

# Supplementary material for Unsupervised corpus-wide claim detection

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## *1. Sentence level index – technical details*

We processed the Wikipedia dump from May 18<sup>th</sup>, 2015. We applied text cleaning and sentence splitting using OpenNlp Sentence Detector [1] and then used the TagMe tool [2] to wikify each sentence, limiting the context used by TagMe for disambiguation to the surrounding sentence. Starting from 4.9M articles, the sentence level index contains 83M sentences.

For efficient selection of the required information, we kept in an inverted index (Apache Lucene4) [3] each Wikipedia sentence in a separate document unit. The surface form of the sentence and the Wikified concepts belonging to this sentence were indexed in dedicated fields. To allow precise span queries, we indexed, in addition, the position and the tokens length of the concepts. Our implementation followed the description in [4]. We define a query item to be either a single word, a conjunction of several words, or a Wikipedia concept. These query items are respectively translated to simple term constraints, Boolean constraints and fielded constraints. The final query is then built from an ordered list of query items. For a sentence to match the query, all items must appear in the sentence in the same order as in the query. Expressing the ordered constraint was obtained by using the LuceneSpanNearQuery with no slop limitation and expressing constraints mixing surface form and Wikified concept was obtained by using SpanFieldMaskingQuery which allows to project the Wikified concept constraint into the surface text space.

[1] OpenNlp - <https://opennlp.apache.org/>

[2] TagMe - Paolo Ferragina and Ugo Scaiella. 2010. Tagme: on-the-fly annotation of short text fragments (by wikipedia entities). In Proceedings of the 19th ACM international conference on Information and knowledge management. ACM, pages 1625–1628

[3] Lucene - <https://lucene.apache.org/>

[4] Indexing tagged data with lucene - <http://shaierera.blogspot.com/2016/01/indexing-tagged-data-with-lucene.html>

## 2. Query matches – summary

The tables below summarize the number of query matches for the development and test sets. Reporting average, standard deviation and median across all motions in the set. A detailed list of all topics in the sets along with their respective query matches are reported at the end of this document. Note that the numbers in the table are computed after removing sentences with the newline character and sentences of length smaller than 5 or larger than 50 (we removed these sentences in our experiments as well).

	development set - 100		
	#MC	#that+MC	#that+MC+CL
Mean	18607.1	1834.1	304.5
Stdev	34390.0	3557.5	650.1
Median	4872.5	493.5	74.5
	test set - 50		
	#MC	#that+MC	#that+MC+CL
Mean	9543.4	1121.6	205.1
Stdev	19286.9	2342.3	377.8
Median	3899.0	467.5	78.0

### 3. Annotation guidelines

Guideline used for annotating the top 50 claim predictions. Annotation was done by 10-15 crowd workers per row via the CrowdFlower platform (<https://www.crowdflower.com/>).

#### Assessing the value of potential claims

In this task you are given a topic and possibly-related statements, each marked within a particular sentence.

For each candidate, you should select **"Accept"**, if you think that the marked statement can be used "as is" during discourse, to directly support or contest the given topic. Otherwise, you should select **"Reject"**.

If you selected "Accept", you should further indicate whether the marked text supports the topic ("Pro") or contests it ("Con").

Note, that if the marked text is non-coherent, hence cannot be used "as is" during a discussion about the topic, you should select "Reject".

Similarly, if the marked text supports/contests a *different* topic, even if it is somewhat related to the examined topic, you should typically select "Reject".

As a rule of thumb, if it is natural to say "I (don't) think that <topic>, because <marked statement>", then you should probably select "Accept". Otherwise, you should probably select "Reject".

Finally, if you are unfamiliar with the examined topic, please briefly read about it in a relevant data source like Wikipedia.

#### Examples for the topic "We should ban the sale of violent video games to minors" –

1. "The researchers found that **adolescents that play violent video games are most at-risk for violent behavior** (but without statistical significance)." -- **Accept / Pro**.
2. "Previous reports suggested that **kids playing Doom are not at a greater risk for violent behavior.**" -- **Accept / Con**.
3. "The researchers **found that adolescents that play violent video games are at no risk for violent behavior.**" -- **Reject**. Due to the prefix "found that", the marked text is not coherent and cannot be used "as is" while discussing the topic.
4. "**While violent video games are often associated with aggressive behavior**, recent studies are starting to suggest otherwise." -- **Reject**. Due to the prefix "While", the marked text is not coherent and cannot be used "as is" while discussing the topic.
5. "Many people believe that **some TV shows increase youth violence.**" -- **Reject**. The marked text is not *directly* supporting/contesting the topic.

#### 4. Analysis of different claim lexicons

As mentioned in the paper, q1-set (the set of sentences that match the query q1=MC) is divided into two classes - consisting of those sentences that contain the token 'that' before the MC, and those that do not; we denote these two classes as c1 and c2, respectively.

Given the weakly positive set (c1) and weakly negative set (c2), one can think of several ways to create a lexicon of words indicative of class c1. Probably the most straightforward option is to count, for each word w in the vocabulary, the number of sentences from c1/c2 in which w appears. The higher the ratio between  $P(c1|w)$  and  $P(c1)$  the more we are certain that word w is indicative of the class c1. We call this lexicon the full sentence lexicon (FSL).

However, the sentences in c1 and c2 are not just random sentences, both contain the MC for the 100 dev-set topics and the sentences in c1 all contain the word 'that' before a match of the MC. The matches of 'that' and 'MC' split the sentences in c1 into 3 parts – the prefix (all words before 'that'), the middle (all words between 'that' and the following MC) and the suffix (all words after the first MC that follows 'that'). It is possible that focusing on the different sentence parts will yield better lexicons. The prefix, middle and suffix lexicons are called PL, ML and SL respectively. For each lexicon, we created a claim sentence query and annotated a sample of the matching sentences in order to estimate the prior probability of the sentence to contain a claim. The annotation set was created by randomly selecting at most 3 sentences that match the query per topic in our dev-set, and annotating the resulting sentences by 5 human annotators.

The table below reports the estimated prior probability for each lexicon/query (we add the queries MC and that->MC for comparison). As mentioned in the paper the suffix lexicon (later denoted simply as the claim lexicon, or CL) was most promising for constructing the CSQ.

Lexicon	Query	Prior Estimation
	MC	0.024
	that -> MC	0.048
FSL	(that -> MC) AND FSL	0.043
PL	PL -> that -> MC	0.047
ML	that -> ML -> MC	0.045
SL	that -> MC -> SL	0.098

## 5. Example output

The following table shows the top 10 predictions for the topic "Social media does more harm than good". The precision at 10 of the chosen topic is 0.4 (compared to the test set average 0.3 and median 0.25). The predicted claims are marked in bold in the respective sentences. The last two columns report the number of annotators who chose to accept or reject the predicted claim.

Rank	Sentence	Label	#Accept	#Reject
1	BPI asserts that <b>social media and ABC News "grossly misrepresented" their product [REF].</b>	Accept	8	7
2	Opponents to this theory also argue that <b>economic regulation of social media sites could decrease investment, and consequently harm customers and rivals.</b>	Reject	3	12
3	In a blog post, he stated that <b>social media has "become an unhealthy part of my life and a danger to the personal relationship I have with my work."</b>	Accept	13	2
4	Although the name was changed the creator of the show researched what happened to Sunil and based the episode around the legal ramifications that <b>social media sites potentially face as a result of false information being disseminated.</b>	Reject	9	5
5	It judged that <b>online activism, particularly in social media, could cause a rise in xenophobia, and that this in turn could lead to polarization within and between extreme political movements.</b>	Accept	13	2
6	Regarding Twitter, he stated that <b>"For all its trendiness, social media is often a waste of their time." [REF] .</b>	Accept	12	3
7	In his article, "Why Music Won't Be Saved By Social Media", Wes Davenport suggests that <b>the role of social media in the industry "has been grossly inflated".</b>	Reject	5	10
8	Opponents point out that <b>because social media is constantly evolving, innovation and competition are necessary for its growth.</b>	Reject	2	13
9	Opponents to this theory believe that <b>imposing utility status on social media websites would consequently cause government regulation, which could result in an unfair change for both businesses and individuals.</b>	Reject	2	13
10	Writing in The Week, Ryan Cooper called the harassment campaign "an online form of terrorism" intended to reverse a trend in gaming culture toward increasing acceptance of women, and stated that <b>social media platforms need to tighten their policies and protections against threats and abuse [REF].</b>	Reject	4	11

## 6. *Claim lexicon*

The claim lexicon sorted by importance:

should, tuned, could, unconstitutional, violate, might, violated, violates, wrong, rather, valid, invalid, irrelevant, inherently, necessarily, cannot, prevail, justify, flawed, merely, corpus, ought, inevitably, cause, justifiable, unacceptable, untrue, abhorrent, unless, harmful, punished, liable, incompatible, beneficial, justifying, undecided, skimmed, indefensible, impossible, undermine, necessary, flourish, meaningless, outweigh, substantiated, refute, jeopardized, incapable, irrational, heterosexual, immoral, tipped, preferable, deterred, wipe, intrinsically, ascending, deserved, enveloped, unduly, anyway, warranted, foreseeable, sure, justified, feasible, consummated, else, meaningful, fundamentally, falsifiable, inconsistent, brute, testable, equally, properly, actually, happen, unfounded, infringed, result, likely, safeguarded, irreversible, destroy, nor, outweighed, unnecessary, dared, legitimate, insignificant, unjustly, unprotected, empirically, acceptable, untenable, constitute, unrealistic, disappear, sooner, unlikely, negligible, retaliatory, needed, faked, misleading, contaminated, fail, socioeconomic, conclusive, undemocratic, deserve, improperly, inevitable, insult, breached, harm, whatsoever, rehired, safer, liberate, overboard, unsound, healthier, mandate, mutually, rationally, stifled, false, unconstitutionally, somehow, LGBTQ, unjust, ridiculous, really, otherwise, causal, legitimately, incorrect, prejudiced, explode, hers, discernible, manipulated, perpetrated, tolerated, lucid, wo, reliably, coercive, desirable, impotent, irresistible, unambiguous, misinterpreted, contradict, detrimental, reasonably, unchanged, too, misrepresented, catastrophic, rogue, ruining, benefit, manipulating, solve, correlate, constitutionally, bigotry, verifiable, obsolete, differently, happening, ethiopian, selfish, unethical, undermines, dangerous, ineffective, endanger, refuted, unproven, shall, dogmatic, ontological, logical, rightful, undermined, abuse, perpetuate, exaggerated, moral, permissible, ridicule, sincerely, sane, subdue, unfairly, inaccurate, discriminatory, erroneous, waste, distract, desire, decreases, insufficient, compelling, destabilize, sexist, morally, absurd, emotional, predicated, overdose, biologically, retracted, distort, adequately, do, intimidated, surely, absolutely, worse, infinite, terrorist, underdeveloped, ourselves, worth, materially, biased, psychologically, unsubstantiated, differentiated, complied, inappropriately, inseparable, ruin, constitutes, disclose, unnatural, poisoning, slitting, invalidated, contradictory, unlawful, corrupted, overdosing, contrary, correct, swallowing, prove, await, intolerable, credible, interfered, anymore, simply, militarily, inflict, disagree, unreliable, unhealthy, perfectly, forever, manipulate, inconclusive, contradicts, arouse, unsafe, despondent, dismisses, sinful, trafficked, succeed, deleted, harmless, trillion, tantamount, us, satisfactory, behave, mortal, copyrighted, harming, atheistic, wage, unwarranted, inferior, reasonable, hardly, fit, appreciate, suit, lawful, unjustified, appropriate, exceeded, futile, infringe, arbitrarily, grossly, conceal, amount, bypassing, decrease, xenophobic, confuse, darwinian, contradicting, revert, disrupt, statistically, desired, disappears, anabolic, incite, diminish, falsified, compatible, weaken, reduces, sufficient, mean, earthly, undesirable, distorted, miss, appropriately, inappropriate, satanic, emitted, flowed, ineligible, outdated, damned, proscribed, materialistic, precisely, affect, mitigating,

solved, supernatural, entail, delete, evolve, trigger, uncomfortable, homosexual, reckless, lawfully, humane, cohabiting, rested, anticipate, eroded, implanted, excessively, therapeutic, bible, conveying, repay, altogether, oppressive, grounded, conform, mere, enslaved, impartial, collapse, reversing, unsure, whichever, sleep, theirs, outright, construed, sinister, artificially, null, pretend, compulsive, unscientific, viable, disparate, fear, invariably, individualistic, implying, correlated, grasp, prematurely, stupid, somewhere, discriminated, pretty, capitalist, accountable, monotheistic, inhumane, predetermined, compel, utterly, wiped, doctrinal, akin, damage, indirect, weaker, legitimize, compliant, misguided, accurate, innocent, flourishing, heal, monogamous, intervene, wrongly, conquer, doomed, imperialist, barred, boost, improves, subjective, accounting, virtuous, poisoned, excited, abnormal, experiential, verified, absolute, depend, wait, ascetic, insofar, need, escalate, eternal, deserves, modify, opposite, aggregate, inefficient, corrected, orderly, emerge, rendering, worldly, regretted, underrepresented, individually, overly, pluralistic, unreasonable, substantive, exacerbated, seem, deprive, irresponsible, yielding, divert, impact, decreasing, inherit, societal, poorer, stimulating, deter, delaying, bogus, confess, inhibit, overthrow, bipolar, adequate, interfere, disproportionate, worry, existent, indispensable, contacting, impede, negatively, imminent, abrupt, uneducated, rest, thereby, divine, coincide, involuntary, psychological, risk, compromising, exploitative, genetically, interstate, replicate, emerges, therefore, sic, mind, underprivileged, genuine, tailored, lacks, pornographic, exclude, apprehended, logically, incomplete, must, guaranteed, ignored, observational, vested, epistemological, vain, verify, impaired, genetic, curtailed, hanging, endure, ca, diminished, blame, nonviolent, questionable, bolster, discounted, reinforcing, leaping, naive, satisfying, obscene, subordinated, analogous, drinking, entails, inadequate, sufficiently, attributable, expire, offended, adversely, occurring, incredibly, exist, revitalize, accelerate, exempt, stems, neutral, compromised, expressly, therein, rational, complementary, boring, rhetorical, amounted, genuinely, burning, vague, existential, spying, intentionally, proletarian, applicable, marital, depressive, authentic, ate, denies, creed, objective, horrible, disruptive, reproduce, superficial, alive, productive

## 7. Query matches – per topic

A table of all topics used as development and test sets along with their respective query matches.

Topic	Main Concept	Motion Set	#MC Matches	#that-MC Matches	#that-MC-CL
Video game controversies	Video game controversies	Development	1113	143	28
Doping in sport	Doping in sport	Development	5560	925	140
Boxing	Boxing	Development	74959	3810	301
Freedom of speech	Freedom of speech	Development	36818	6087	1318
Intellectual property	Intellectual property	Development	14147	1607	255
Endangered species	Endangered species	Development	16669	1142	94
Gaza War (2008,??09)	Gaza War (2008,??09)	Development	1041	131	8
Tower block	Tower block	Development	9635	422	35
Blasphemy	Blasphemy	Development	2985	532	109
Holocaust denial	Holocaust denial	Development	1851	321	81
Private university	Private university	Development	4025	153	14
Association of Southeast Asian Nations	Association of Southeast Asian Nations	Development	2364	171	33
Free market	Free market	Development	4826	964	215
Child actor	Child actor	Development	1958	66	5
Religion	Religion	Development	166379	23028	4388
Plastic surgery	Plastic surgery	Development	4983	504	71
Same-sex marriage	Same-sex marriage	Development	102199	11244	2151
Reality television	Reality television	Development	19703	1139	111
Internet censorship	Internet censorship	Development	3245	523	57
Socialism	Socialism	Development	29785	3650	763
Beauty pageant	Beauty pageant	Development	12162	416	84
Vegetarianism	Vegetarianism	Development	6101	640	95
Libertarianism	Libertarianism	Development	4919	529	107
Internet	Internet	Development	108302	11635	1672
Science	Science	Development	164299	15408	3200
Suicide	Suicide	Development	46658	8235	1285
Nationalism	Nationalism	Development	76324	7552	1087
Atomic bombings of Hiroshima and Nagasaki	Atomic bombings of Hiroshima and Nagasaki	Development	11441	1075	130
Television	Television	Development	147875	9039	929
Casino	Casino	Development	14582	1125	134
Age of consent	Age of consent	Development	2088	282	74
Higher education	Higher education	Development	60811	5753	880
Organic food	Organic food	Development	2133	216	41
Standardized test	Standardized test	Development	2460	274	48
Urbanization	Urbanization	Development	14009	1079	145
Extreme sport	Extreme sport	Development	1390	70	7
Direct democracy	Direct democracy	Development	10902	1631	448
Instant-runoff voting	Instant-runoff voting	Development	1564	142	24
Lottery	Lottery	Development	6124	564	77
Homeschooling	Homeschooling	Development	7222	653	76
Guantanamo Bay detention camp	Guantanamo Bay detention camp	Development	3565	743	215
Insanity defense	Insanity defense	Development	1770	394	91
Newspaper	Newspaper	Development	107511	5297	506
Illegal immigration	Illegal immigration	Development	8090	1712	287
Renewable energy	Renewable energy	Development	10677	1248	163
Coral reef	Coral reef	Development	7241	486	67
Daylight saving time	Daylight saving time	Development	812	78	11
NASA	NASA	Development	21686	1299	196
Geothermal energy	Geothermal energy	Development	1199	96	11
Generic drug	Generic drug	Development	1419	138	29

Electoral College (United States)	Electoral College (United States)	Development	7713	501	63
Nuclear weapon	Nuclear weapon	Development	55722	8368	1636
Hacker (computer security)	Hacker (computer security)	Development	11863	1747	326
Speed limit	Speed limit	Development	5407	427	75
Randomized controlled trial	Randomized controlled trial	Development	3874	405	101
Global warming	Global warming	Development	9024	2146	583
Assisted suicide	Assisted suicide	Development	1743	263	50
Anarchism	Anarchism	Development	14034	1505	314
United Nations	United Nations	Development	56321	5336	828
Public broadcasting	Public broadcasting	Development	10734	649	70
Trade union	Trade union	Development	89956	7796	1308
Hate speech	Hate speech	Development	3889	914	172
Energy development	Energy development	Development	5360	640	103
Quebec sovereignty movement	Quebec sovereignty movement	Development	1258	215	44
Child labour	Child labour	Development	12306	1381	241
Pride parade	Pride parade	Development	2202	177	34
Parental leave	Parental leave	Development	1814	167	15
Tabloid journalism	Tabloid journalism	Development	2500	217	43
UNESCO	UNESCO	Development	10012	370	25
Paralympic Games	Paralympic Games	Development	4474	201	8
National Rifle Association	National Rifle Association	Development	2039	134	20
Chain store	Chain store	Development	10004	546	27
Habitat for Humanity	Habitat for Humanity	Development	1067	39	3
Public art	Public art	Development	3318	134	8
IKEA	IKEA	Development	1004	72	5
Online advertising	Online advertising	Development	2052	207	20
Mixed-use development	Mixed-use development	Development	4227	202	16
Second Life	Second Life	Development	1526	157	17
Greyhound racing	Greyhound racing	Development	1568	80	3
Israeli disengagement from Gaza	Israeli disengagement from Gaza	Development	2121	272	32
Single parent	Single parent	Development	4031	288	50
Private military company	Private military company	Development	731	86	13
Coaching	Coaching	Development	4285	249	26
Economic sanctions	Economic sanctions	Development	1676	240	51
Diaper	Diaper	Development	1364	160	23
PayPal	PayPal	Development	1143	109	11
Internet Archive	Internet Archive	Development	1204	42	5
Vietnam War	Vietnam War	Development	34132	2936	364
2003 invasion of Iraq	2003 invasion of Iraq	Development	10139	1432	218
Virtual reality	Virtual reality	Development	7789	763	111
HTTP cookie	HTTP cookie	Development	1027	144	30
Animal slaughter	Animal slaughter	Development	1522	210	42
Magnet school	Magnet school	Development	2808	122	12
Strike action	Strike action	Development	35957	3808	595
Corporate tax	Corporate tax	Development	1472	203	32
Student loan	Student loan	Development	1250	146	22
YouTube	YouTube	Development	28527	1591	132
Division of labour	Division of labour	Development	9546	897	162
Ecotourism	Ecotourism	Development	2376	142	16
Academic freedom	Academic freedom	Development	1013	203	45

Affirmative action brings more good than harm	Affirmative action	Test	1559	306	79
We should ban gambling	Gambling	Test	22048	2972	541
We should abolish the monarchy	Monarchy	Test	39611	4156	684
Atheism is the only way	Atheism	Test	7556	1227	299
We should further exploit wind power	Wind power	Test	4786	466	87
We should legalize polygamy	Polygamy	Test	7991	876	173
We should further exploit hydroelectric dams	Hydroelectricity	Test	11843	801	93
We should privatize water supply	Water supply	Test	12171	1062	168
We should legalize prostitution	Prostitution	Test	29121	4066	792
Zoos bring more harm than good	Zoo	Test	10579	654	73
Private education brings more good than harm	Private school	Test	12237	604	71
Recall elections are beneficial	Recall election	Test	1813	182	33
We should further exploit nuclear power	Nuclear power	Test	8251	1273	319
We should abolish temporary employment	Temporary work	Test	1533	180	38
Surrogacy should be banned	Surrogacy	Test	1340	164	47
Progressive tax is beneficial	Progressive tax	Test	1073	141	44
We should ban alcoholic beverages	Alcoholic beverage	Test	13458	2022	499
We should ban abortions	Abortion	Test	14438	3800	1091
Astrology brings more harm than good	Astrology	Test	4756	677	159
Embryonic stem cell research brings more good than harm	Embryonic stem cell	Test	1194	183	31
We should abolish the Olympic Games	Olympic Games	Test	25977	1215	77
We should end athletic scholarships	Athletic scholarship	Test	2473	111	8
Social media does more harm than good	Social media	Test	7423	901	124
We should disband the United Nations Security Council	United Nations Security Council	Test	10457	1035	289
Manned spaceflights bring more good than harm	Human spaceflight	Test	6885	545	106
Extra-curricular activity is beneficial	Extracurricular activity	Test	3909	205	5
We should legalize insider trading	Insider trading	Test	1104	241	50
We should prohibit hydraulic fracturing	Hydraulic fracturing	Test	1836	277	75
We should prohibit corporal punishment	Corporal punishment	Test	2758	469	124
Homework does more harm than good	Homework	Test	989	110	15
We should disband NATO	NATO	Test	11324	1274	286
We should abolish the two-party system	Two-party system	Test	2258	316	46
Capital punishment brings more harm than good	Capital punishment	Test	131080	15773	2339
We should abolish term limits	Term limit	Test	3889	508	95
We should protect whistleblowers	Whistleblower	Test	2265	354	85
Twitter brings more harm than good	Twitter	Test	14668	1487	199
ISO brings more harm than good	International Organization for Standardization	Test	3970	381	52
Conscientious objectors are justified	Conscientious objector	Test	1655	176	41
The American Bar Association brings more harm than good	American Bar Association	Test	1887	112	27
Digital rights management brings more harm than good	Digital rights management	Test	2571	486	112
We should ban the Church of Scientology	Church of Scientology	Test	1410	222	46
eBay brings more good than harm	EBay	Test	7997	606	65
We should abolish the caste system in India	Caste system in India	Test	1199	151	20
We should abolish infant baptism	Infant baptism	Test	835	134	45
EHRs bring more harm than good	Electronic health record	Test	1054	135	16
Wildlife management brings more good than harm	Wildlife management	Test	1734	172	17
We should tax plastic bags	Plastic bag	Test	1490	119	27
The energy industry should be nationalized	Energy industry	Test	1823	137	20
We should adopt economic regionalisation	Protectionism	Test	10314	2213	402
We should limit genetic testing	Genetic testing	Test	2578	403	119