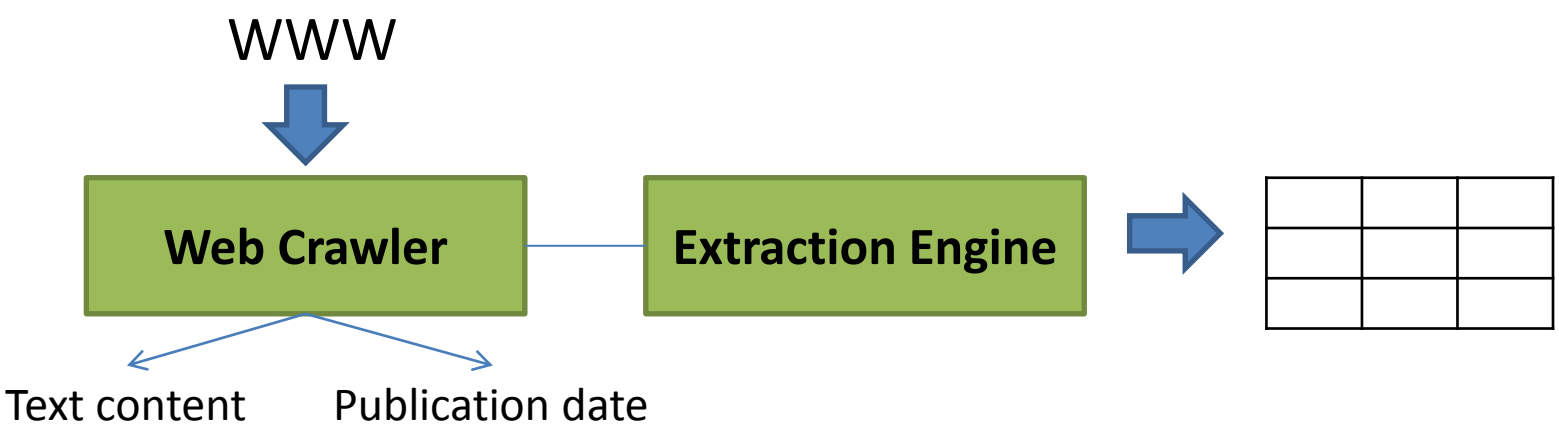
# News Cluster (Google News)

- Each cluster typically represent *one news item*

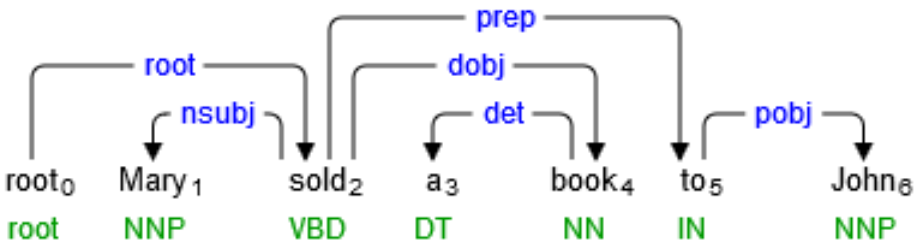



# Temporal Tagger

- Recognize temporal expressions and normalized to a specific points in time.
- Use article's publication date as reference point in which the statement was made.

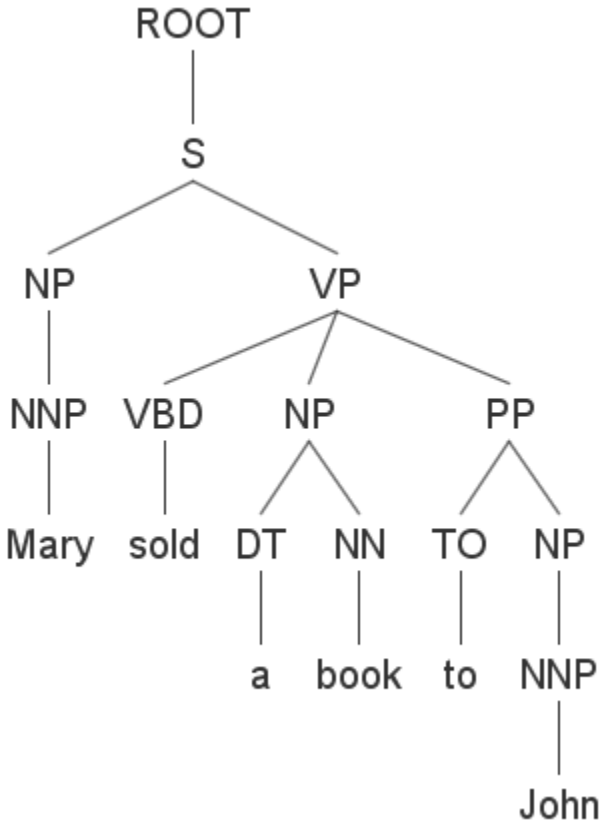
| Expression | Type | Value |
|---|---|---|
| 12 December 1974 | DATE | 1974-12-12 |
| Last Monday | DATE | 2014-02-17 |
| Christmast Eve | DATE | 2014-12-24 |
| Winter of 2014 | DATE | 2014-WI |
| Saturday Morning | TIME | 2014-02-22TMO |
| 7:18 p.m. | TIME | 2014-08-21T19:18 |
| 3 days | DURATION | P3D |
| from 2010 to 2014 | RANGE | 2010/2014 |
| every third Saturday | SET | XXXX-WXX-6 |

## Dependency Parsing




- Easier to understand
- faster
- binds grammaticality to words

## Constituent Parsing



# Semantic Role Labeler (SRL)

- "Who did What to Whom, When and Where?"

Mary sold a book to John in the library yesterday

↓

Mary sold a book to John in the library yesterday

**ARG0** **ARG1** **ARG2** **ARGM-LOC** **ARGM-TMP**

↓

**Predicate**: sell

**Roles**:

ARG0: Seller

ARG1: thing sold

ARG2: instrument/buyer

ARGM-LOC: location modifier

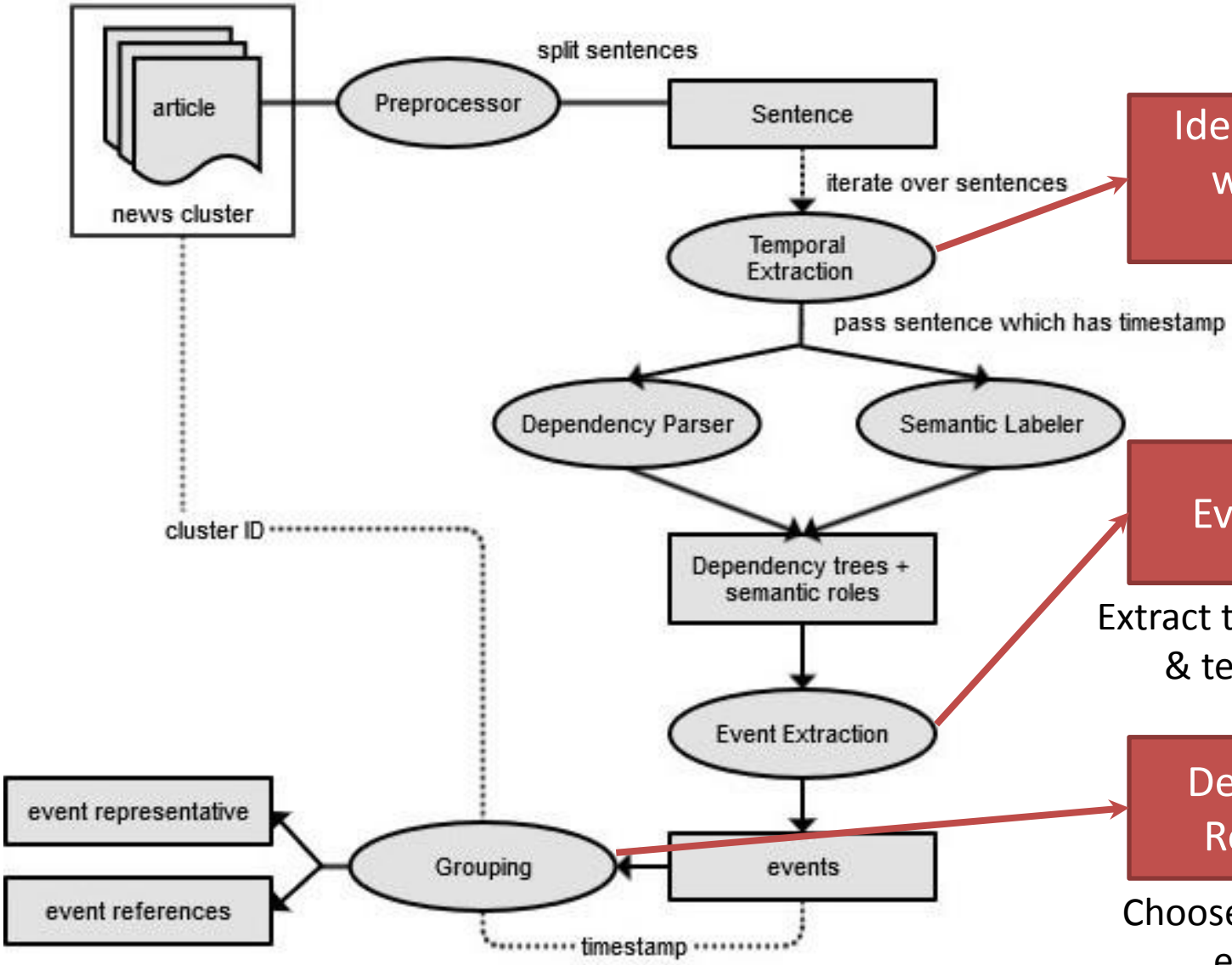
ARGM-TMP: temporal modifier

# Main Hypothesis

**Hypothesis: "same cluster + same timestamp = same event"**

| Timestamp | Sentences |
|---|---|
| 2014-02-19 | Facebook inked a deal **late Wednesday** to buy popular texting service WhatsApp |
| | **Yesterday**, Facebook Chief Executive Officer Mark Zuckerberg bought their five-year-old company. |
| | **19 February 2014** Facebook Inc will buy fast-growing mobile-messaging startup WhatsApp. |
| 2014-07-17 | Malaysia Airlines flight MH17 went down over Ukraine shortly **after 2 PM**. |
| | MH17, flying from Amsterdam to Kuala Lumpur **today**, was shot down over Eastern Ukraine. |
| | Malaysia Airlines MH17 carrying 298 on board crashed in eastern Ukraine **July 17, 2014**. |

# Overall Framework




Identify sentences with temporal expressions

Choose unit "day" as the granularity

Event Extraction

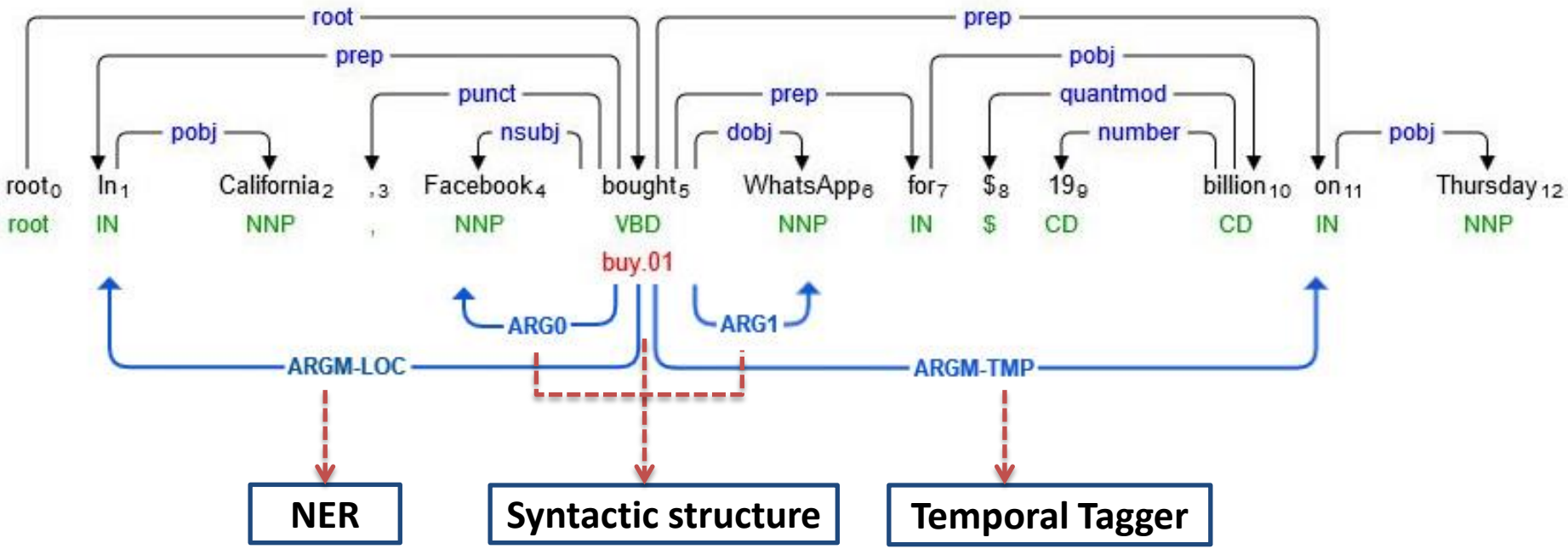
Extract timestamp, location & textual reference

Determine Event Representative

Choose the most frequent event reference

# Event Extraction

- Top arcs: typed dependencies (nsubj, dobj, prep,..)
- Bottom arcs: semantic roles (ARG0, ARG1, ARGM-TMP, ARGM-LOC)




(California) (Facebook buy WhatsApp) (2014-02-19)

# Temporal Extraction

- Eliminate Ambiguous Temporal Expression

| Expression | Value |
|---|---|
| **A few months ago** | 2014-05-20 |
| **A few years ago** | 2013-06-20 |
| day and **night** | 2014-06-20TNI |
| man's **last minute** will | 2014-06-19TXX |
| **the same day** that Facebook celebrated | 2014-06-20 |

- Using tenses of the verb

Given a reference date of "2014-02-23", a *Monday,*

"Wednesday" → last Wednesday or next Wednesday?

"Facebook bought ... on Wednesday"

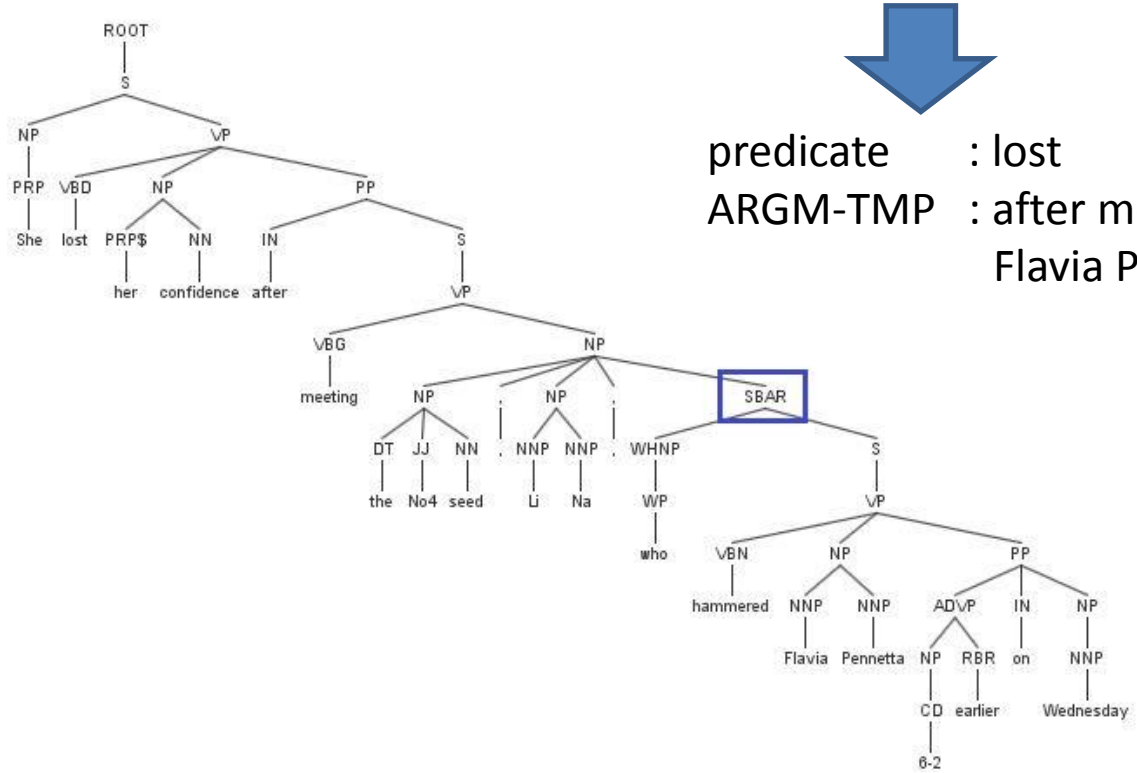
VBD
(verb, past tense)

→ last Wednesday → **2014-02-19**

# Temporal Extraction (Cont)

- Using dependent clause
  - ARGM-TMP argument is a dependent clause (contain subject and predicate)

"She **lost** her confidence after meeting Li Na, who hammered Flavia Pennetta 6-2 on Wednesday

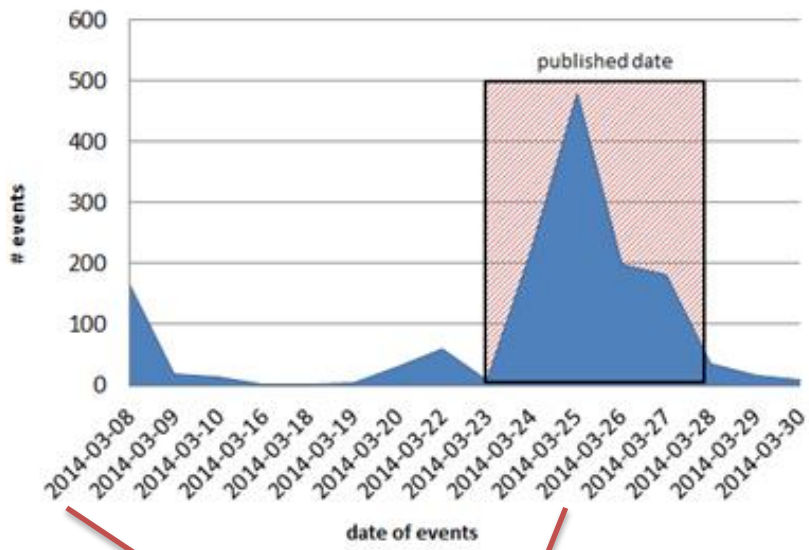



predicate : lost
ARGM-TMP : after meeting Li Na, who **hammered** Flavia Pennetta 6-2 on **Wednesday**

"lost" : Main clause
"Wednesday" : SBAR

**removed!**

# Preliminary Inspection of Result




**Hypothesis**
**"same cluster + same timestamp = same event"**
**fails in some cases!**

| Cluster ID | Timestamp | Textual Reference |
|---|---|---|
| 43988874 | 2014-03-08 | Malaysian Flight MH370 lose contact |
| | : | |
| | 2014-03-27 | Thailand spot 300 floating objects |
| | | Thaichote satellite acquire imagery of flotsam |
| | | Thai satellite detect 300 objects floating |
| | | Bangladesh join international search operations |

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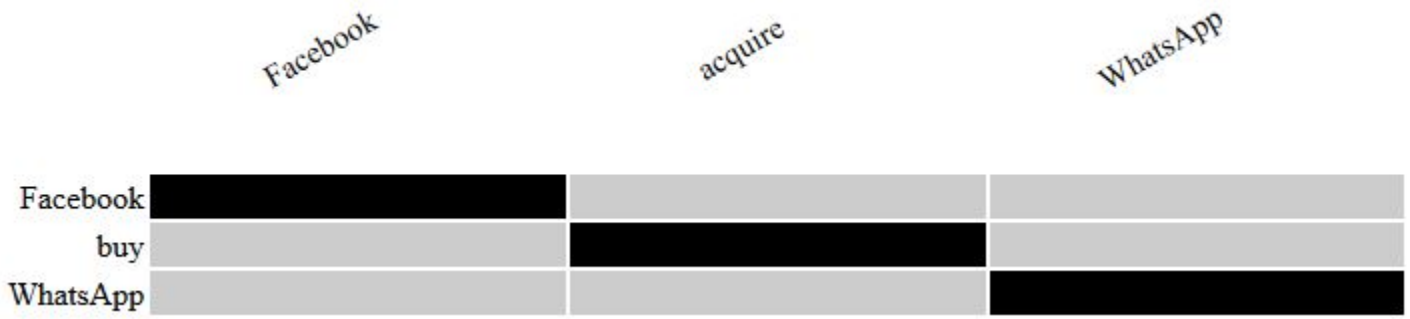
# Improving Event Quality

- Time Window Filter
  - Filter out events occur within 2 days of the article's publishing date.

- Word Alignment Condition
  - determine the "similarity" of two event references.




(Yao et al., 2013)

2014-02-19

Facebook buy mobile messaging service
Facebook acquire Whatsapp
Facebook ink deal

venture capital firm hit 3 billion
jackpot company IPO hit jackpot

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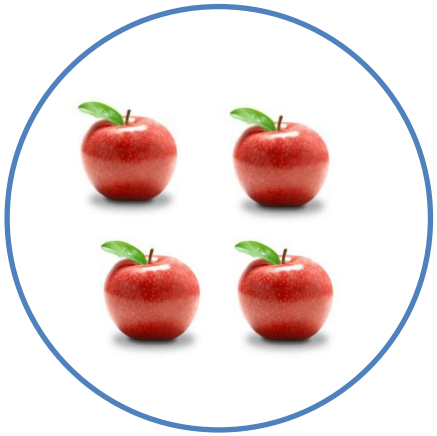
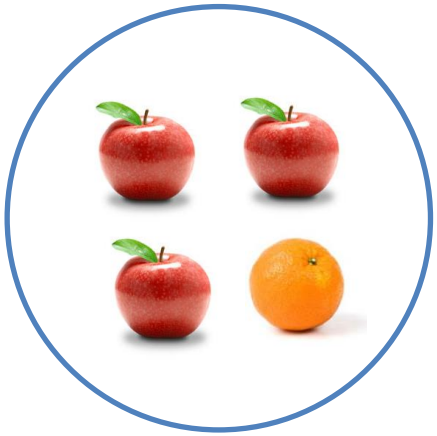
# Evaluation Metrics

- Precision: fraction of extracted event references that are correct.
- Recall: fraction of correct event references that are extracted.
- Purity: fraction of the biggest group of event references per detected event that refer to the same actual event.



Purity = 1.0



Purity = 3/4
= 0.75

# Evaluation Method

- Evaluated in 4 setups on a sample of 40 news clusters with an average size of 300 news articles
  - BASE : Only the "same cluster + same timestamp = same event" hypothesis.
  - TIME: BASE + the time window filter.
  - ALIGN: BASE + the word alignment condition.
  - ALL: BASE + the time window filter and the word alignment condition.

# Precision and Purity

| Method | Total Events References | Correct Events References | Precision of Event References | Event Purity |
|---|---|---|---|---|
| BASE | **2052** | 1711 | 0.834 | **0.798** |
| TIME | **339** | 274 | 0.808 | 0.788 |
| ALIGN | 2052 | 1793 | 0.874 | **0.917** |
| ALL | 339 | 277 | 0.817 | 0.893 |

- Hypothesis produces promising results with a precision of 0.84.
- Time Window Filter provides no significant contribution but greatly reduces number of extracted events references.
- Word Alignment Condition increase both precision and purity significantly.

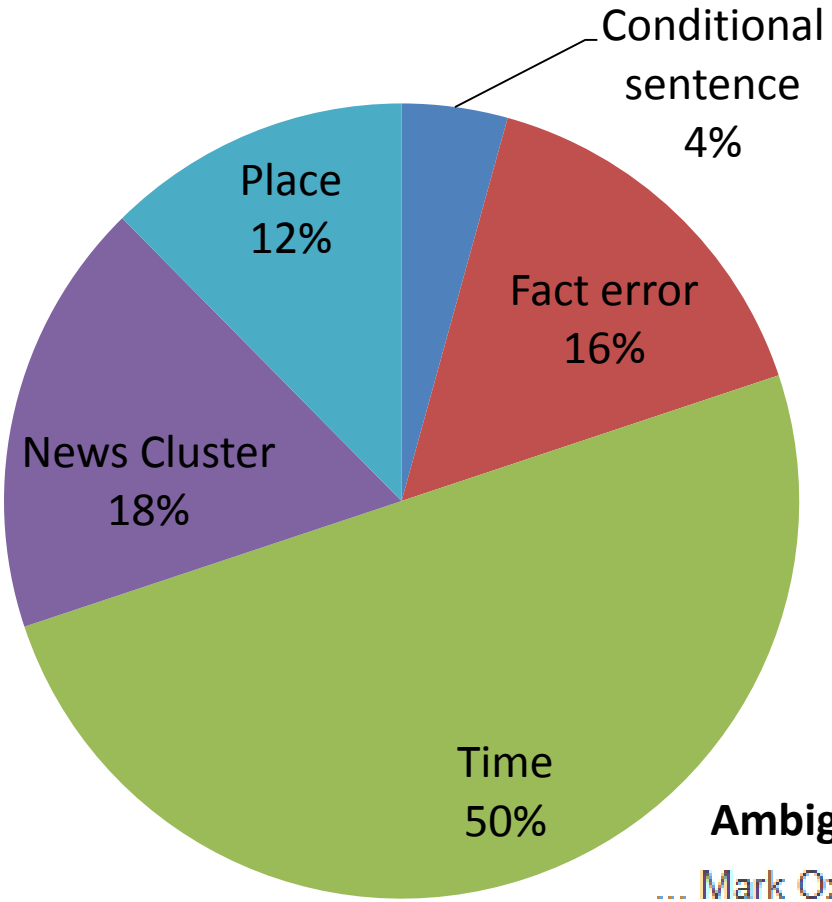
# Recall

- Evaluated on 202 news articles by obtaining all sentences that contain temporal expressions.
- 446 manually extracted events, a total of 229 events were found by our system.

| | # Events | Percent |
|---|---|---|
| Noun phrase | 21 | 4.72 % |
| Coreference | 37 | 8.29 % |
| Common predicate | 77 | 17.27 % |
| Insufficient semantic roles | 82 | 18.38 % |
| **True positives** | **229** | **51.34 %** |

# Error Analysis

## Source of Errors




**If construction:**

win against the Dutch that there "will be a war" if Argentina beats Germany on July 13.

**Incorrect time mention:**

NEW DELHI: Facebook, on Thursday, agreed to buy mobile messaging service WhatsApp for $19

Facebook announced the purchase of the mobile messaging WhatsApp on Wednesday, in a $19bn deal that represents

**Ambiguous temporal expression:**

... Mark Oxley vowed to beat Andy Goram's goal-scoring record this season after his comical strike scuppered Livingston 2-1 at Easter Road.

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# Result Presentation

- Top 3 events for each day based on their frequency

« January 2014 »

| Mon | Tue | Wed | Thu | Fri |
|---|---|---|---|---|
| 20<br>Tehran shut its most sensitive nuclear work<br>bombing kill 28 people<br>Japanese government spokesman defend annual dolphin hunt<br>see more | 21<br>Japanese fishermen kill 30 dolphins<br>Oklahoma City Thunder beat Trail Blazers 105-97<br>Royal Caribbean ship depart Cape Liberty<br>see more | 22<br>Shiite Muslims protest action to stop violence<br>Chief Minister Balochistan visit Alamdar Road<br>Boston beat Washington 113-111<br>see more | 23<br>Woodbury unveil new details of Diagon Alley<br>Vincent Asaro plead not guilty<br>Anaheim Duck beat Los Angeles Kings 2-1<br>see more | 24<br>Google Inc suffer service outage<br>Pope Francis receive Hollande<br>London Stock Exchange list Cairn Energy PLC<br>see more |

# Summary

- Generate 24.808 events from 205 news cluster with 71.493 articles.

- Contributions:
  - A novel approach for automatically mining events and event references from news clusters.
  - Develop algorithm for extracting open-domain events using Open IE techniques.
  - Present the result in a repository as resource to gain a comprehensive overview of world events and also serve as a resource for event-linking efforts in future IE research.

# Publication

- Paper accepted at AHA! Workshop on Information Discovery in Text.

**Extracting a Repository of Events and Event References from News Clusters**


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- Oral and poster presentation at Coling Conference 2014 in Dublin, 23 August 2014.

aha! of course is A (a) workshop.

Coling
Dublin | 2014
23-29 August

# Future Work

- Adding Coreferences Resolution.
- Improving the event representation (e.q., n-ary relations, noun-phrase events).
- Merge events across news cluster (e.q., election) .
- Exploring other tools or resources for the underlying components.

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