

Using machine learning to predict temporal orientation of search engines' queries in the Temporalia challenge

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私は



日本

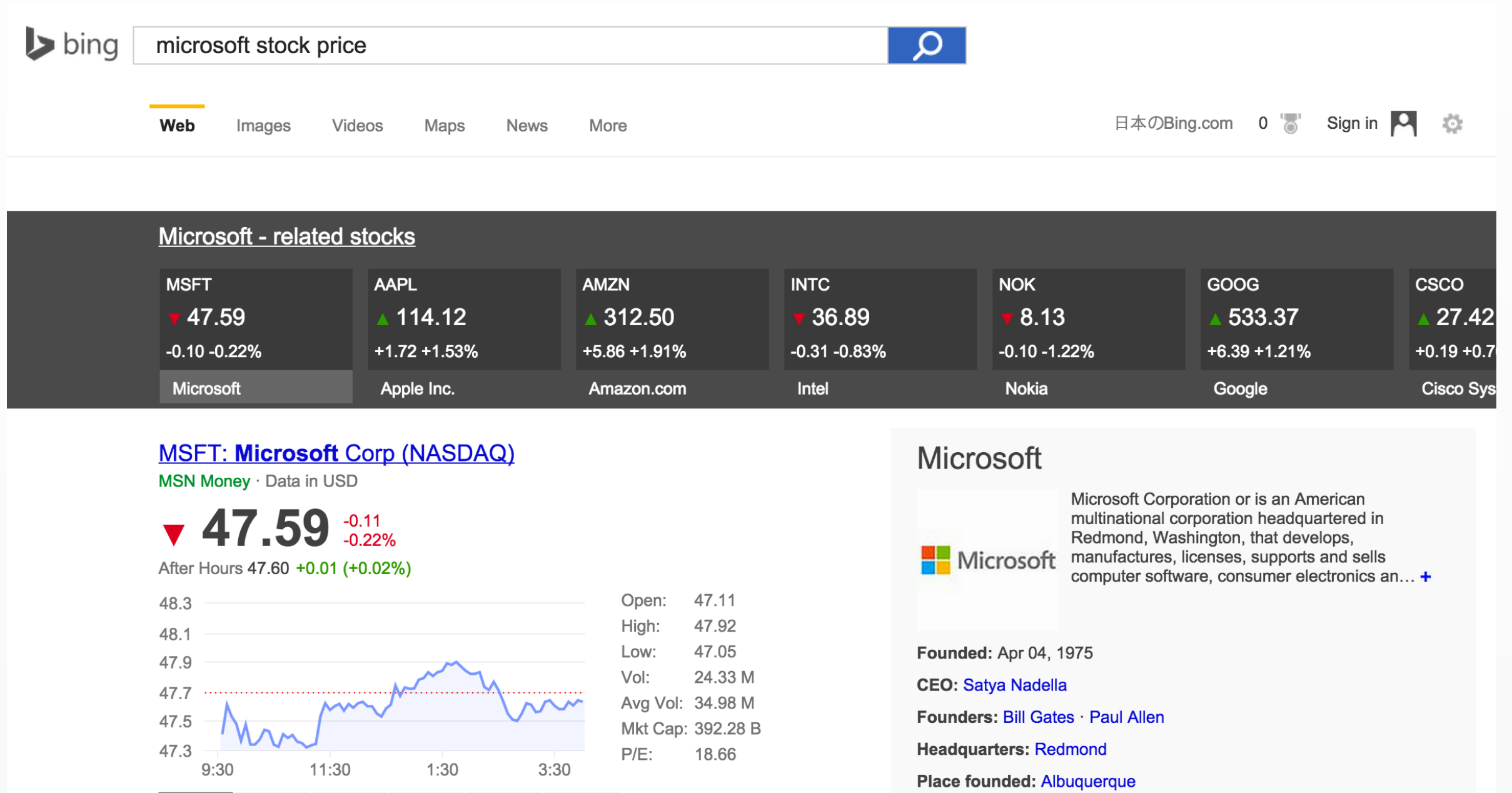
temporal intent of queries (TIQ)

Given a user query and its submission time, can a system predict its temporal intent?

- **input**: queries & submission date
- **output**: temporal intent
 - PAST, RECENCY, FUTURE or ATEMPORAL
- **easy** for people
- **hard** for machines



TQI: recency



TQI: future

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Weather in Manchester, United Kingdom

msn.com/weather · Data from WDT



39°F
Partly Cloudy °F | °C

Wed



46° / 39°

Thu



42° / 37°

Fri



44° / 34°

Sat



42° / 35°

Sun



48° / 40°

Next 5 days >

ALERTS · Wind - Yellow from Dec 10, 12:05 AM to Dec 11, 6:00 AM

BBC Weather - Manchester

www.bbc.com/weather/2643123 ▾

Hourly weather for Manchester with a 5 to 10 day forecast, giving a look further ahead.

Manchester, United Kingdom Forecast | Weather Underground

www.wunderground.com/weather-forecast/UK/Manchester.html ▾

Weather in Manchester - Get the latest Weather Forecast details such as climate, temperature map, humidity, wind etc. for Manchester on Weather Underground.

Related searches for weather forecast manchester



Manchester



Manchester is a city in the metropolitan county of Greater Manchester with a population of 514,417 in 2013; it lies within the United Kingdom's second

11/12/2014, Tokyo

TQI: past

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Michael Jackson date of death

June 25, 2009

[Data from wikipedia](#)

[Death of Michael Jackson - Wikipedia, the free encyclopedia](#)

en.wikipedia.org/wiki/Death_of_Michael_Jackson ▾

... "Michael Jackson passed away today at the age of 50." ... BET's annual **2009** Awards Ceremony aired three days after Jackson's death, on **June 28, 2009**.

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[King of Pop, Michael Jackson, Passed Away](#)

www.aceshowbiz.com ▸ [News](#) ▸ [Celebrity Gossip](#) ▾

Jun 26, 2009 · The singer **passed away** on Thursday afternoon, **June 25**, ... **Michael Jackson, Passed Away**. ... **2009 Michael** if you **did** revert to Islam, ...

[Videos of when did michael jackson pass away](#)

bing.com/videos



Michael Jackson



www.imdb.com

[Twitter](#) [Facebook](#)

Lived: Aug 29, 1958 - Jun 25, 2009 (age 50)

Height: 5' 9" (1.75 m)

Spouse: [Debbie Rowe](#) (1996 - 1999) · [Lisa Marie Presley](#) (1994 - 1999)

Children: [Paris Jackson](#) · [Prince Michael](#) · [Prince Michael Jackson II](#)

Michael Joseph Jackson was an American singer, songwriter, dancer, and actor. Called the King of Pop, his contributions to music and dance, along with his publicized personal life, made him a global figure in popular culture for over four d... +

en.wikipedia.org

TQI: atemporal

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bing when did michael jackson pass away

bing the difference between mass and weight

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What is the difference between mass and weight?

Since you say that you have read the definitions in books, lets refer to them : Mass remains same everywhere and weight changes. What does that exactly mean? Lets say you are made up of atoms and particles whose quantity can be measured as ...

Reference: www.quora.com/...ference-between-mass-and-weight-1

[What is the difference between mass and weight?](http://www.physlink.com/Education/AskExperts/ae321.cfm)

www.physlink.com/Education/AskExperts/ae321.cfm

Question What is the difference between mass and weight? Asked by: Eddo Answer
Mass is a measure of how much matter an object has. Weight is a measure of how ...

[The Differences Between Mass & Weight for Kids | eHow](http://www.ehow.com/...Education/K-12/K-12-For-Educators)

www.ehow.com/...Education/K-12/K-12-For-Educators

Related searches

YouTube [Difference Between Mass and Weight](#)

[Difference Between Mass and Weight](#) for Kids

[Difference Between Volume and Mass](#)

How are [Mass and Weight](#) Related

Definition of [Mass](#) for Kids

Are [Mass and Weight](#) The Same

[Mass vs Weight](#) Worksheet

[Weight vs Mass](#)

the data

- training set
 - 80 instances +
 - 20 instances (released as preliminary test set)
- test
 - 300 instances
- artificially balanced classes

presentation: NTCIR-11 Temporalia

```
<query_string>i am a gummy bear</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
<temporal_class>recency</temporal_class>
</query>
<query>
<id>005</id>
<query_string>i am a gummy bear</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
<temporal_class>atemporal</temporal_class>
</query>
<query>
<id>006</id>
<query_string>madden 2014 release date</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
<temporal_class>future</temporal_class>
</query>
<query>
<id>007</id>
<query_string>comet coming in 2013</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
<temporal_class>past</temporal_class>
</query>
<query>
<id>008</id>
<query_string>2013 official</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
<temporal_class>future</temporal_class>
</query>
<query>
<id>009</id>
<query_string>daylight savings time 2010 united</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
<temporal_class>past</temporal_class>
</query>
<query>
<id>010</id>
<query_string>attack synonym</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
<temporal_class>atemporal</temporal_class>
</query>
<query>
<id>011</id>
<query_string>may 2013 calendar</query_string>
<query_issue_time>May 1, 2013 GMT+0</query_issue_time>
```


proposed approach

- data-driven
- low-sparsity attributes
- external resources:
 - TempoWordNet¹, a temporal lexical KB
 - title of Wikipedia pages
 - ManTIME, a temporal expression

extraction system



NLTK



[1] G. H. Dias, M. Hasanuzzaman, S. Ferrari, and Y. Mathet. TempoWordNet for sentence time tagging. In Proceedings of the 23rd International Conference on World Wide Web Companion, pages 833–838, Republic and Canton of Geneva, Switzerland, 2014.

TempoWordNet

40554	eruptive.s.05	s	actively spewing out lava	0.000000	0.200400	0.000534	0.733				
40685	dormant.a.02	a	(of e.g. volcanos) not erupting and not extinct	0.000000	0.068862	0.000138	0.931				
40909	quiescent.s.03	s	being quiet or still or inactive	0.000000	0.934128	0.001872	0.064				
41051	extinct.a.02	a	(of e.g. volcanos) permanently inactive	0.000000	0.068862	0.000138	0.931				
41202	dead.s.05	s	physically inactive	0.000000	0.001485	0.493515	0.505				
41361	active.a.12	a	(of e.g. volcanos) capable of erupting	0.000000	0.863270	0.001730	0.135				
41488	alive.s.07	s	capable of erupting	0.000000	0.271456	0.000544	0.728				
41618	active.a.11	a	(used of verbs (e.g. 'to run') and participial adjectives (e.g. 'running' in 'running water')) expressing action rather than a								
41841	stative.a.01	a	(used of verbs (e.g. 'be' or 'own') and most participial adjectives) expressing existence or a state rather than an action								
42037	active.a.10	a	expressing that the subject of the sentence has the semantic function of actor: "Hemingway favors active constructions"	0.000000							
42228	passive.a.03	a	expressing that the subject of the sentence is the patient of the action denoted by the verb	0.000000	0.003045	0.605955					
42457	active.a.06	a	exerting influence or producing a change or effect	0.000000	0.944108	0.001892	0.054				
42692	activated.s.03	s	rendered active; e.g. rendered radioactive or luminescent or photosensitive or conductive	0.000000	0.860276	0.001724					
42837	counteractive.s.01	s	opposing or neutralizing or mitigating an effect by contrary action	0.000000	0.930136	0.001864	0.068				
42982	surface-active.s.01	s	capable of lowering the surface tension of a liquid; used especially of detergents	0.000000	0.201596	0.000404					
43125	inactive.a.04	a	not exerting influence or change	0.000000	0.120758	0.000242	0.879				
43231	quiescent.s.01	s	not active or activated	0.000000	0.968060	0.001940	0.03				
43411	active.a.09	a	(of the sun) characterized by an increased occurrence of sunspots and flares and radio emissions	0.000000	0.099800	0.000000	0.000				
43615	quiet.a.06	a	of the sun characterized by a low level of surface phenomena like sunspots e.g.	0.000002	0.000998	0.000000	0.999				
43765	actual.a.01	a	presently existing in fact and not merely potential or possible	0.001994	0.995006	0.000000	0.003				
44132	effective.s.05	s	existing in fact; not theoretical; real	0.001322	0.659678	0.000000	0.339				
44353	potential.a.01	a	existing in possibility	0.001764	0.880236	0.000000	0.118				
44608	latent.s.01	s	potentially existing but not presently evident or realized	0.001988	0.992012	0.000000	0.006				
44760	acute.a.01	a	having or experiencing a rapid onset and short but severe course	0.000000	0.000488	0.243512	0.756				
44987	subacute.s.01	s	less than acute; relating to a disease present in a person with no symptoms of it	0.000040	0.019960	0.000000	0.98				
45123	chronic.a.01	a	being long-lasting and recurrent or characterized by long suffering	0.000440	0.219560	0.000000	0.78				
45356	degenerative.s.01	s	(of illness) marked by gradual deterioration of organs and cells along with loss of function	0.000000	0.003992	0.000000	0.0				
45561	virulent.a.02	a	infectious; having the ability to cause disease	0.000000	0.003992	0.000008	0.996				
45735	highly_infective.s.01	s	(of a microorganism) extremely infective	0.000000	0.468062	0.000938	0.531				
45888	deadly.s.06	s	(of a disease) having a rapid course and violent effect	0.000000	0.001624	0.810376	0.188				
46014	avirulent.a.01	a	not virulent; unable to produce disease	0.000000	0.005988	0.000012	0.994				
46109	adaptive.a.01	a	having a capacity for adaptation	0.000000	0.266466	0.000534	0.733				
46339	accommodative.s.03	s	tending to reconcile or accommodate; bringing into harmony	0.000000	0.008982	0.000018	0.991				
46471	adaptational.s.01	s	of or relating to adaptation	0.000000	0.020958	0.000042	0.979				
46558	adjustive.s.01	s	conducive to adjustment	0.000000	0.266466	0.000534	0.733				
46673	maladaptive.a.01	a	showing faulty adaptation	0.000000	0.266466	0.000534	0.733				
46792	dysfunctional.s.02	s	(of a trait or condition) failing to serve an adjustive purpose	0.000000	0.108782	0.000218	0.891				
46955	maladjustive.s.01	s	poorly adjusted	0.000000	0.266466	0.000534	0.733				
47029	addicted.a.01	a	compulsively or physiologically dependent on something habit-forming	0.000408	0.407184	0.000816	0.592				
47243	alcoholic.s.02	s	addicted to alcohol	0.000000	0.266466	0.000534	0.733				
47406	dependent.s.06	s	addicted to a drug	0.000000	0.200598	0.000402	0.799				
47566	unaddicted.a.01	a	not addicted	0.000000	0.266466	0.000534	0.733				
47653	clean.s.18	s	free of drugs	0.000000	0.023952	0.000048	0.976				
47786	addictive.a.01	a	causing or characterized by addiction	0.000000	0.000998	0.000002	0.999				
47954	nonaddictive.a.01	a	not causing or characterized by addiction	0.000000	0.000998	0.000002	0.999				
48129	additive.a.02	a	characterized or produced by addition	0.000000	0.004990	0.000010	0.995				
48460	accumulative.s.01	s	increasing by successive addition	0.000000	0.266466	0.000534	0.733				

ManTIME¹ usage

- a ML-based temporal expression extraction system

“madden 2014 release date”



madden <TIMEX3 value=“2014-XX-XX” type=“DATE”>2014</TIMEX3> release date

“drudge report 2013 september”



drudge report <TIMEX3 value=“2013-09-XX” type=“DATE”>2013 september</TIMEX3>

[1] M. Filannino, G. Brown, and G. Nenadic. ManTIME: Temporal expression identification and normalization in the TempEval-3 challenge. In Proceedings of SemEval 2013, pages 53–57, Atlanta, USA, June 2013. ACL.

trigger classes

- BOW representation
- Feature selection RELIEF algorithm
- 4 dictionaries (1 per class)

PAST

ancient
days
death
did
history
last
months

21 triggers

RECENCY

actual
cost
costs
current
daily
day
direction

44 triggers

FUTURE

agenda
calendar
chance
coming
dates
forecast
forthcoming

27 triggers

ATEMPORAL

chords
lyrics

2 triggers

attributes

#	Attribute description	Sparsity	Example Input (query/time) → attribute value
1	Is it a Wikipedia page title?	2	"New York Times" → YES
2	Does it contain a temporal expression?	2	"june 2013 movies" → YES
3	Submission's term	3	"Feb 28, 2013 GMT+0" → 'B'
4	Submission's trimester	4	"Aug 26, 2013 GMT+0" → 'M2'
5	Timing	4	"Movies 2012", "Feb 28, 2013" → 'past'
6	Most frequent trigger class	5	"peso dollar exchange rate" → 'present'
7	Wh type	5	"how did hitler die" → 'how'
8	Most frequent TempoWordNet class	5	"current stock prices" → 'present'
9	Most frequent POS tag tense	7	"what is stop kony 2012" → 'VBZ'

attributes

#	Attribute description	Sparsity	Example Input (query/time) → attribute value
10	Most frequent coarse-grained POS tag	8	“kony 2012 fake” → ‘N’
11	Trigger classes footprint	11	“what was I thinking lyrics” → ‘past-atemporal’
12	Temporal Δ between submission and query	16	“father’s day 2010”, “Feb 28, 2013” → 36.0
13	Tenses footprint	18	“when does fall start” → ‘VBZ-VB’
14	Ordered TempoWordNet classes	18	“the last song” → ‘past-future-present-atemporal’
15	Most frequent fine-grained POS tag	21	“kony 2012 fake” → ‘NN’
16	Coarse-grained POS tag ordered footprint	119	“when is labour day” → ‘N-W-V’
17	Fine-grained POS tag ordered footprint	202	“when is labour day” → ‘NN-WRB-VBZ’
18	Coarse-grained POS tag footprint	204	“when is labour day” → ‘W-V-N-N’
19	Fine-grained POS tag footprint	265	“when is labour day” → ‘WRB-VBZ-NN-NN’

run 1: minimal

- classifier:
SVM with polynomial
kernel

#	Attribute description	Sparsity
1	Is it a Wikipedia page title?	2
2	Does it contain a temporal expression?	2
3	Submission's term	3
4	Submission's trimester	4
5	Timing	4
6	Most frequent trigger class	5
7	Wh type	5
8	Most frequent TempoWordNet class	5
9	Most frequent POS tag tense	7
10	Most frequent coarse-grained POS tag	8
11	Trigger classes footprint	11
12	Temporal Δ between submission and query	16
13	Tenses footprint	18
14	Ordered TempoWordNet classes	18
15	Most frequent fine-grained POS tag	21
16	Coarse-grained POS tag ordered footprint	119
17	Fine-grained POS tag ordered footprint	202
18	Coarse-grained POS tag footprint	204
19	Fine-grained POS tag footprint	265

run 2: intermediate

- classifier:
SVM with polynomial
kernel

#	Attribute description	Sparsity
1	Is it a Wikipedia page title?	2
2	Does it contain a temporal expression?	2
3	Submission's term	3
4	Submission's trimester	4
5	Timing	4
6	Most frequent trigger class	5
7	Wh type	5
8	Most frequent TempoWordNet class	5
9	Most frequent POS tag tense	7
10	Most frequent coarse-grained POS tag	8
11	Trigger classes footprint	11
12	Temporal Δ between submission and	16
13	Tenses footprint	18
14	Ordered TempoWordNet classes	18
15	Most frequent fine-grained POS tag	21
16	Coarse-grained POS tag ordered footprint	119
17	Fine-grained POS tag ordered footprint	202
18	Coarse-grained POS tag footprint	204
19	Fine-grained POS tag footprint	265

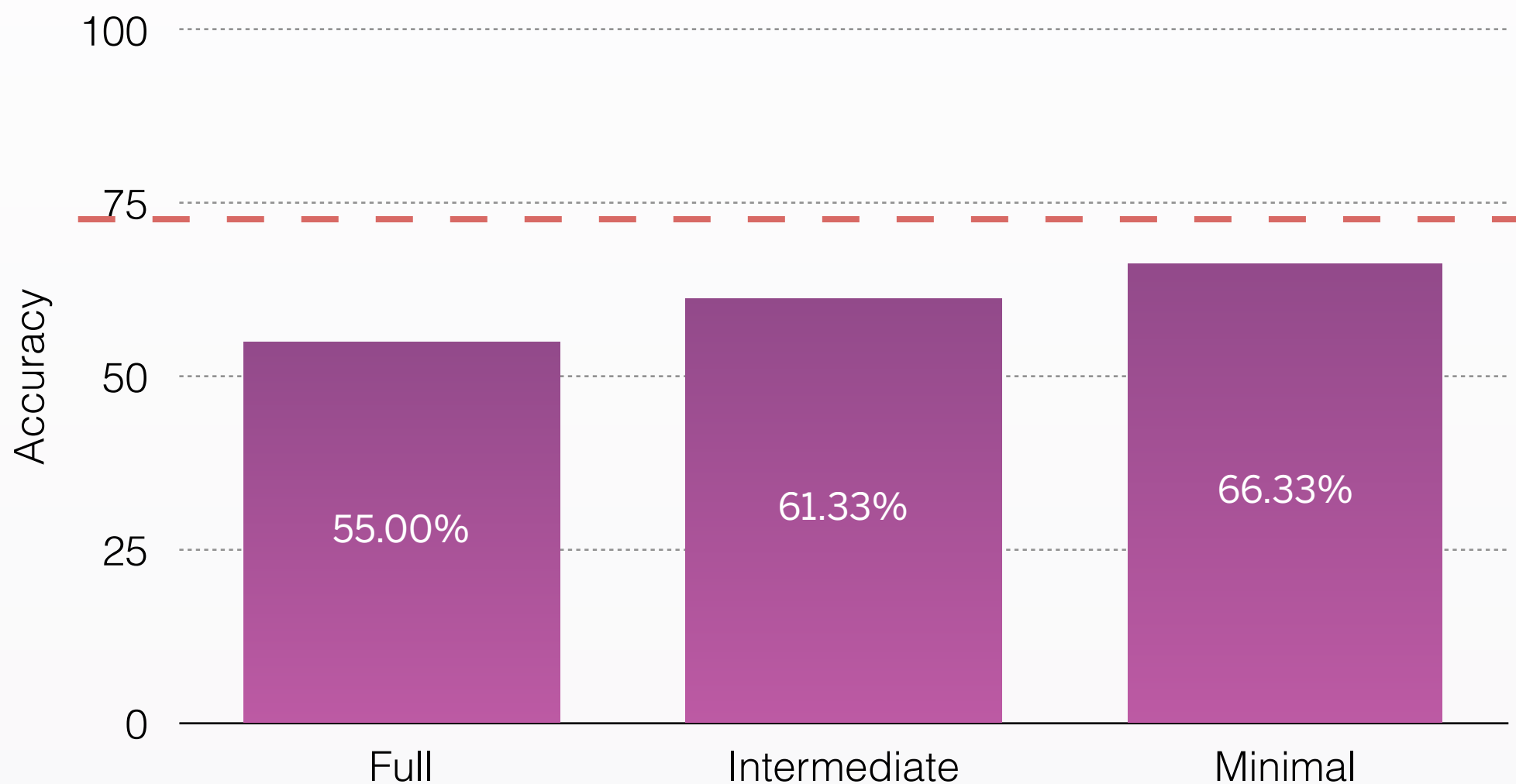
run 3: full

- classifier:

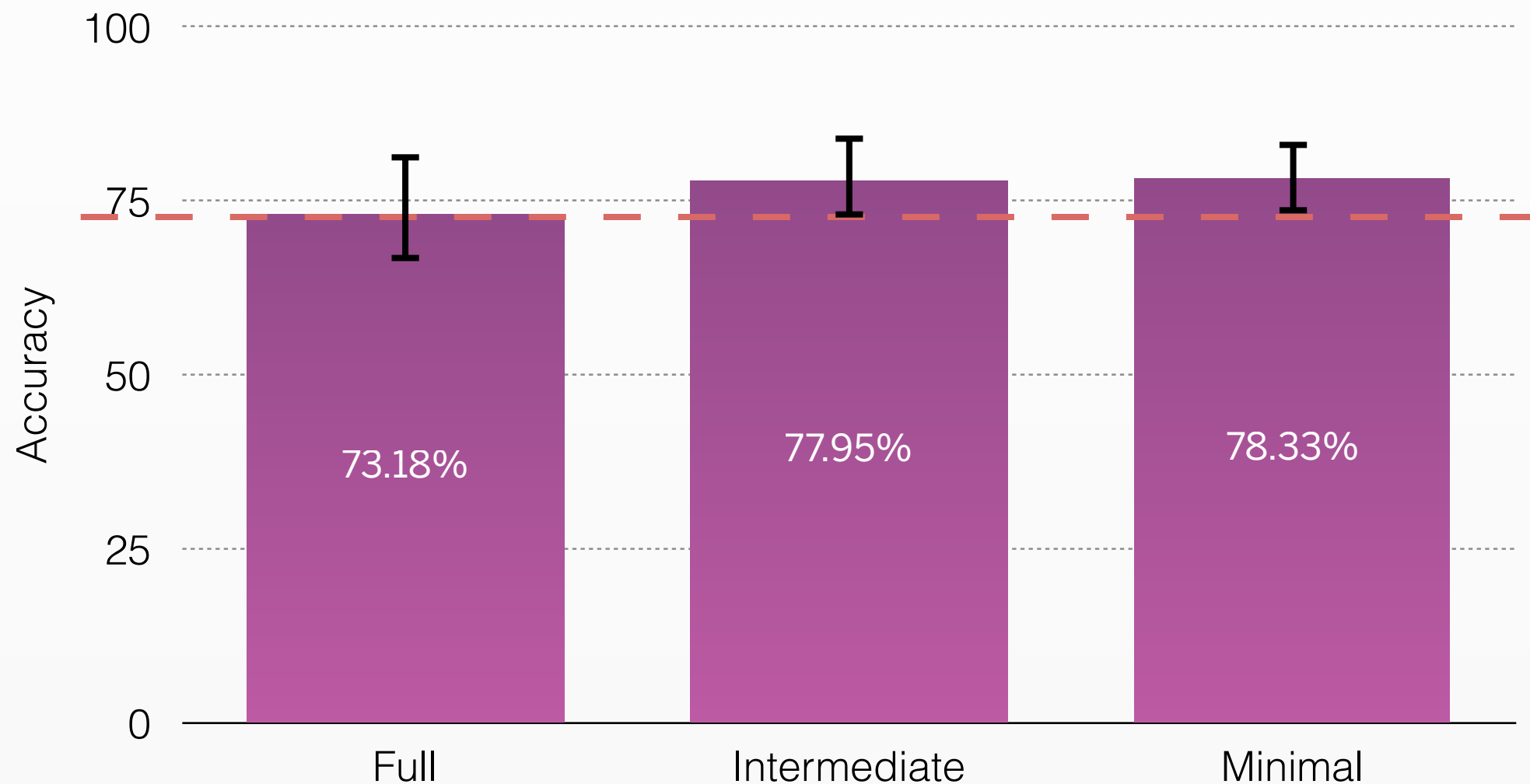
Random Forests

#	Attribute description	Sparsity
1	Is it a Wikipedia page title?	2
2	Does it contain a temporal expression?	2
3	Submission's term	3
4	Submission's trimester	4
5	Timing	4
6	Most frequent trigger class	5
7	Wh type	5
8	Most frequent TempoWordNet class	5
9	Most frequent POS tag tense	7
10	Most frequent coarse-grained POS tag	8
11	Trigger classes footprint	11
12	Temporal Δ between submission and	16
13	Tenses footprint	18
14	Ordered TempoWordNet classes	18
15	Most frequent fine-grained POS tag	21
16	Coarse-grained POS tag ordered footprint	119
17	Fine-grained POS tag ordered footprint	202
18	Coarse-grained POS tag footprint	204
19	Fine-grained POS tag footprint	265

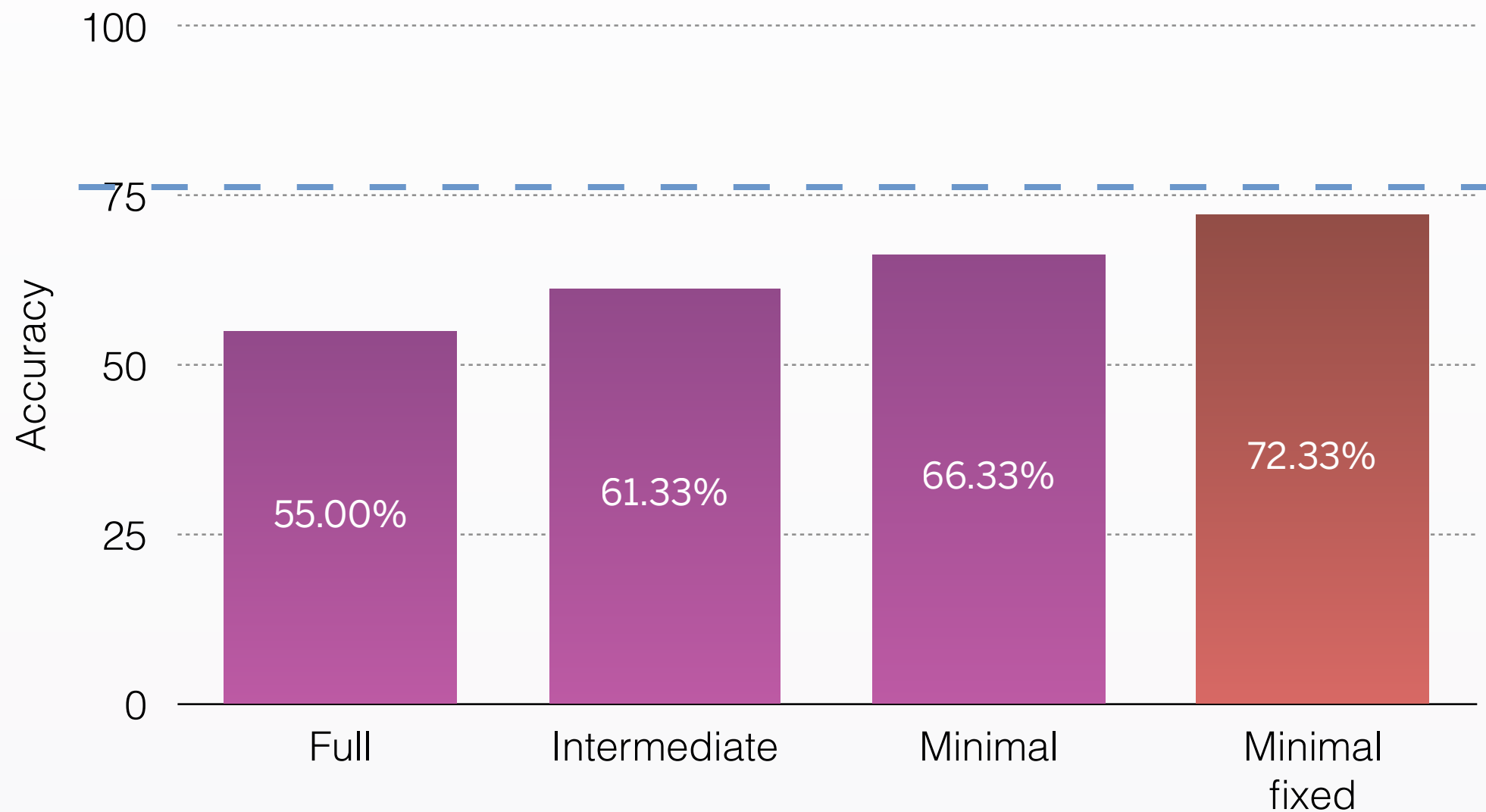
results (submitted runs)



results: 5 x 10 cross-fold v.



a posteriori fix



--- best combination of attributes: 76%

11/12/2014, Tokyo

20 / 27



how to reach the peak?

confusion matrix

	Classified as			
	Recency	Past	Future	Atemporal
Recency	43	0	21	11
Past	3	60	6	6
Future	38	0	35	2
Atemporal	6	5	3	61

confusion matrix

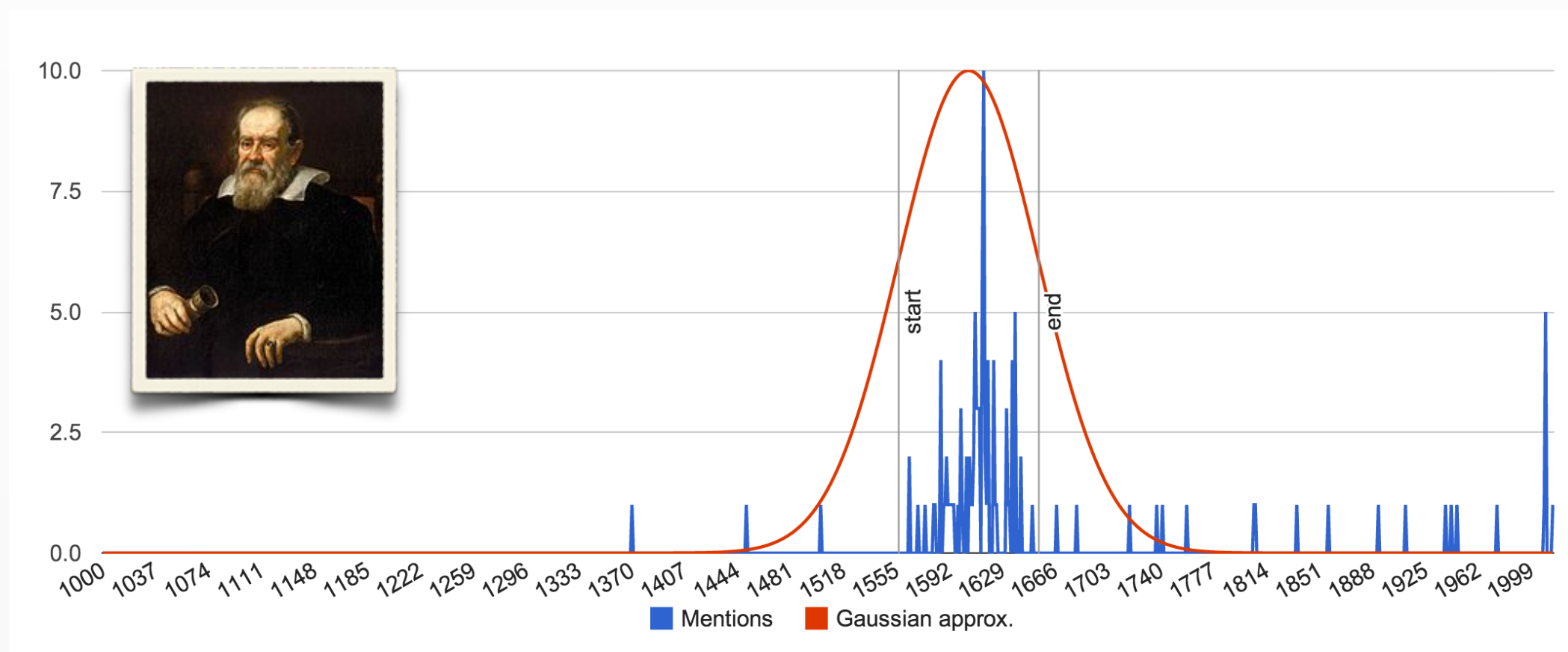
	Classified as			
	Recency	Past	Future	Atemporal
Recency	43	0	21	11
Past	3	60	6	6
Future	38	0	35	2
Atemporal	6	5	3	61

difficult queries

- “iPhone 5 release date”
 - it can be FUTURE or PAST according to the submission time
 - keywords don’t help here
- “2061: Odyssey Three”
 - keywords can lie!
- “season 2 dexter”
 - use of external sources of knowledge

temporal footprint

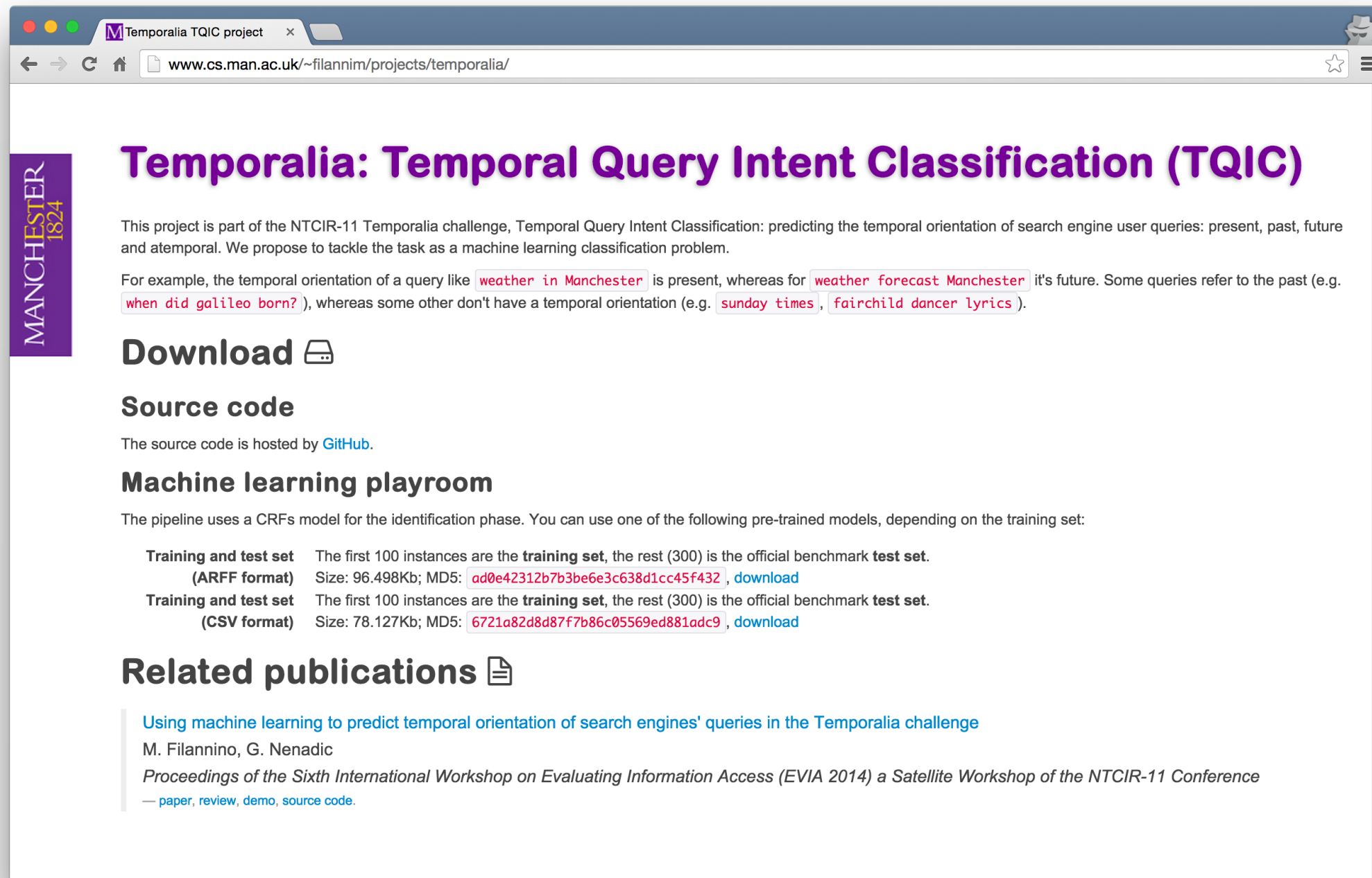
a continuous period on the time-line that temporally defines the existence of a particular concept.



what we learned

- lexical and morphological analysis is not enough
 - mapping entities to knowledge bases
 - full temporal information analysis (flow of events)
- future vs. recency is an open problem
- challenging
 - queries are usually very short
 - semantic analysis of the indexed documents is tough
- more data

online material



The screenshot shows a web browser window with the URL `www.cs.man.ac.uk/~filannim/projects/temporalia/`. The page title is "Temporalia: Temporal Query Intent Classification (TQIC)". The content includes a description of the project as part of the NTCIR-11 Temporalia challenge, examples of query temporal orientation, and links to download data and source code. A sidebar on the left features the Manchester 1824 logo.

Temporalia: Temporal Query Intent Classification (TQIC)

This project is part of the NTCIR-11 Temporalia challenge, Temporal Query Intent Classification: predicting the temporal orientation of search engine user queries: present, past, future and atemporal. We propose to tackle the task as a machine learning classification problem.

For example, the temporal orientation of a query like `weather in Manchester` is present, whereas for `weather forecast Manchester` it's future. Some queries refer to the past (e.g. `when did galileo born?`), whereas some other don't have a temporal orientation (e.g. `sunday times`, `fairchild dancer lyrics`).

Download

Source code

The source code is hosted by [GitHub](#).

Machine learning playroom

The pipeline uses a CRFs model for the identification phase. You can use one of the following pre-trained models, depending on the training set:

Training and test set (ARFF format)	The first 100 instances are the training set , the rest (300) is the official benchmark test set . Size: 96.498Kb; MD5: <code>ad0e42312b7b3be6e3c638d1cc45f432</code> , download
Training and test set (CSV format)	The first 100 instances are the training set , the rest (300) is the official benchmark test set . Size: 78.127Kb; MD5: <code>6721a82d8d87f7b86c05569ed881adc9</code> , download

Related publications

[Using machine learning to predict temporal orientation of search engines' queries in the Temporalia challenge](#)
M. Filannino, G. Nenadic
Proceedings of the Sixth International Workshop on Evaluating Information Access (EVIA 2014) a Satellite Workshop of the NTCIR-11 Conference
— [paper](#), [review](#), [demo](#), [source code](#).

