Forecasting Protests by Detecting Future Time Mentions in News and Social Media

Sathappan Muthiah

Virginia Tech

July 2nd, 2014

Table of Contents

Table of Contents

Problem Overview

- Detecting Future time mentions in relevant media to build a protest forecasting system
- Investigate the selective superiorities of different social media

Motivation

- Around 75% of the protests are planned, organized, or announced in advance
- Identifying these planned protests is an easy way to forecast protests

Key Contributions

- Real-Time Prospective Study - most studies until now have been retrospective
- Semi-Automatic approach for learning keyphrase filters
- Handling mutliple sources
- Reasoning about locations
- Handling relative dates - some recent work use only absolute dates

Overall Framework

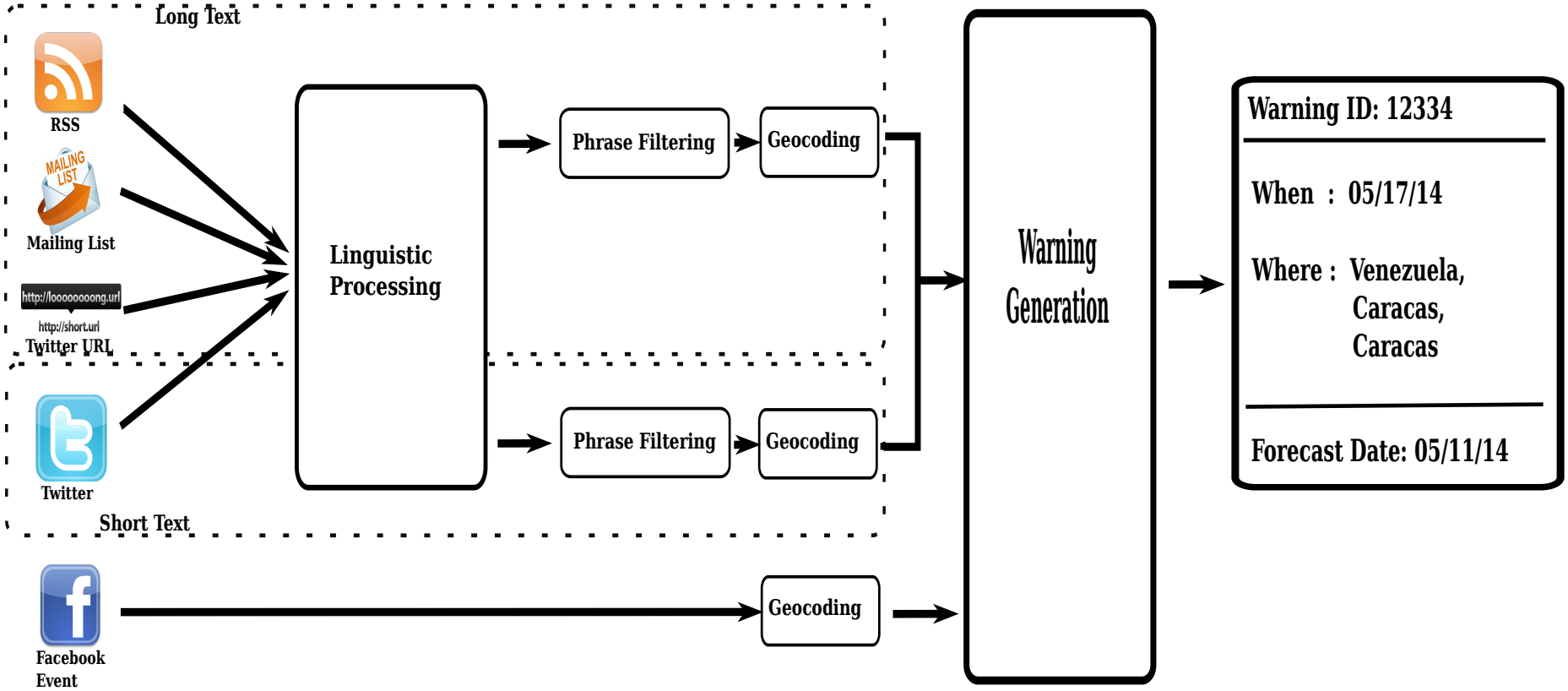


Table of Contents

Data Sources

- Long Text
  - RSS Feeds
    - News
    - Blogs
  - Twitter-URL
- Short Text
  - Twitter
- Facebook-Event

Long Text - RSS Feeds

- A total of 9498 different RSS feeds are ingest - 6236 news sources and 3262 blogs
- Duration: November 2012 to present
- List of news sources to ingest were obtained from Wikipedia,`www.onlinenewspapers.com`, LANIC, etc
- List of blogs were obtained from blog search engines like `www.technorati.com`
- Google/Talkwalker Alerts - Alerts for phrases in our keyphrase dictionary

Long Text - Example


```
author': u'Daniele Persegani*',
 'author_detail': {'name': 'Daniele Persegani*'},
 'authors': [{}],
 'content': 'STJ: rceitas decorrentes da venda de im\xf3veis comp\xf5em PIS e Cofin .....
                    .....".
'date': '2014-03-31T09:42:43',
 'embersId': '4b0f1d0950fe15d89e9930822a1d9f677c36340f',
 'embersLang': 'und',
 'feed': 'rss-content-enriched',
 'feedPath': [['rss-entries'], 'rss-content'],
 'guidislink': False,
 'id': 'http://www.jb.com.br/sociedade-aberta/noticias/2014/03/31/stj-receitas-.....'
 'link': 'http://www.jb.com.br/sociedade-aberta/noticias/2014/03/31/stj-receitasca.....',
 'links': [{'href': u'http://www.jb.com.br/sociedade-aberta/noticias/2014/03/31/stj.....',
            'rel': 'alternate',
            'type': 'text/html'}],
 'parentId': 'dae1d03d5407f1ac0e16ae5c7cc21d10357ac875',
 'published': 'Mon, 31 Mar 2014 06:42:43 -0300',
 'tags': [{'label': None, 'scheme': None, 'term': 'Sociedade Aberta'}],
 'title': 'STJ: receitas decorrentes da venda de im\xf3veis comp\xf5em PIS e Cofins',
 'title_detail': {'base': 'http://www.jb.com.br/sociedade-aberta/noticias/rss.xml',
                  'language': None,
                  'type': 'text/plain',
                  'value': 'STJ: receitas decorrentes da venda de im\xf3veis comp\xf5em..'},
 'url': 'http://www.jb.com.br/sociedade-aberta/noticias/2014/03/31/stj-receitas-decor...',
 'url_location': {'city': '', 'country': 'Brazil', 'state': ''}
```

Short Text - Twitter

- Datasift Firehose
- Duration: November 2012 to present
- URL's mentioned in a tweet are fetched and used as a separate source (alongwith RSS feeds).

Facebook

- Facebook Graph API - Query for Facebook Events that contain a particular keyword
- Facebook Query Language (FQL) - Obtain extra information of an Event-Id obtained by searching through Graph API

Table of Contents

Preliminaries-Probabilistic Soft Logic

- Framework for collective probabilistic reasoning in relational domains
- Uses first order logic rules as a template language for graphical models
- Soft truth values
- Applications in collective classification, ontology alignment,opinion diffusion, graph summarization etc
- A simple PSL rule:

$$0.3 : friend(B, A) \wedge votesFor(A, P) \rightarrow votesFor(B, P)$$
$$0.8 : spouse(B, A) \wedge votesFor(A, P) \rightarrow votesFor(B, P)$$

PSL MPE Inference

- Lukasiewicz t-norm is used to determine the degree to which a ground rule is satisfied
- Most Probable Explanation or Inference (MPE): Inferring the most likely values for a proposition given values of remaining propositions

$$f(I) = \frac{1}{Z}\exp[-\sum_{r \in R} \lambda_r (d_r(I))^p]$$

- Here, I is an interpretation of the proposition,
  λ_r is the weight of the rule,
  $d_r(I)$ is the distance to satisfaction of the rule (degree to which the condition/rule is violated)

Table of Contents

Natural Language Enrichment

- Tokenization
- Lemmatization
- Noun Phrase Extraction
- Named Entity Extraction and Classification

Basis RLP


```
"BasisEnrichment":
{
  "language": "Spanish",
  "errorMessage": "",
  "enrichmentProcess": "RLP Java API v7.9.100"

  "nounPhrases": [{"expr": "Convocatoria", "offset":
"0:1"},
                  {"expr": "Tercer Marcha de la
Dignidad Nacional http",  "offset": "2:9"},
                   .....
                  ],
  "tokens": [{"lemma": "convocatoria", "POS":
"NOUNSG", "value": "Convocatoria"},
              {"lemma": ":", "POS": "PUNCT",
"value": ":"},
               .....
               .....
             ],
  "entities": [{"expr": "Dignidad Nacional",
"neType": "ORGANIZATION", "offset": "6:8"},
              {"expr": "http://t.co/qsCggp8Zv4",
"neType": "IDENTIFIER:URL", "offset": "8:15"},
               .....
               {"expr": "http://t.co/rAI9epu5NX",
"neType": "IDENTIFIER:URL", "offset": "15:22"}
            ],
  "langSource": "Basis-RLI"
}
```

TIMEN Enrichment

- Extraction of Absolute Dates from text
- Identification of Relative dates like ‘yesterday, next wednesday’ etc

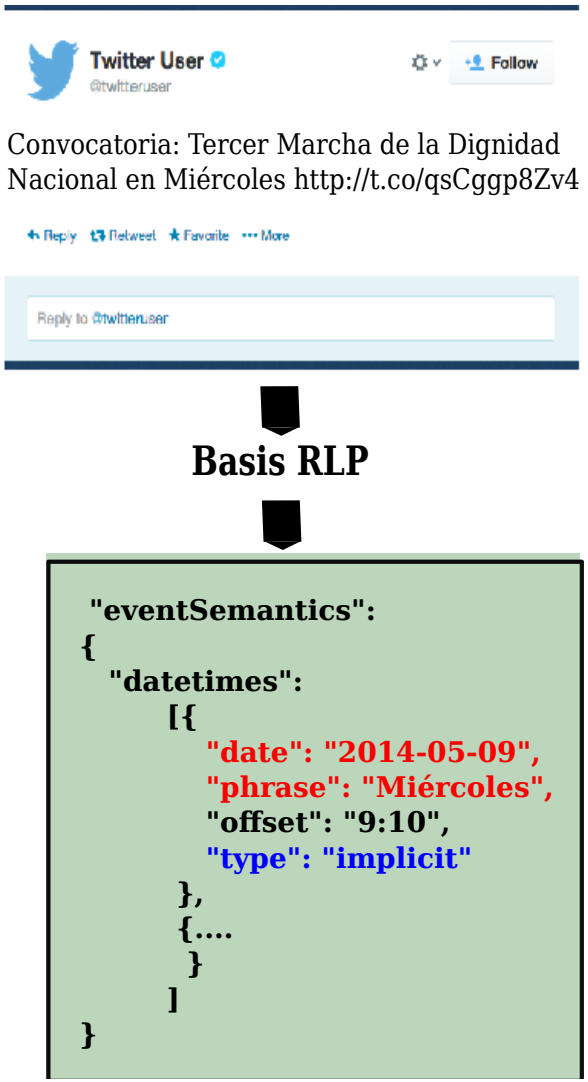


Table of Contents

Geocoding - RSS Feeds

Que la calle no calle
A pesar de que el Gobierno insiste en promulgar la paz la concentración de ayer terminó con gases lacrimógenos. La GN volvió a salirse con las suyas y haciendo usos de las ballenas reprimieron otra manifestación pacífica, sin embargo, los estudiantes no se dan por vencidos y anunciaron que marcharán el domingo

La concentración convocada por el movimiento estudiantil en Caracas no culminó pacíficamente. Aunque desde las 11 de la mañana hasta las 2 de la tarde todo transcurrió con normalidad, a eso de las 2:30 pm, cuando la mayoría de los que se encontraban en la avenida Venezuela de El Rosal se disponían a irse, otros decidieron trasladarse hasta la autopista Francisco Fajardo para trancarla.

Fue en ese momento cuando efectivos de la Guardia Nacional accionaron sus bombas lacrimógenas contra los manifestantes para impedir que realizaran la toma.

Después la arremetida, a través de su cuenta twitter Juan Requesens, presidente de la Federación de Centros de Estudiantes de la Universidad Central de Venezuela (FCU-UCV) criticó que se hable de paz y luego se utilicen acciones violentas por parte de las fuerzas de seguridad: "Hablan de paz y después que los estudiantes nos concentramos pacíficamente gritando Ni un muerto más, nos lanzan bombas lacrimógenas".

El alcalde de Baruta, Gerardo Blyde, consider{o que fue "excesiva" la represión de la GN hacia los manifestantes en Las Mercedes. Pasadas las 4 de la tarde la arremetida contra los jóvenes continuó, esta vez desde la Plaza Altamira en Chacao.

El próximo domingo los universitarios esperan mantener la actividad de calle. Es por ello que convocaron a una marcha en la capital, donde esperan congregar a ciudadanos de todos los sectores que saldrán desde distintos puntos a la Plaza Brión, en Chacaito.

En las próximas horas deben confirmar ruta. "No nos arrodillamos seguiremos exigiendo justicia, igualdad y paz. Luchamos con el pueblo por sus derechos", Escribió Requesens.

{"admin1": "Caracas",
"city": "Caracas",
"country": "Venezuela",
"confidence": 0.42186905915279704}

{"admin1": "Miranda",
"city": "Baruta",
, "country": "Venezuela",
"confidence": 0.2639358965025394}

{"admin1" : "Ciego de Ávila",
"city" : "Venezuela",
"country" : "Cuba",
"confidence": 0.05116227467273876}

{"admin1": "Miranda",
"city": "Chacao",
, "country": "Venezuela",
"confidence": 0.2639358610172565}

{"admin1": "Cundinamarca",
"city": "El Rosal",
, "country": "Colombia",
"confidence": 0.0011984789871345436}

Admin1 : Caracas
City : Caracas
Country : Venezuela
Confidence : 0.42186905915279704

Geocoding - RSS Feeds (contd...)

- Primary rules

$$ENTITY(L, location) \tilde{\wedge} REFERSTO(L, locID) \rightarrow PSLLOCATION(Article, locID)$$

$$ENTITY(C, location) \tilde{\wedge} IsCountry(C) \rightarrow ArticleCountry(Article, C)$$

$$ENTITY(S, location) \tilde{\wedge} IsState(S) \rightarrow ArticleState(Article, S)$$

Geocoding - RSS Feeds (contd...)

- Secondary rules

$$ENTITY(O, organization) \tilde{\wedge} REFERSTO(O, locID) \rightarrow PSLLOCATION(Article, locID)$$

$$ENTITY(O, organization) \tilde{\wedge} IsCountry(O) \rightarrow ArticleCountry(Article, O)$$

$$ENTITY(O, organization) \tilde{\wedge} IsState(O) \rightarrow ArticleState(Article, O)$$

Geocoding - Twitter

- Geotag of the tweet
- Twitter "places" metadata
- Other text fields (user profile, tweet text)

Geocoding - Facebook

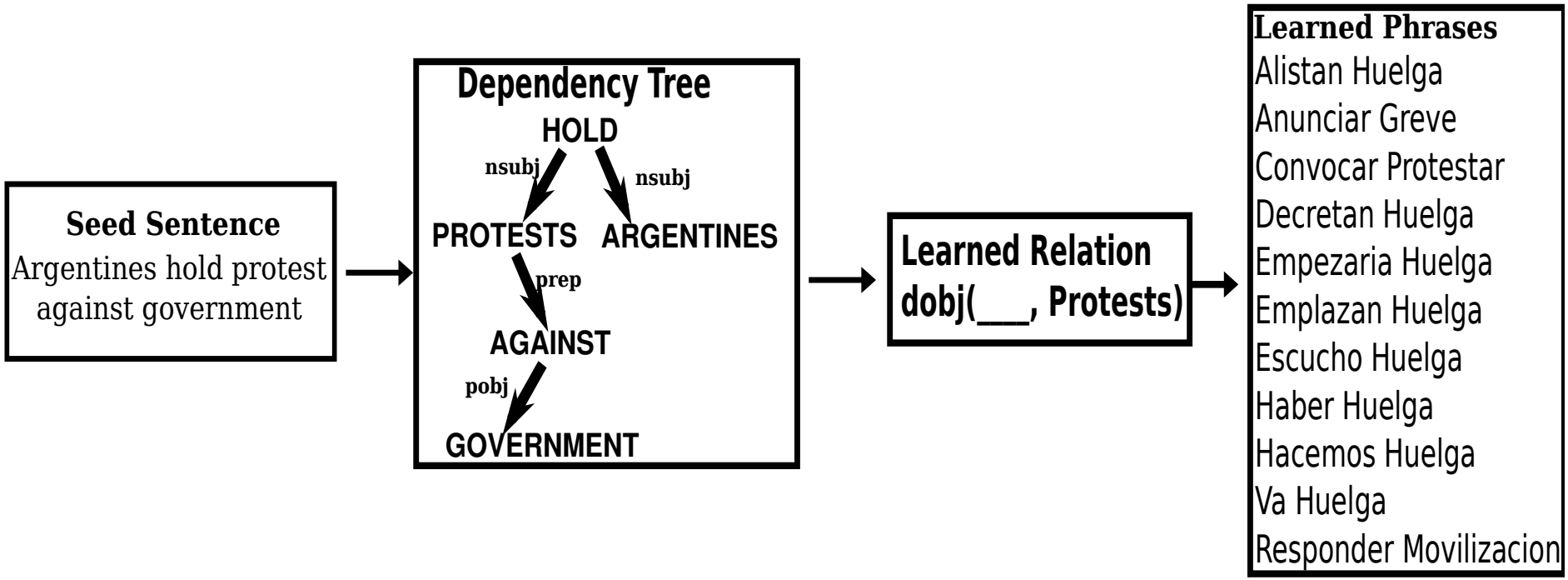
- Facebook Locations - similar to twitter places
- Facebook Event Venue tag
- Nearest geocoded point search using KD-Tree algorithm

Table of Contents

Phrase List Development

- Semi-Automatic
- Different Lists are built for different Sources
- Seed phrases are identified from analysis of known planned events from print media.

Dependency Parsing



Phrase List for Long Text

ANUNCIAR GREVE
COMEÇAR GREVE
OUVIR GREVE
TEM GREVE
GREVE IR PASSAR
PREPARAÇÃO DE GREVE
ANUNCIAR MOBILIZAÇÃO
ANUNCIAR MOBILIZAÇÃO
PRÓXIMO MOBILIZAÇÃO
FAZER MOBILIZAÇÃO
MANHÃ DE MOBILIZAÇÃO
RADICALIZAR PROTESTAR
IR PARA ESSE MOBILIZAÇÃO
FAZER MOBILIZAÇÃO
VOSOTROS MANIFESTANTE SE REUNIRAM
CAMINHAR POR O RUA
ACOMPANHAR O PROTESTO
PROTESTARAM CONTRA
PROTESTO EM O BRASIL

ORGANIZE DEMONSTRATION
ORGANIZE PROTEST
ORGANIZE STRIKE
ORGANIZE WORK STOPPAGE
PLAN MARCH
PLAN MARCH
PLAN PROTEST
PLAN STRIKE

CONVOCAN HUELGA
DECRETAN HUELGA
EMPEZARIA HUELGA
PREPARANDO HUELGA
ALISTAN MOVILIZACIONES
INVITANDO MOVLIZACION
PROXIMO MOVLIZACION
MOVILIZACION MANANA
MOVILIZACION SABER
VAN A HUELGA
CONVOCAR PROTESTA
CONVOCAR HUELGA

Phrase List for Short text

MARCHAR	ANNOUNCE MOBILIZATION
GO PROTEST	JOIN MOVEMENT
PROTESTA	MOVILIZACIÓN
MARCHARAN	UNETE PROTESTA
RESPONDER MOVILIZACION	VENIR PROTESTA
MOVILIZACION MANANA	PROTESTAR
MOVILIZACION SABER	VAMOS PROTESTAR
ANUNCIAR PARO	PROTESTANDO CITO
CONFIRMAN PARO	MARCHAN CITO
INFILTREN PARO	PROTESTAR VER
HUELGA	INVITANDO MOVLIZACION
HABER HUELGA	PARTICIPAR MOVILIZACION
HACEMOS HUELGA	PROXIMO MOVLIZACION
VA HUELGA	REALIZAR MOVILIZACION
	RESPONDER MOVILIZACION

Phrase Matching

- Sample phrase matching rule:


```
{"dist": 5, "language": "English", "ignoreHash": true, "text": "plan protest",
"tokens": [{"form": "lemma", "neType": "any", "POS": "NOUN", "value":
"plan", "lemma": "plan", "mode": "any"}, {"form": "lemma", "neType":
"any", "POS": "NOUN", "value": "protest", "lemma": "protest", "mode":
"any"}], "key": "plan protest"}
```


- Linguistically sophisticated and flexible matching
- Near regex style matching
- Example matched sentence: *"The students are planning a couple of big protests tomorrow"*

System Framework Once again

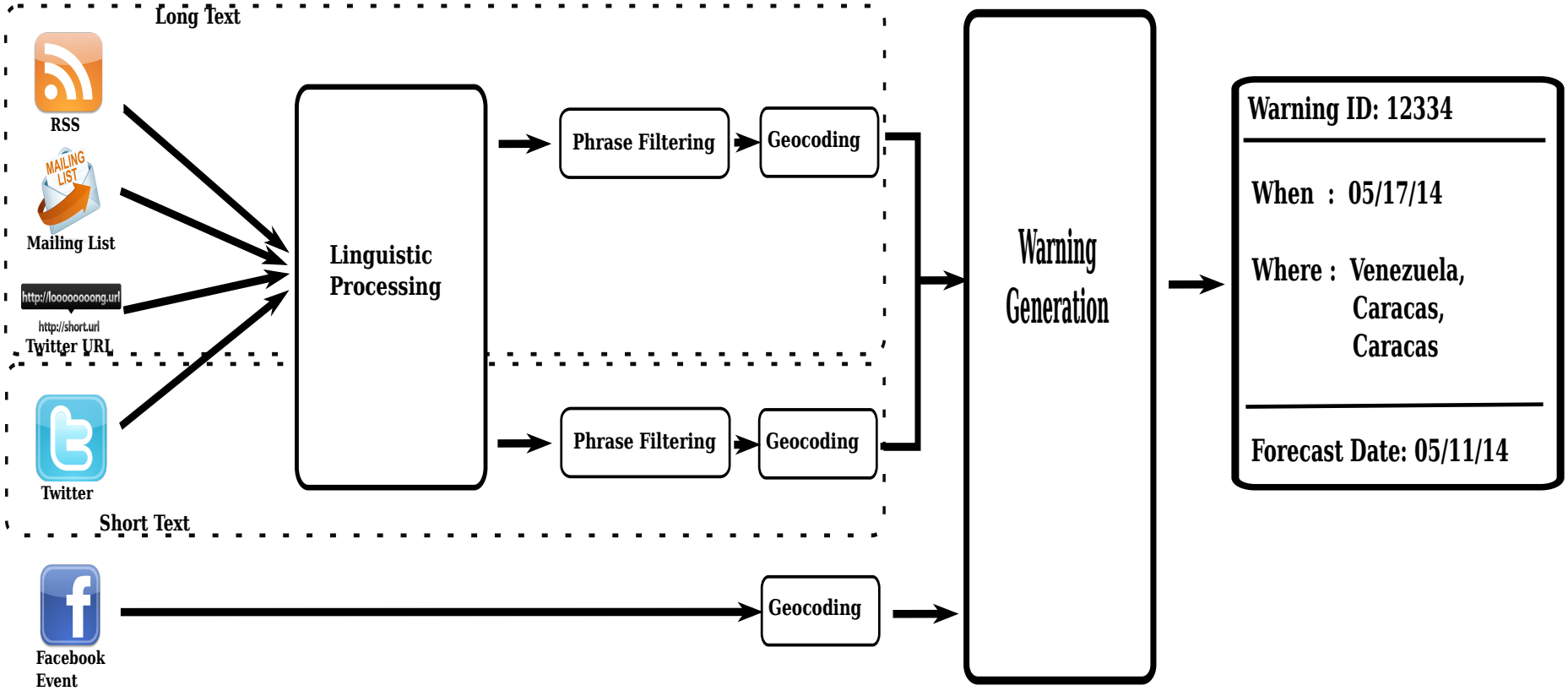
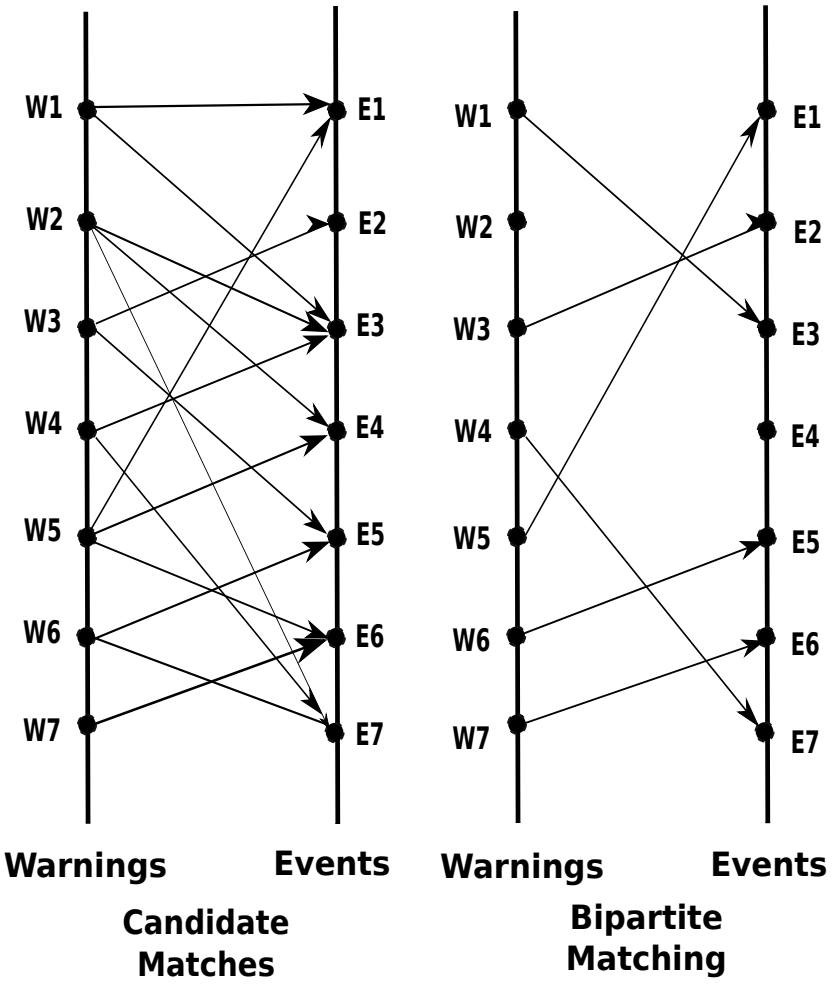


Table of Contents

Evaluation Methodology

- Bipartite Matching



Evaluation Methodology (contd ...)

- Location Score

$$\text{LS} = 1 - \frac{\min(\text{distance offset}, 300)}{300}$$

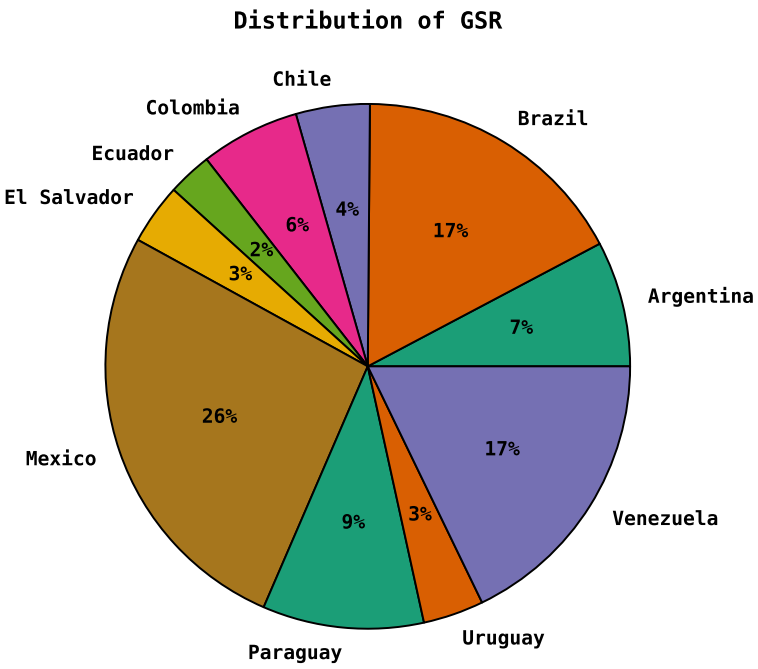
- Date Score

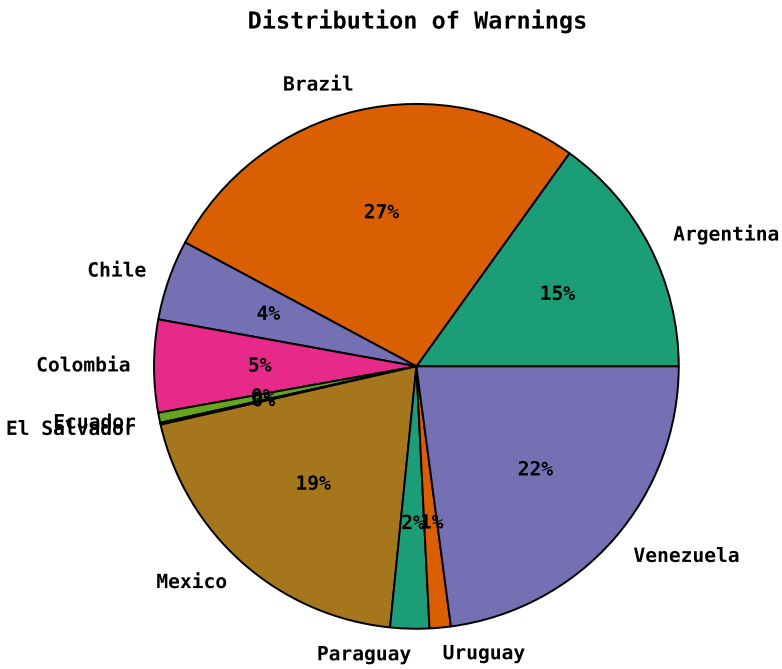
$$\text{DS} = 1 - \frac{\min(\text{date offset}, \text{INTERVAL})}{\text{INTERVAL}}$$

- Total Quality Score

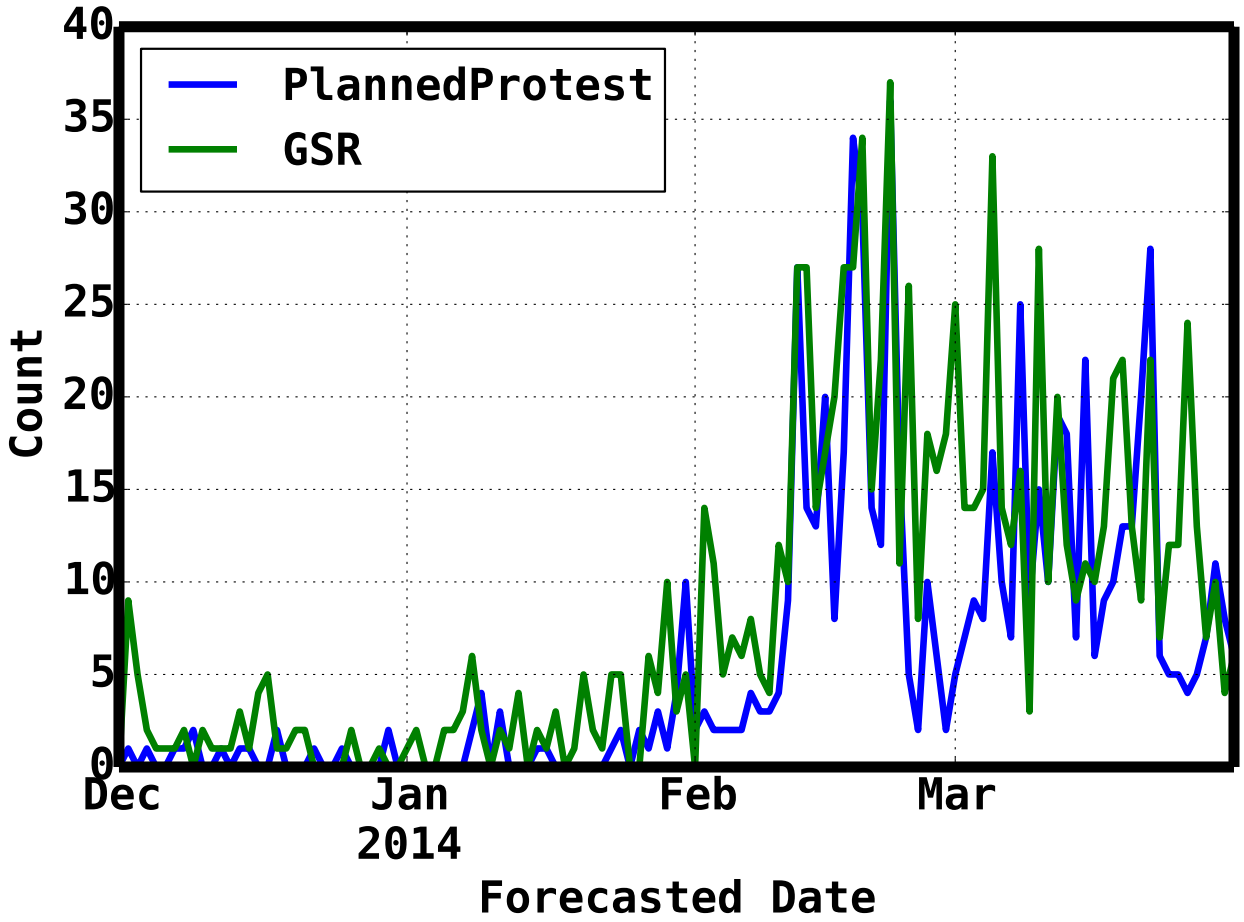
$$\text{QS} = (\text{DS} + \text{LS}) * 2$$

Warnings vs GSR

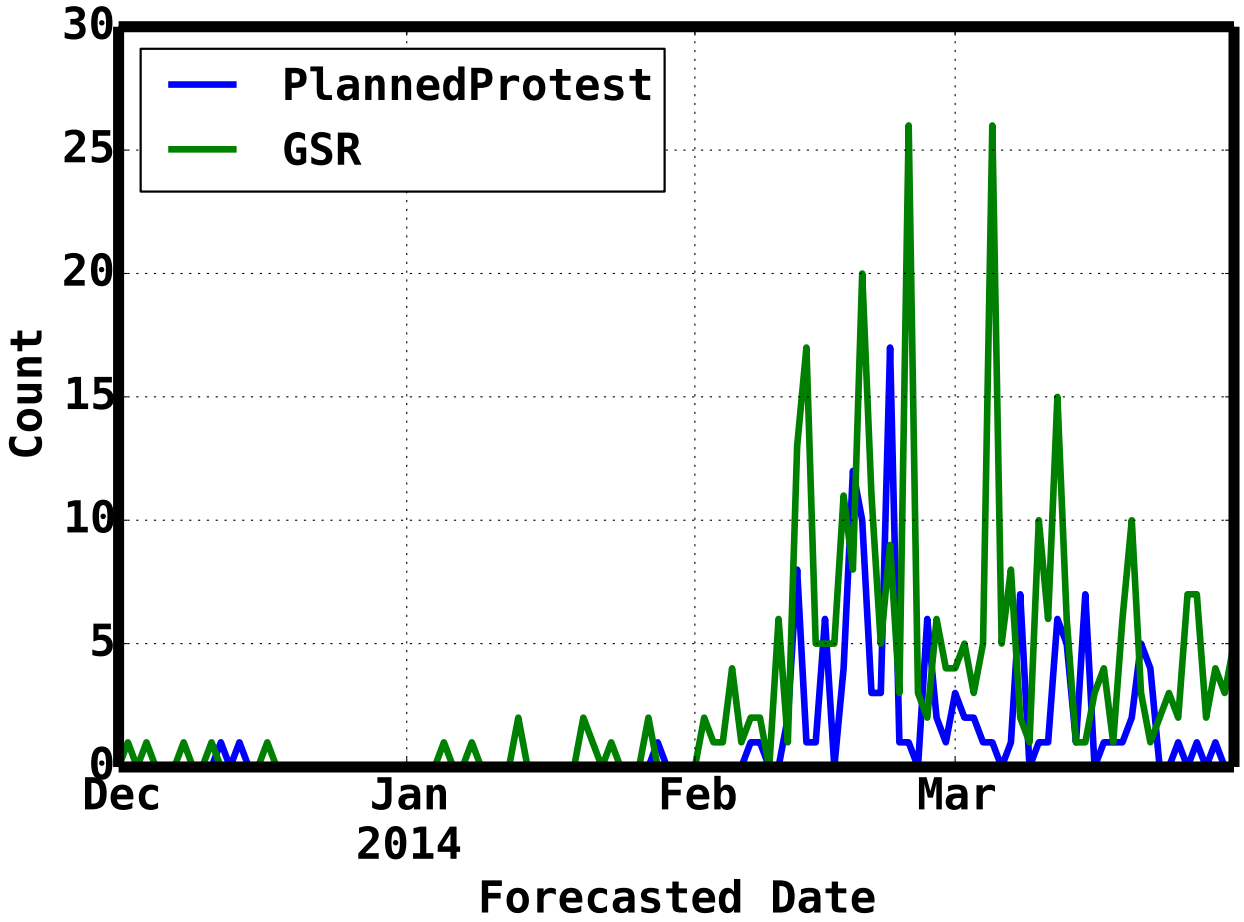




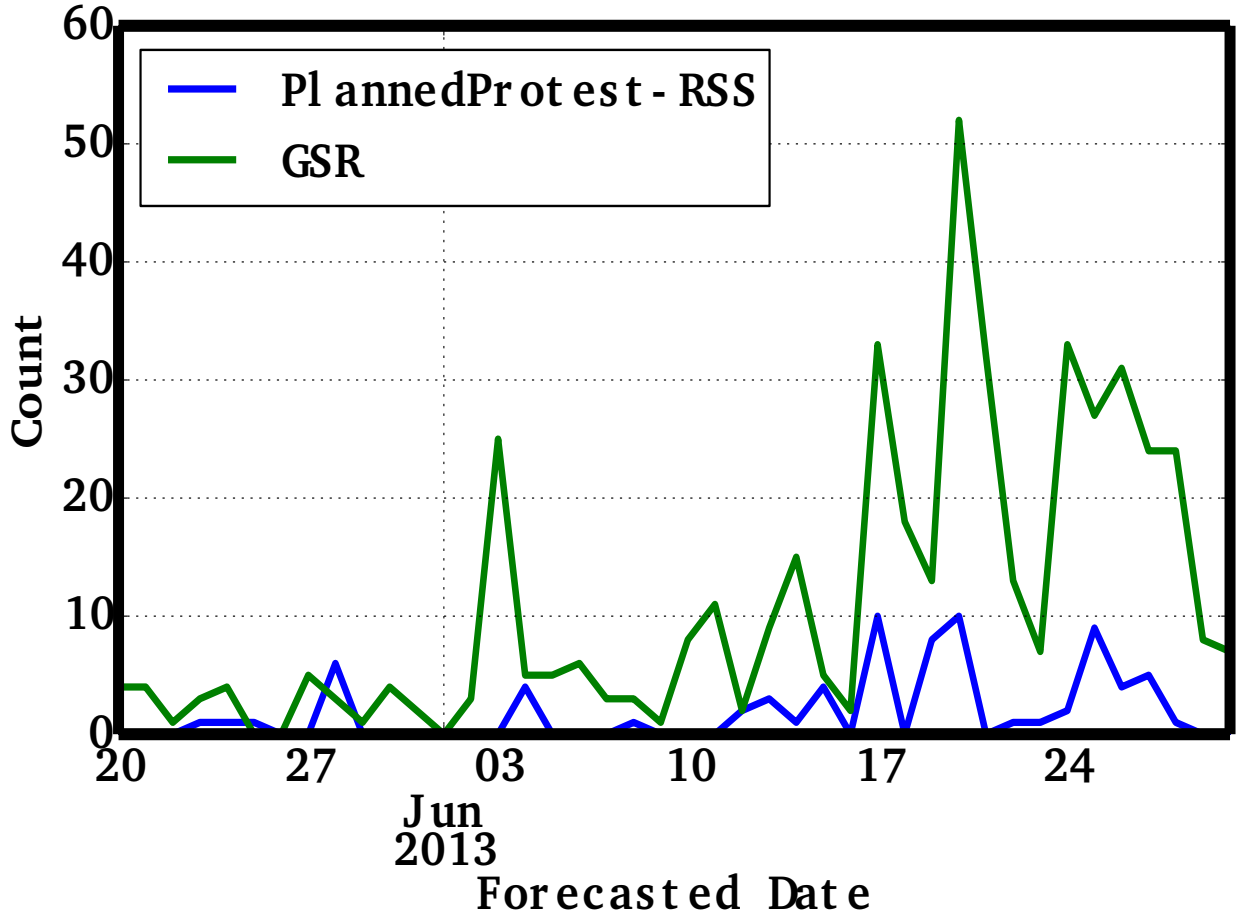
Venezuelan Spring



Venezuelan Violent Protests



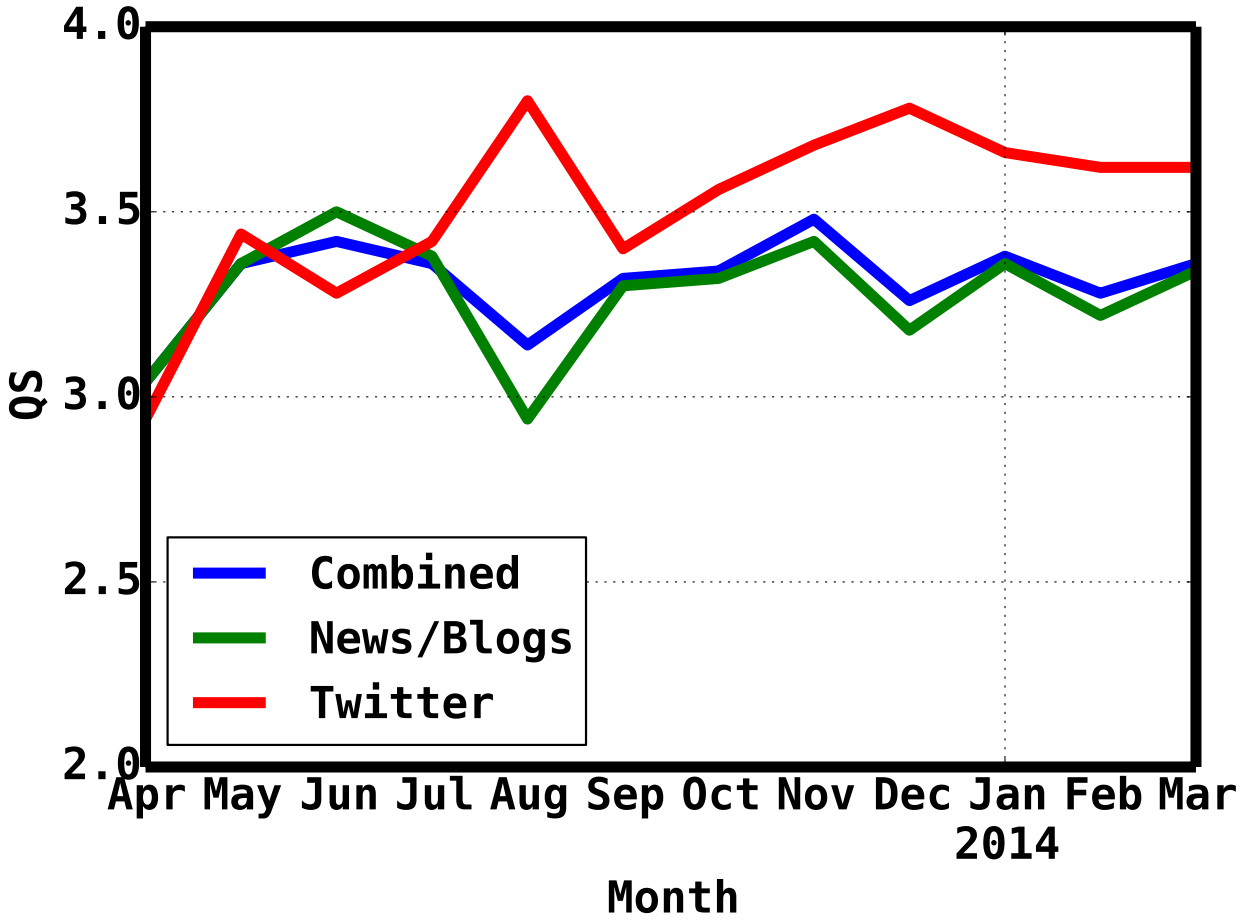
Brazilian Spring



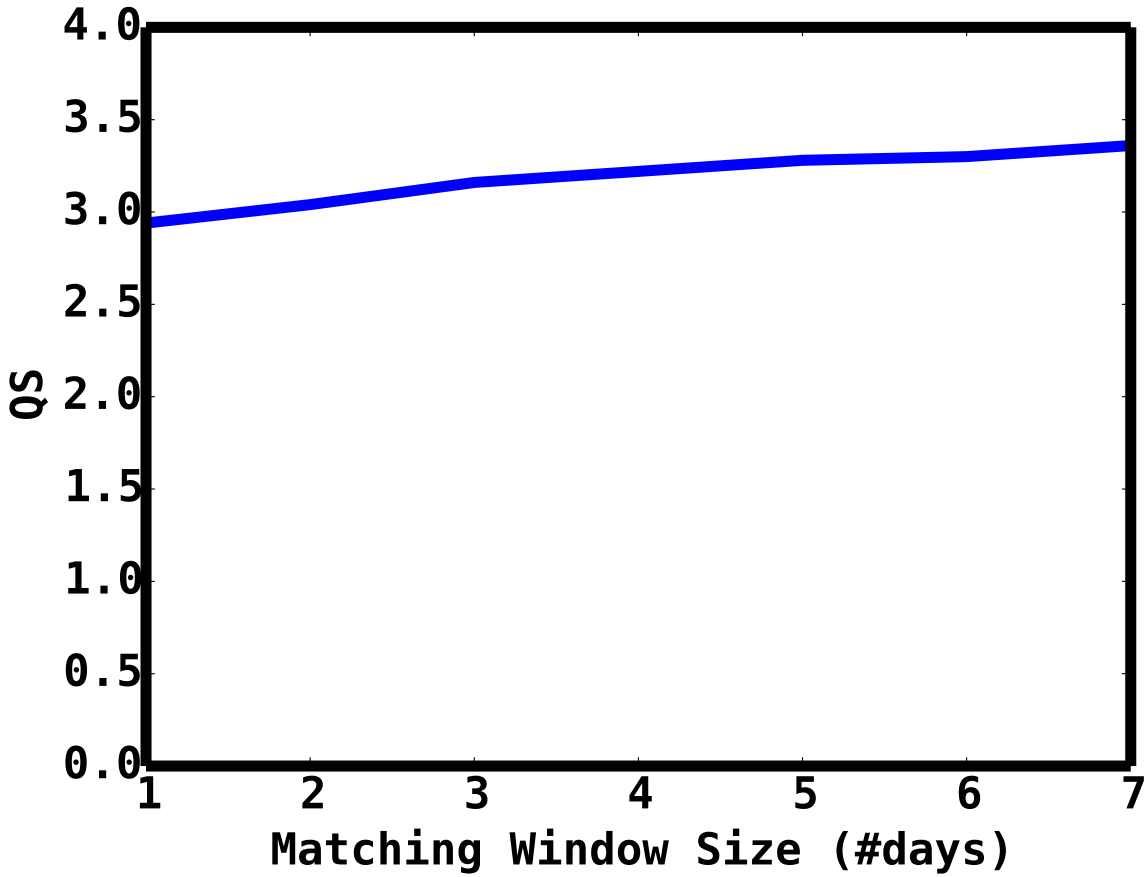
Individual Source Level Perfomance

	News/Blogs				Twitter				Facebook				Combined			
	QS	Pr.	Rec.	LT	QS	Pr.	Rec.	LT	QS	Pr.	Rec.	LT	QS	Pr.	Rec.	LT
AR	3.14	0.32	0.69	3.94	3.52	**0.78**	0.14	3.14	**3.70**	0.50	0.04	3.00	3.02	0.36	**0.80**	**4.50**
BR	3.14	0.48	0.54	**5.85**	-	-	-	-	**3.62**	**0.76**	0.18	2.46	3.28	0.49	**0.65**	5.15
CL	3.06	0.91	0.67	5.40	**3.52**	**1.00**	0.23	4.29	-	-	-	-	3.16	0.83	**0.80**	**5.92**
CO	2.74	0.90	0.56	**7.44**	3.30	**1.00**	0.15	2.43	**4.00**	**1.00**	0.02	2.00	2.88	0.84	**0.65**	6.47
EC	-	-	-	-	**2.32**	**1.00**	**0.06**	**17.00**	-	-	-	-	**2.32**	**0.50**	**0.06**	**17.00**
MX	2.96	0.88	0.25	**3.69**	3.14	**1.00**	0.02	1.43	**3.72**	0.67	0.01	2.00	3.00	0.87	**0.27**	3.51
SV	**3.22**	**1.00**	**0.03**	**1.0**	-	-	-	-	-	-	-	-	**3.22**	**1.0**	**0.03**	**1.0**
PY	3.38	**1.00**	**0.16**	9.11	3.84	**1.00**	0.04	**11.40**	3.96	**1.00**	0.01	2.00	3.60	0.96	**0.20**	9.35
UY	**3.24**	**1.00**	**0.29**	**2.40**	-	-	-	-	-	-	-	-	3.24	**1.00**	**0.29**	3.24
VE	**3.80**	**1.00**	0.36	**3.27**	3.68	0.97	0.33	2.39	-	-	-	-	3.64	0.99	**0.69**	2.88
ALL	3.34	0.69	0.35	**4.57**	3.62	**0.97**	0.15	2.82	3.66	0.74	0.03	2.44	3.36	0.73	**0.51**	4.08

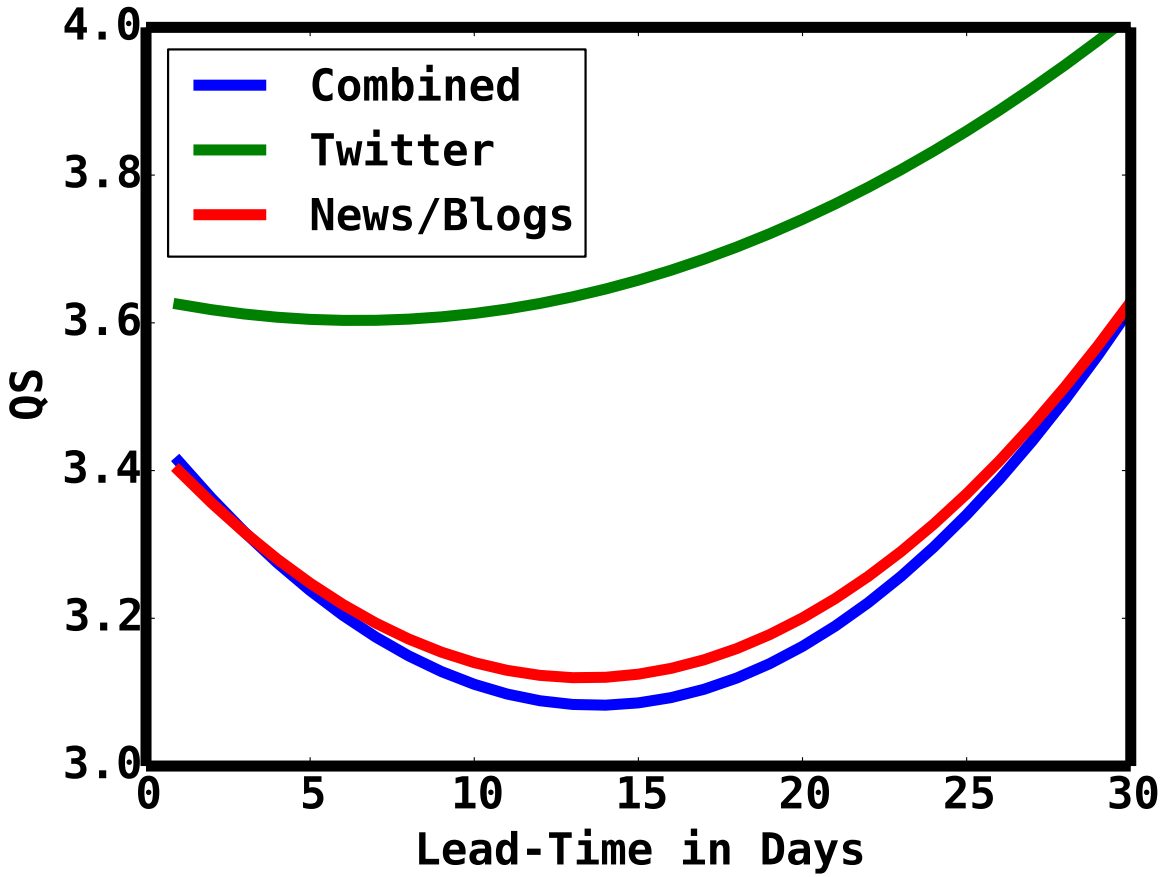
Performance over time



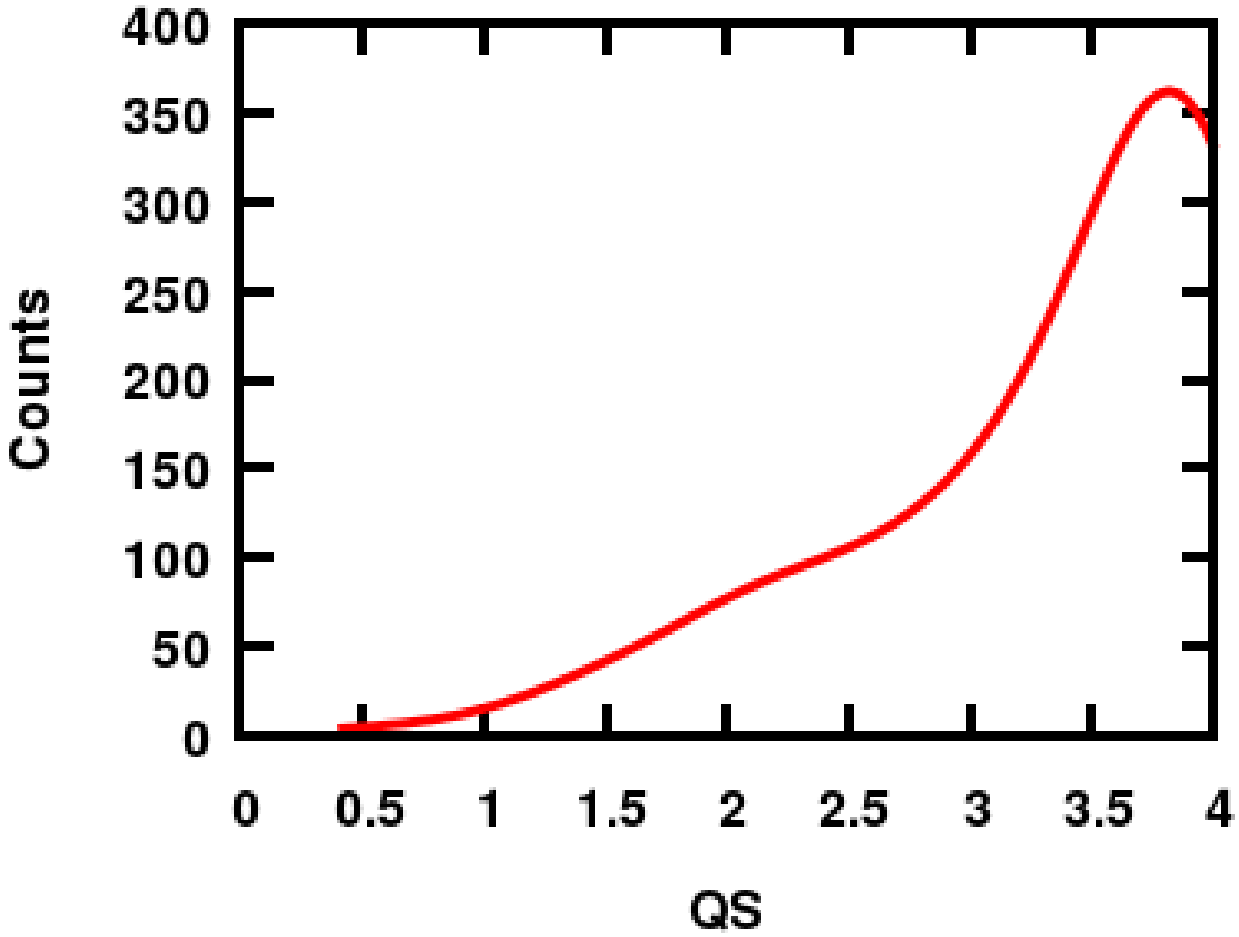
Quality Score vs Matching window size



Lead-Time vs Quality



Quality Score Distribution



Conclusion and Framework

- Current system capable of detecting planned protests and resolve (*i*) date and (*ii*)location of an event satisfactorily
- Different sources have different advantages and superiorities
- Future work is aimed at three aspects
  - Address situations involving nationwide protests and systems of protests
  - Generalize system to be able to make predictions from groups of articles and possibly from different sources
  - Generalize system to detect not-so-explicitly stated expressions of discontent
  - Generalize approach to consider other population level events of interest other than civil unrest like domestic political crises

End

Thank You!

Acknowledgement

Acknowledgement

Appendix A

- Lukasiewicz t-norm

$$\begin{aligned} \ell_1 \tilde{\wedge} \ell_2 &= \max\{0, I(\ell_1) + I(\ell_2) - 1\}, \\ \ell_1 \tilde{\vee} \ell_2 &= \min\{I(\ell_1) + I(\ell_2), 1\}, \\ \tilde{\neg} l_1 &= 1 - I(\ell_1), \end{aligned}$$

- Distance to Satisfaction

$$d_r(I) = \max\{0, I(r_{body}) - I(r_{head})\}$$