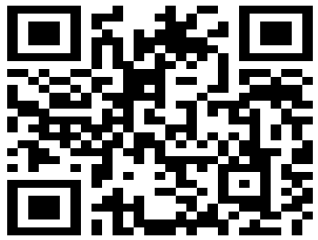
The Quest to Automate Fact-checking

Chengkai Li
University of Texas at Arlington

MetroCon, October 26, 2017



https://idir.uta.edu/claimbuster

Innovative Database and Information Systems Research Laboratory

iDiR
idir.uta.edu

Chengkai Li, Associate Professor and Associate Chair

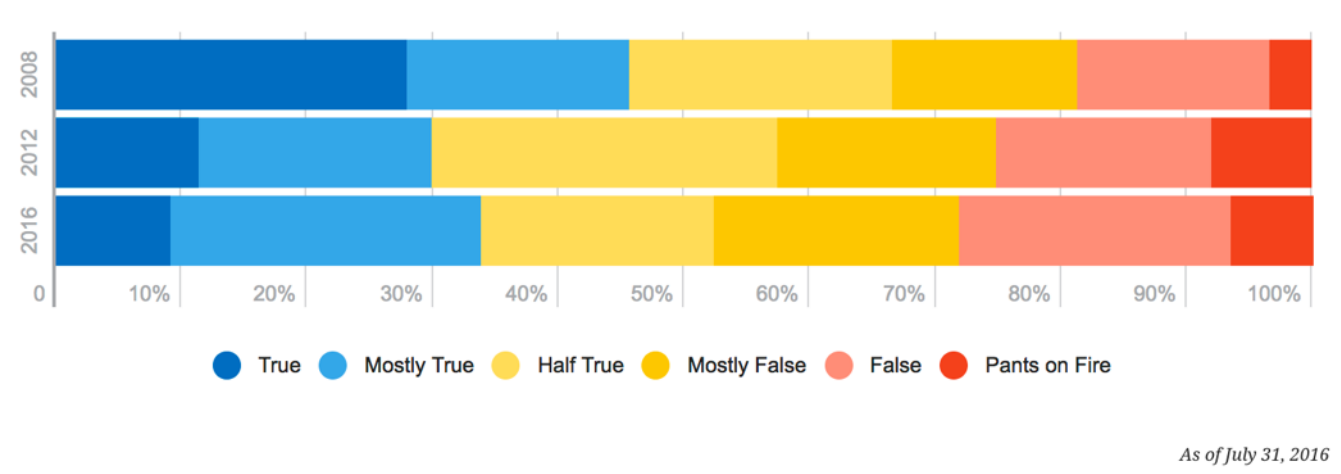
Research areas

- Big Data Intelligence and Data Science (Database, Data Mining, Natural Language Processing)

Research directions

- computational journalism, computational fact-checking
- crowdsourcing and human computation
- cybersecurity, social bots
- data exploration by ranking/skyline/preference queries
- graph database usability, knowledge graphs

Politicians Make False and Misleading Claims



Fact-checks on major party presidential nominees.
Source: PolitiFact.com

National Security Threats

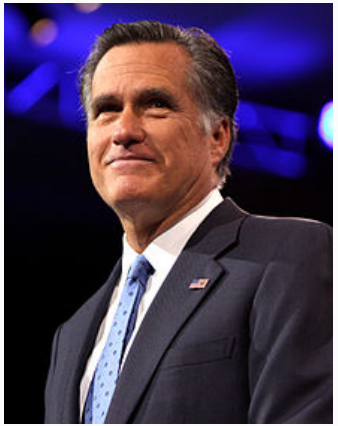
- Fake-news floods social media ("filter bubbles" and "echo chambers").
  - Facebook trending topic algorithms promoted fake-news.
  - A sample of 140,000 Twitter users in the battleground state of Michigan shared as many junk news items as professional news during the final ten days of the 2016 election. http://politicalbots.org/?p=1064
  - Russian government interfered with the 2016 election. Fake-news websites and bots used.
  - Pizzagate: conspiracy theory led to shooting

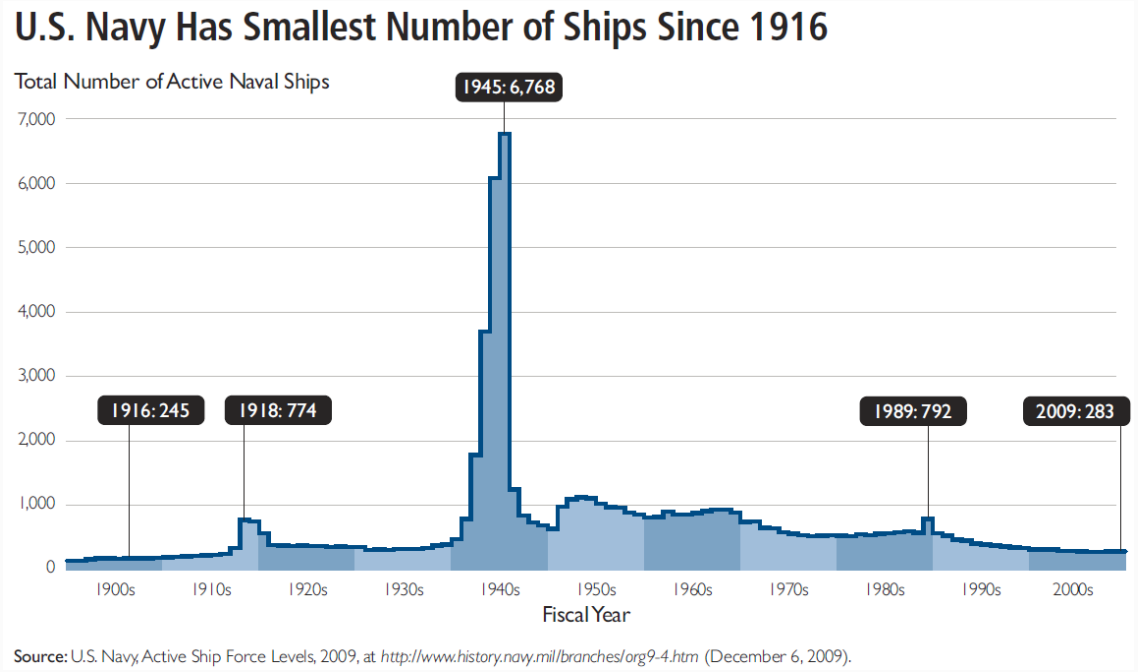
Combating Falsehoods

- 100+ active fact-checking sites in 2017 (PolitiFact.com, FullFact.org, CNN, Washington Post, New York Times, …)
- Google and Bing include fact-checks in search results.
- Facebook lets users report false items and flags items disputed by fact-checkers.

Fact-checking is Hard

"… our Navy is smaller than it's been since 1917", said Republican candidate Mitt Romney in third presidential debate in 2012.

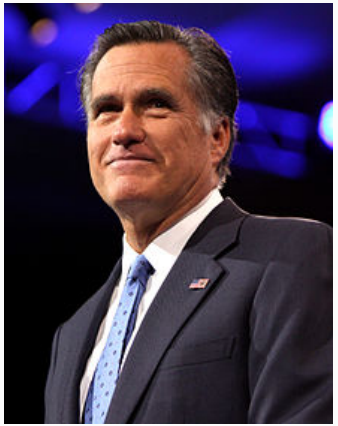




http://en.wikipedia.org/wiki/Mitt_Romney
http://s3.amazonaws.com/thf_media/2010/pdf/Military_chartbook.pdf

Fact-checking is Hard

"… our Navy is smaller than it's been since 1917", said Republican candidate Mitt Romney in third presidential debate in 2012.



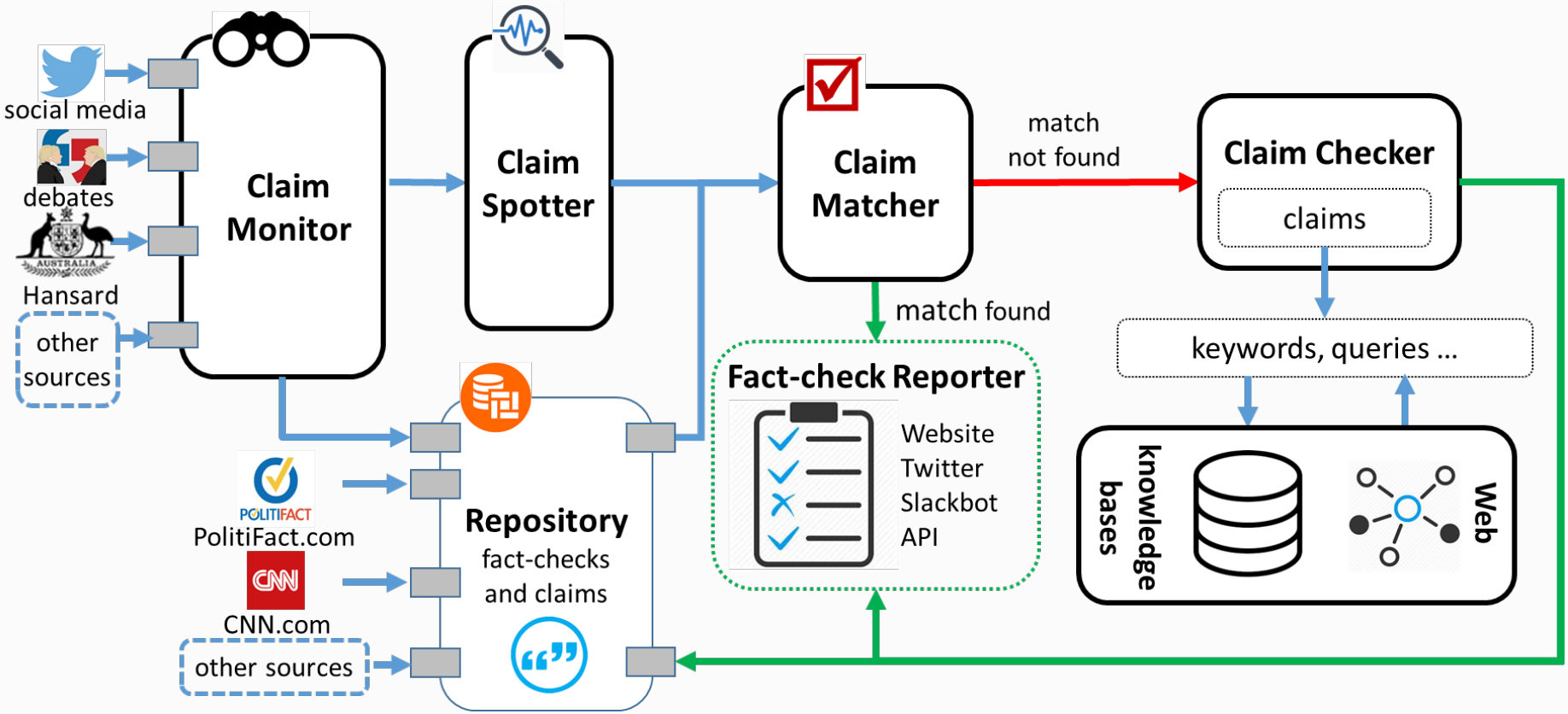
VS

http://en.wikipedia.org/wiki/Mitt_Romney
http://s3.amazonaws.com/thf_media/2010/pdf/Military_chartbook.pdf
http://en.wikipedia.org/wiki/United_States_Navy

Demanding Task vs. Lack of Automated Tools

The Holy Grail: Automated, Live Fact-Checking

ClaimBuster: The First-ever End-to-end System



ClaimBuster: Automated Live Fact-checking

Enter Your Own Text

2016 U.S. Presidential Debates

Hansard: Parliament of Australia

ClaimBuster API

ClaimBuster Slackbot

End-to-end Fact-checking (beta)

Tweets by @ClaimBusterTM

ClaimBuster Retweeted

Linda McMahon @SBALinda

The U.S. has 29 million small businesses & nearly 867,000 of them are in #Michigan. Almost ALL businesses in Michigan, 99.6% are #SmallBiz.

Aug 8, 2017

ClaimBuster Retweeted

Governor Walker @GovWalker

Since 2013, Kenosha County has seen nearly $1 billion in capital investment – creating over 6,000 jobs!

Embed View on Twitter

ClaimBuster automated live fact-checking

Data Collection Press Acknowledgement

ON AIR

2016 Third Presidential Debate Live. Oct. 19, 2016, 9 p.m. EST

Paticipants: Donald Trump, Hillary Clinton
Moderators: Chris Wallace

2016 Third Presidential Debate. Oct. 19, 2016, 9 p.m. EST

Paticipants: Hillary Clinton, Donald Trump
Moderators: Chris Wallace

2016 Second Presidential Debate. Oct. 9, 2016, 9 p.m. EST

Paticipants: Hillary Clinton, Donald Trump
Moderators: Martha Raddatz, Anderson Cooper, Chris Wallace

2016 Vice Presidential Debate. Oct. 4, 2016, 9 p.m. EST

Paticipants: Tim Kaine, Mike Pence, Hillary Clinton, Donald Trump
Moderators: Elaine Quijano, Martha Raddatz, Anderson Cooper

2016 First Presidential Debate. Sep. 26, 2016, 9 p.m. EST

Paticipants: Hillary Clinton, Donald Trump
Moderators: Lester Holt

2016 Democratic Party Presidential Debate. April 14, 2016, 9 p.m. EST

Paticipants: Bernard Sanders, Hillary Clinton, Donald Trump

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2016 Third Presidential Debate. Oct. 19, 2016, 9 p.m. EST

Chronological Order | Order by Score

Least Check-worthy >=0.1 >=0.2 >=0.3 >=0.4 >=0.5 >=0.6 >=0.7 >=0.8 >=0.9 >=1.0 Most Check-worthy

is tougher. But they know what's going on. They know it better than anybody. They want strong borders. They feel we have to have strong borders. I was up in New Hampshire the other day. The biggest complaint they have -- it's with all of the problems going on in the world, many of the problems caused by Hillary Clinton and by Barack Obama. All of the problems -- the single biggest problem is heroin that pours across our southern border. It's just pouring and destroying their youth. It's poisoning the blood of their youth and plenty of other people. We have to [Fact-check this] ders. We have to keep the drugs out of our country. We are -- right now, we're getting the drugs, they're getting the cash. We need strong borders. We need absolute -- we cannot give amnesty. Now, I want to build the wall. We need the wall.

Claim Checker - Knowledge Bases

Consulting the knowledge bases produced the following results:

Truth Rating Indeterminable

Question Asked
What is all of the problems-- the single biggest problem?

Response Recieved
The single biggest problem in communication is the illusion that it has ...

Claim Matcher

We found the following claims which have been professionally fact-checked. Check them out!

Truth Rating True

Claim
"Heroin .. pours across our southern borders."

Speaker Donald Trump

URL politifact

Truth Rating True

Claim Checker - Search Engine

We found the following information after processing some search engine results:

All of the problems -- the single biggest problem is heroin that pours across our southern border. It's just pouring and destroying their youth.

Similarity Rating 0.8320502943378437

URL source

"I was up in New Hampshire the other day," Trump said in the debate. "The biggest

GENIUS

FILTER BY All Annotations

The biggest complaint they have -- it's with all of the problems going on in the world, many of the problems caused by Hillary Clinton and by Barack Obama

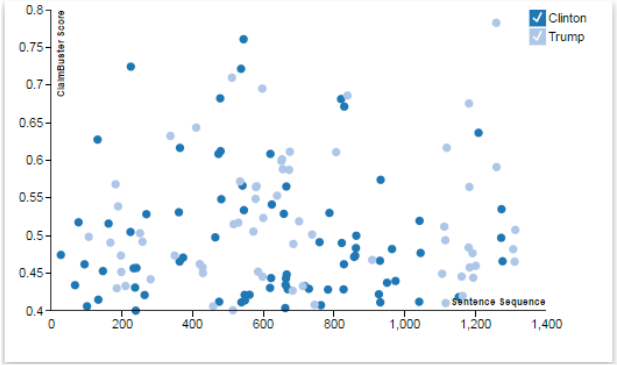
JosueCaraballo 17d

Is that true? What is the source?

report abuse

Upvote

Add a comment



CLAIM TO CHECK | Drinking champagne could help prevent Alzheimer's and other forms of dementia.

Claim Checker - Knowledge Bases

Consulting the knowledge base produced the following results:

INCLUDE THIS IN REPORT ☐

Question: What could help prevent Alzheimer's and other forms of dementia?

Google Answer Box: People also ask

Details

Claim Matcher

We found the following claims which have been professionally fact-checked. Check them out!

INCLUDE THIS IN REPORT ☐

RATING False

CLAIM

Drinking champagne could help prevent Alzheimer's and other forms of dementia.

URL politifact

INCLUDE THIS IN REPORT ☐

RATING false

CLAIM

Red Bull and other brands of energy drinks contain bull semen.

URL snopes

Claim Checker - Search Engine

We found the following information after processing some search engine results:

INCLUDE THIS IN REPORT ☐

Nov 9, 2015 - Scientists have found that drinking three glasses of champagne every day can help to prevent the onset of dementia and Alzheimer's.

SIMILARITY RATING 0.556

URL cosmopolitan

INCLUDE THIS IN REPORT ☐

Sep 1, 2016 - Drinking champagne may help prevent dementia and Alzheimer's ... other things, the neurotransmitters essential for memory recall can function ...

SIMILARITY RATING 0.554

URL nowtolove.com

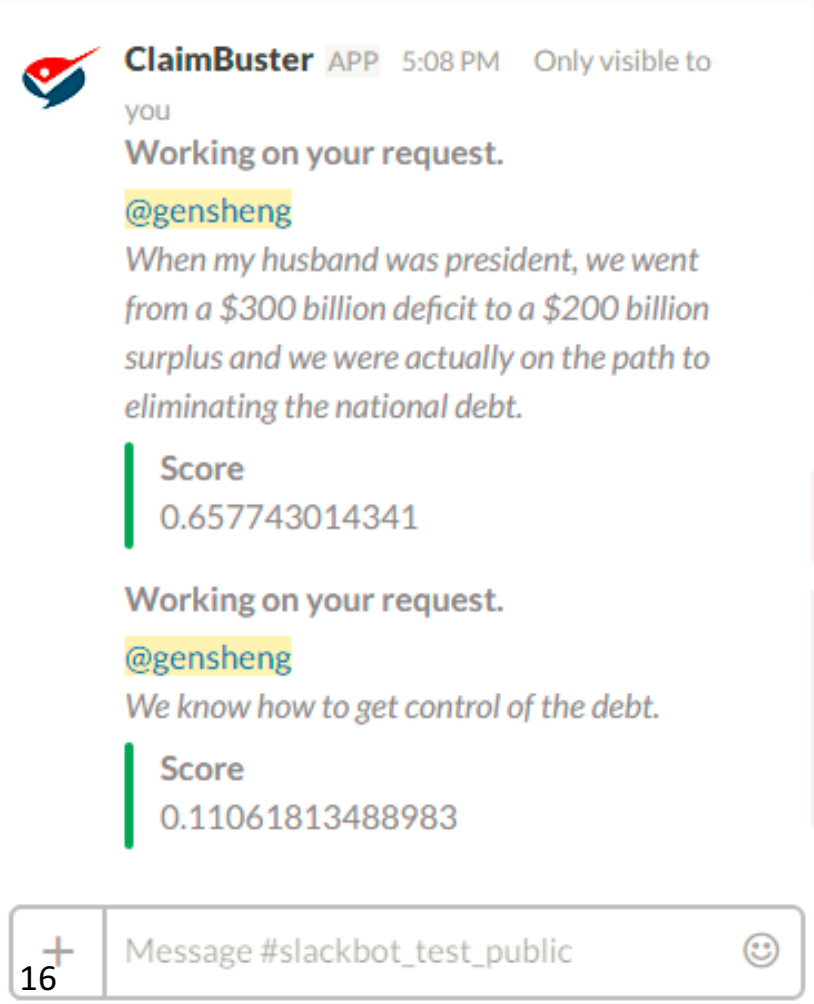
Generate a report from selected evidence

ClaimBuster API Documentation

apidocs : ClaimBuster API

Show/Hide | List Operations | Expand Operations | Raw

GET	/all/{claim}	All
GET	/se/{claim}	Claim Checker - Search Engine
GET	/fm/{claim}	Claim Matcher
GET	/kb/{claim}	Claim Checker - Knowledge Bases
GET	/score_text/{text}	Claim Spotter - Get Score
GET	/score_url/{url}	Claim Spotter - Get Score URL



ClaimBuster + Slack

ClaimBuster provides a platform for you to evaluate pieces of text and identify sentences that are check-worthy. This is our first step in our long-term goal of automating fact-checking. Our Slack app allows you to score individual sentences using the `/getscore claim` command, create a Dropbox folder on our servers using the `/createfolder e-mail` command, store text files from the web into your assigned Dropbox folder for future processing on our servers using the `/processfile e-mail file-url` command, and submit feedback to help us keep improving our services using the `/claimbusterfeedback message` command.

Add to Slack

Finding Important Factual Claims: A Supervised Learning Task

2016 Presidential Debates

Human Annotation

Presidential Debate Transcripts (1960-2012)

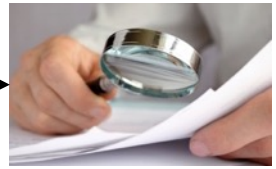
Ground Truth

Feature Extraction

Feature Vectors

Learning Algorithm

CLAIMBUSTER



Important factual claims

Dataset: Presidential Debate Transcripts

- Source: http://www.debates.org/index.php?page=debate-transcripts
- All 30 debates (11 general elections) in history: 1960, 1976—2012
- 20k sentences by presidential candidates: removed very short (< 5 words) sentences

Classification and Ranking by Check-worthiness

CFS: Important factual claims

"We spend less on the military today than at any time in our history." "The President's position on gay marriage has changed." "More people are unemployed today than four years ago."

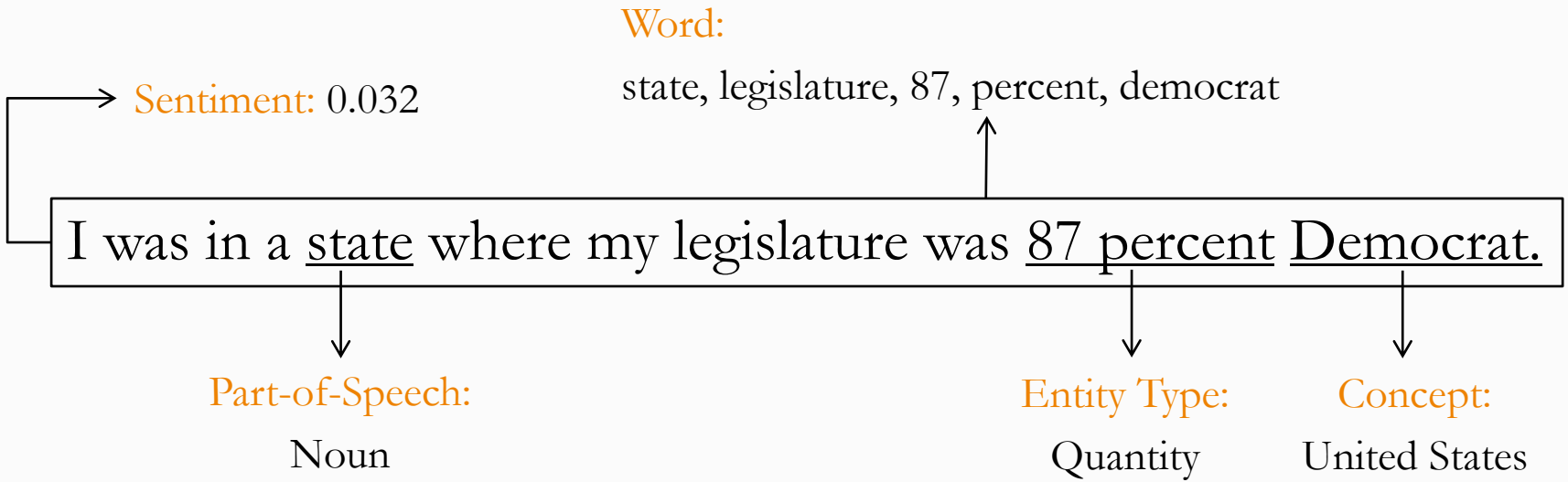
UFS: Unimportant factual claims

"I was in Iowa yesterday." "My mother enjoys cooking." "I ran for President once before."

NFS: No factual claims (opinions, questions & declarations)

"Iran must not get nuclear weapons." "7% unemployment is too high." "My opponent is wishy-washy." "I will be tough on crime." "Why should we do that?" "Hello, New Hampshire!" "Our plan is to reduce tax rate by 10%."

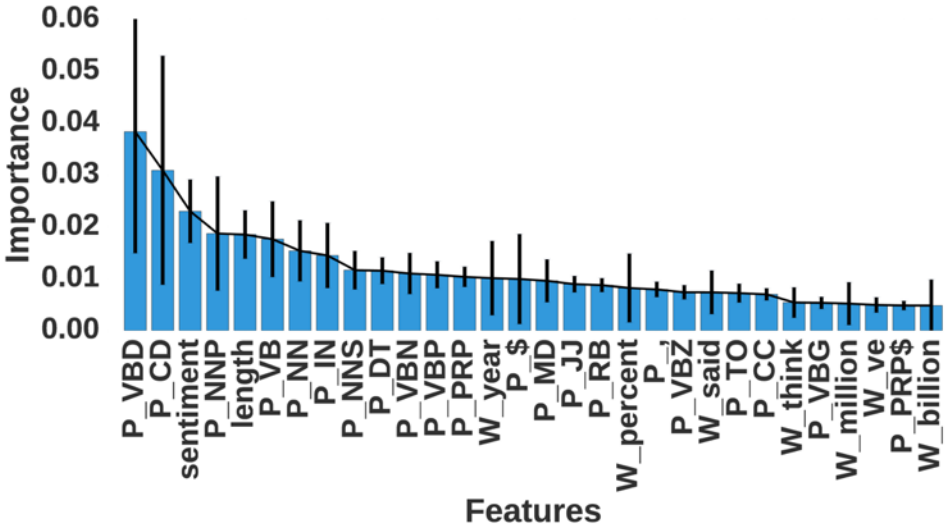
Feature Extraction



Sentiment: [-1.0 to 1.0]
Word: tf-idf scores of 6130 words (excluding rare words)
POS Tag: 43 tags
Entity Type: 26 types

Feature Importance

- 6615 features in total
- Used a Random Forest Classifier to calculate the importance of each feature.



Word	percent; people; jobs
POS Tag	noun; cardinal number; past tense; preposition
Entity Type	Quantity; Country; FieldTerminology; Person
Concept	United States Senate; Barack Obama
Sentiment	

Classification Accuracy

Class Totals	
Non-factual Statement (NFS)	5894
Unimportant Factual Statement (UFS)	485
Contains a Factual Statement (CFS)	1849

Algorithm	Features	P NFS	P UFS	P CFS	P AVG*	R NFS	R UFS	R CFS	R AVG*	F NFS	F UFS	F CFS	F AVG*
SVM	Parts of Speech	**0.873**	0.430	**0.724**	**0.813**	**0.925**	**0.240**	**0.671**	**0.827**	**0.898**	**0.307**	**0.696**	**0.818**
CNN	Google News[1]	0.874	**0.649**	0.775	0.838	**0.951**	0.250	**0.725**	**0.859**	0.911	0.361	0.749	0.842
RNN	GLoVE[2]	**0.900**	**0.397**	**0.811**	**0.853**	0.928	**0.457**	0.712	0.852	**0.914**	**0.425**	**0.758**	**0.851**

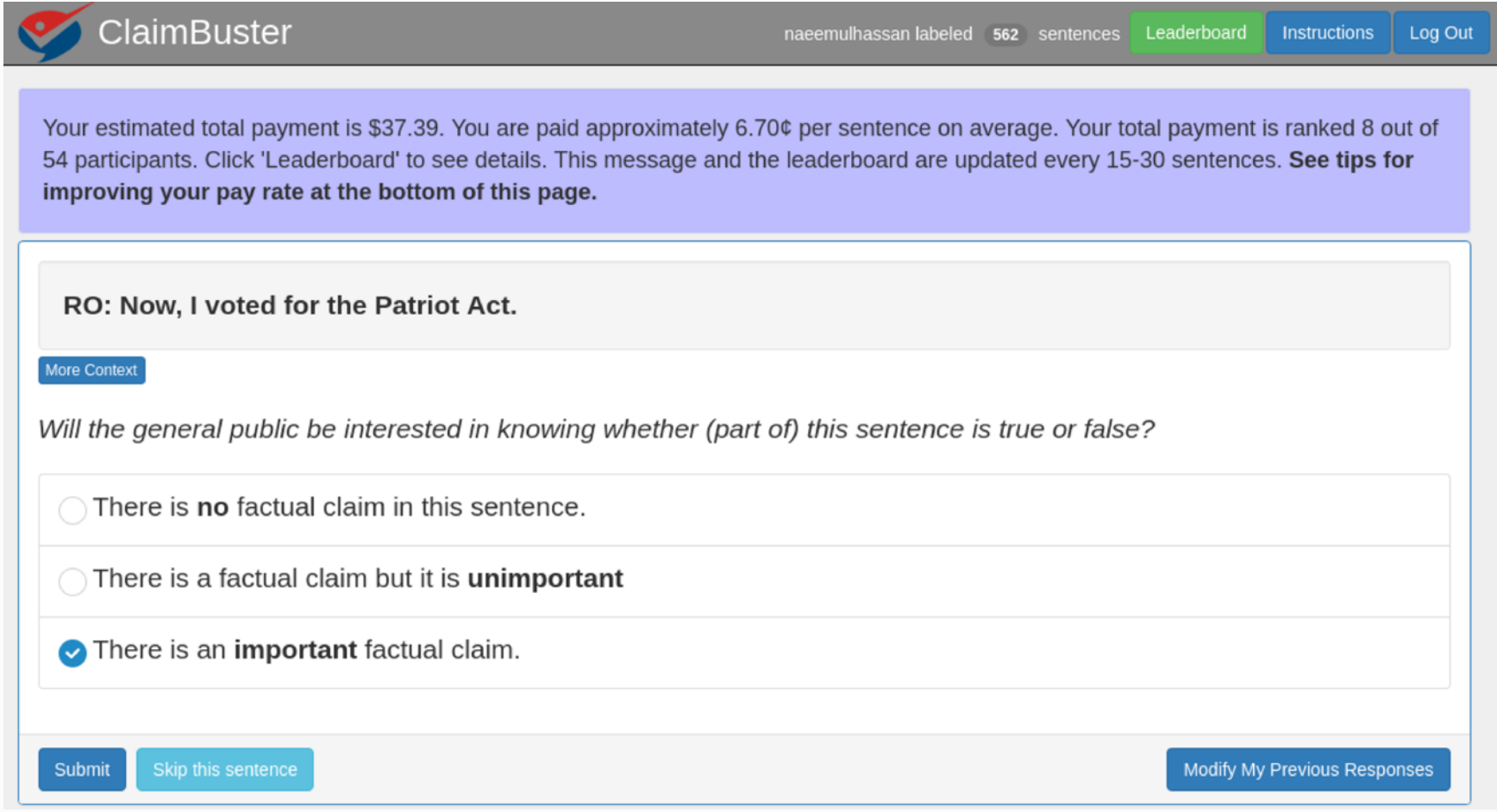
P: Precision | R: Recall | F: F1-Score

*: Average (AVG) is weighted based on the distribution of the number of labels in each class.

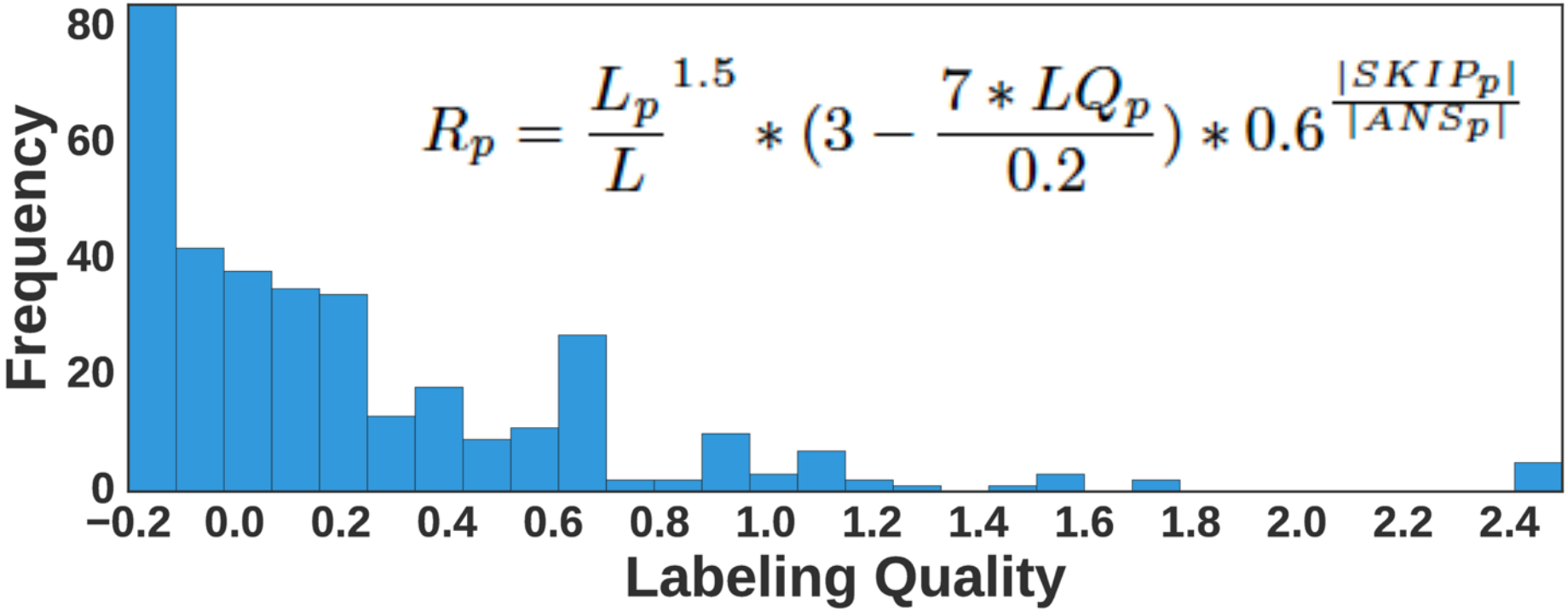
1: Pre-trained vectors trained on part of Google News dataset (about 100 billion words). The model contains 300-dimensional vectors for 3 million words and phrases. https://code.google.com/archive/p/word2vec/

2: Global Vectors for Word Representation using The Common Crawl corpus which contains petabytes of data collected over the last 7 years. https://nlp.stanford.edu/projects/glove/

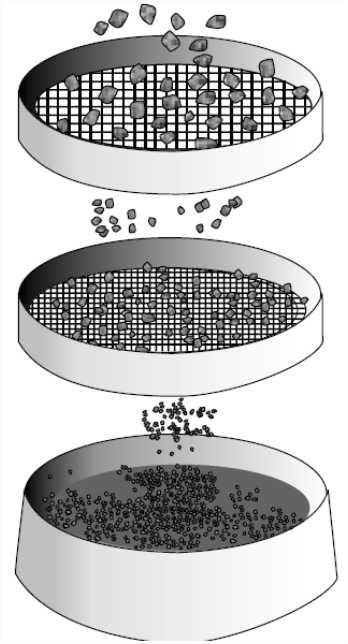
Our Own CrowdFlower



Coder Quality



Ground Truth Collection



20788 sentences

374 coders

76552 labels

86 top-quality coders

52333 labels

Majority voting

20617 admitted sentences

- 20788 sentences
- 20 months, 374 coders, ~$4,000 paid
- 30 training sentences
- 1032 screening sentences (731 NFS, 63 UFS, 238 CFS) to detect spammers & low-quality coders

Class	Count	Percentage
CFS	4849	23.52%
UFS	2097	10.17%
NFS	13671	66.31%

http://www.engineersdaily.com/2014/03/basics-of-soil-compaction.html

Examples of Challenging Cases

- "But everybody's affected by the debt because of the tremendous interest that goes into paying on that debt everything's more expensive."

- "And General Brown has indicated uh – his apology, his regrets, and I think that will, uh - in this situation, settle the matter."

Case Study: 2016 U.S. Presidential Election Debates

Table 6: Score differences between sentences fact-checked and those not chosen for checking

Platforms	avg(YES)	avg(NO)	t-value	p-value
CNN	0.433	0.258	21.137	1.815E-098
PolitiFact	0.438	0.258	16.362	6.303E-060

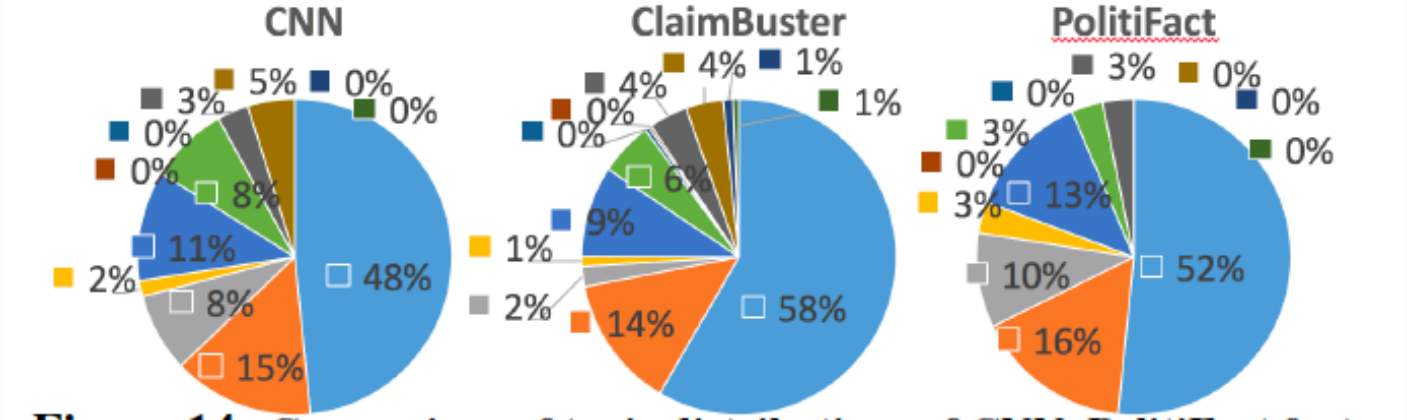
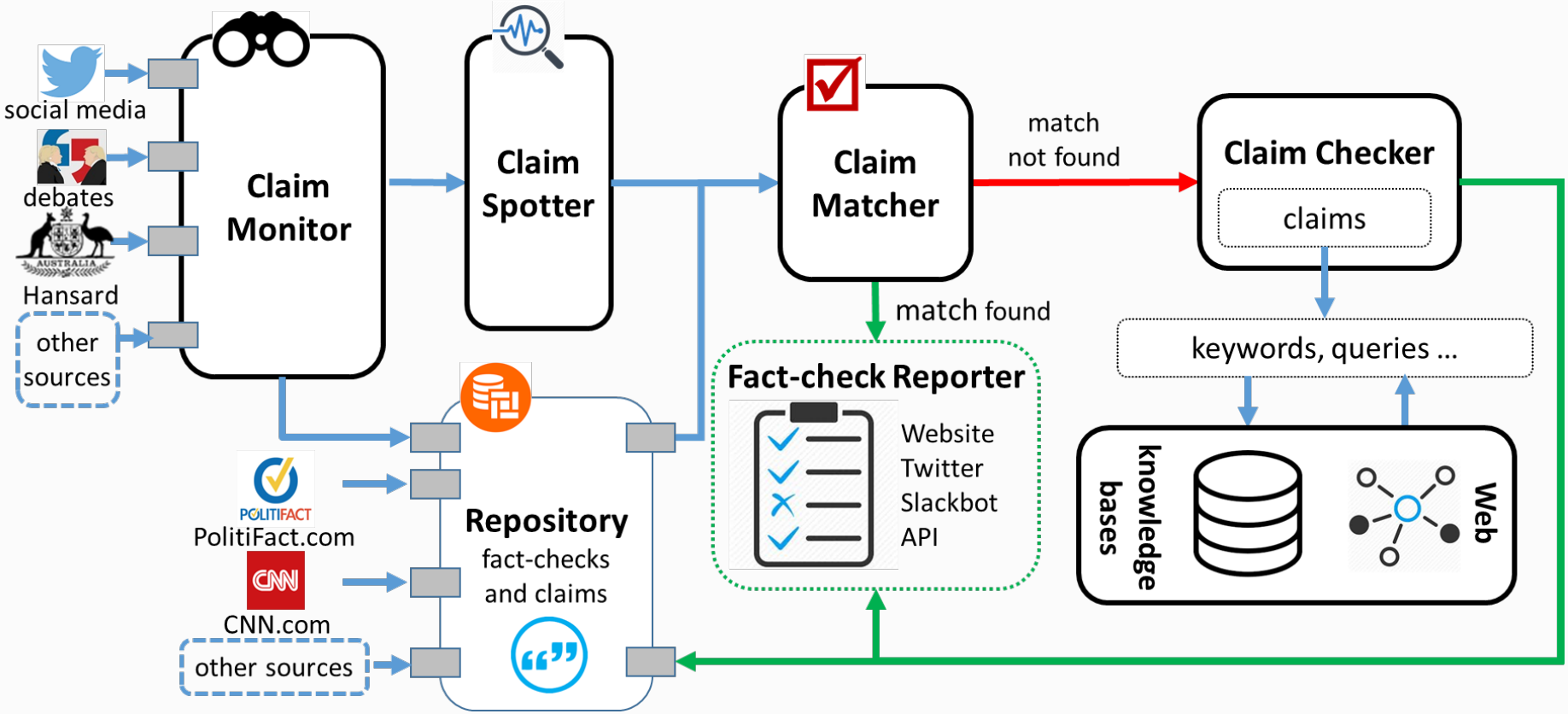


Figure 14: Comparison of topic distributions of CNN, PolitiFact fact-checked sentences and sentences scored high (≥ 0.5) by ClaimBuster

ClaimBuster: The First-ever End-to-end System



Ongoing Development

Front end: Claim portal

- Repository of claims (social media, congressional record, news article)
- Taxonomy
- Structured Analysis
- Search and browsing interface
- Analytics

Back end: Claim understanding and algorithmic fact-checking

- Claim representation and semantics
- Claim-to-query translation
- Question answering
- Claim exceptionality/rebustness

Collaborators

Current/Former UTA Students

- Fatma Arslan
- Josue Caraballo
- Naeemul Hassan
- Damian Jimenez
- Gensheng Zhang
- Siddhantsanjeev Gawsane
- Shohedul Hasan
- Minumol Joseph
- Aaditya Kulkarni
- Anil Kumar Nayak
- Vikas Sable

Collaborators

- Bill Adair (Duke)
- Pankaj Agarwal (Duke)
- Peter Frays (University of Technology Sydney)
- James Hamilton (Stanford)
- Mark Tremayne (UTA)
- You Wu (Google)
- Jun Yang (Duke)
- Cong Yu (Google)

Funding Sponsors

Craig Newmark Foundation

- NSF IIS #1719054
- Duke Tech & Check Cooperative
- NSF I-Corps Teams #1565699
- Knight Prototype Fund
- NSF IIS Medium #1408928

In the Press

AP
Associated Press

The Washington Post

theguardian

The Dallas Morning News

Star-Telegram

THE SHORTHORN
UT-ARLINGTON'S MAIN NEWS SOURCE SINCE 1919

CUNY GRADUATE SCHOOL OF JOURNALISM
TOW-KNIGHT CENTER FOR
ENTREPRENEURIAL JOURNALISM

journalism
.co.uk

SXSW

Poynter.
A global leader in journalism

NiemanReports

POLICY
OPTIONS
POLITIQUES

MEDIASHIFT

FIRST DRAFT

NewStatesman

PLAID ZEBRA

TechXplore

WIRED

New
Scientist

NEW ATLAS

ZDNet Korea

EurekAlert!
The Global Source for Science News
AAAS

Austin
American-
Statesman

the FACT-
CHECKING
PROJECT
AMERICANPRESS
institute

NORDIC APIS

Botminator: Automated Detection of Fake-news Bots

Objective

- discover social bots that publish and spread fake news

Recently funded by the Texas National Security Network

Interdisciplinary Approach

- Social network, graph, and text mining
- Code analysis
- News content and effect analysis