

A Stylometric Inquiry into Hyperpartisan and Fake News



Martin Potthast*, **Johannes Kiesel**[†], Kevin Reinartz[†], Janek Bevendorff[†], Benno Stein[†]

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webis.de

ACL, July 16th, 2018





Donald J. Trump

@realDonaldTrump

Follow



....it is very possible that those sources don't exist but are made up by fake news writers.
#FakeNews is the enemy!

5:45 AM - 28 May 2017

12,418 Retweets 56,686 Likes



19K



12K



57K



What are Fake News?

Disinformation displayed as news articles

What are Fake News?

Disinformation displayed as news articles

FIRSTDRAFT

7 TYPES OF MIS- AND DISINFORMATION



SATIRE OR PARODY

No intention to cause harm but has potential to fool



MISLEADING CONTENT

Misleading use of information to frame an issue or individual



IMPOSTER CONTENT

When genuine sources are impersonated



FABRICATED CONTENT

New content is 100% false, designed to deceive and do harm



FALSE CONNECTION

When headlines, visuals or captions don't support the content



FALSE CONTEXT

When genuine content is shared with false contextual information



MANIPULATED CONTENT

When genuine information or imagery is manipulated to deceive

Image: Claire Wardle, First Draft

What are Fake News?

Disinformation displayed as news articles

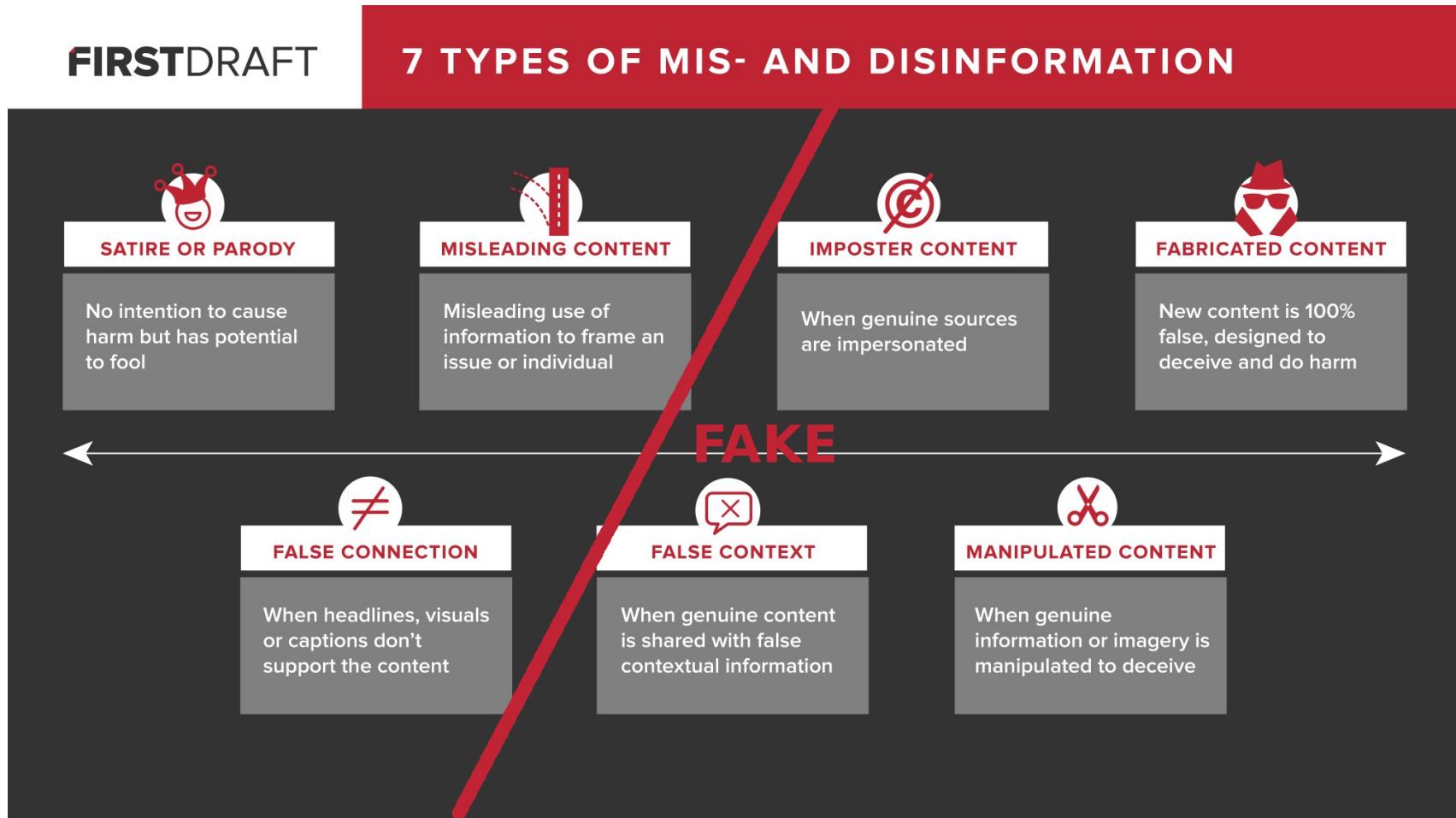


Image: Claire Wardle, First Draft

A Stylometric Inquiry into Hyperpartisan “News” and “News” in False Context and/or with Content that is Impostered, Manipulated, and/or Fabricated



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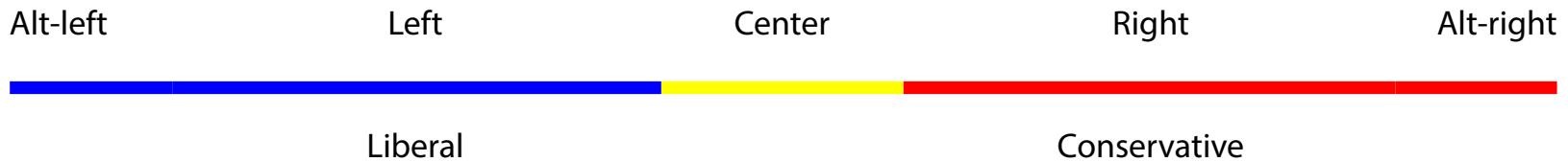
The Political Spectrum

The left-right political spectrum is a system of classifying political positions, ideologies and parties. Left-wing politics and right-wing politics are often presented as opposed, although either may adopt stances from the other side. [\[Wikipedia\]](#)



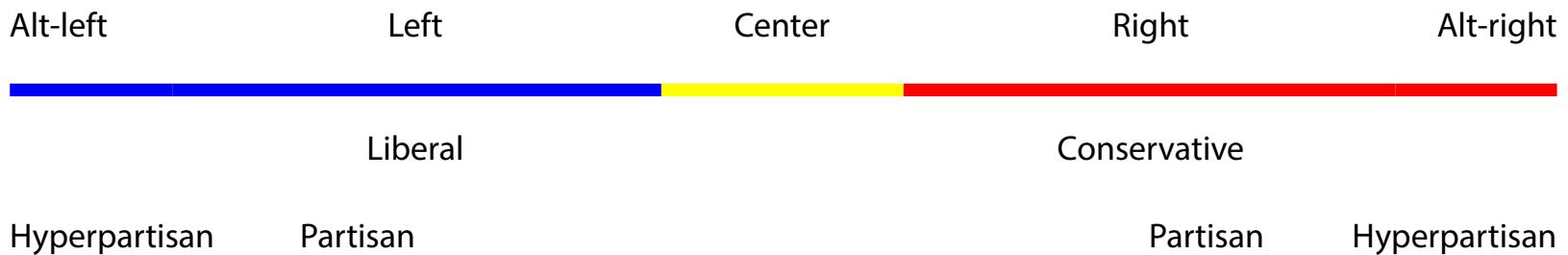
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The Political Spectrum

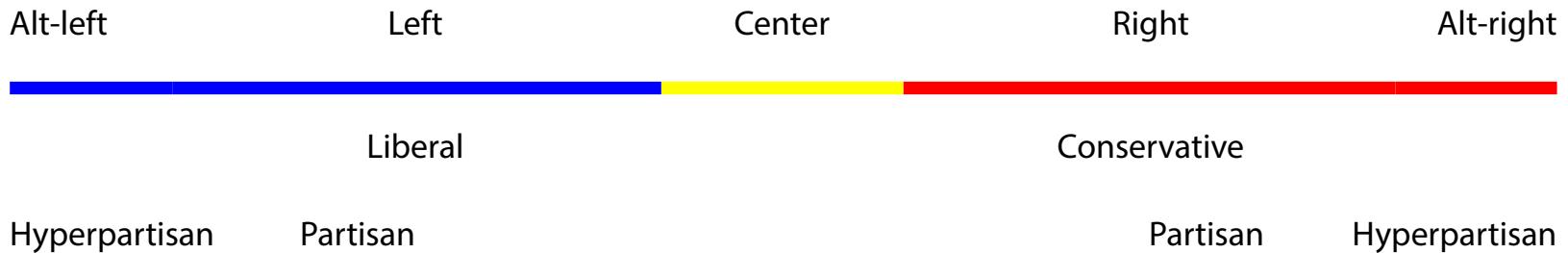
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Partisan: someone with a psychological identification with one major party. [\[Wikipedia\]](#)

The Political Spectrum

The left-right political spectrum is a system of classifying political positions, ideologies and parties. Left-wing politics and right-wing politics are often presented as opposed, although either may adopt stances from the other side. [\[Wikipedia\]](#)



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News media reporting on politics can be aligned on this spectrum as well.

We are observing an increasing number of hyperpartisan news publishers.

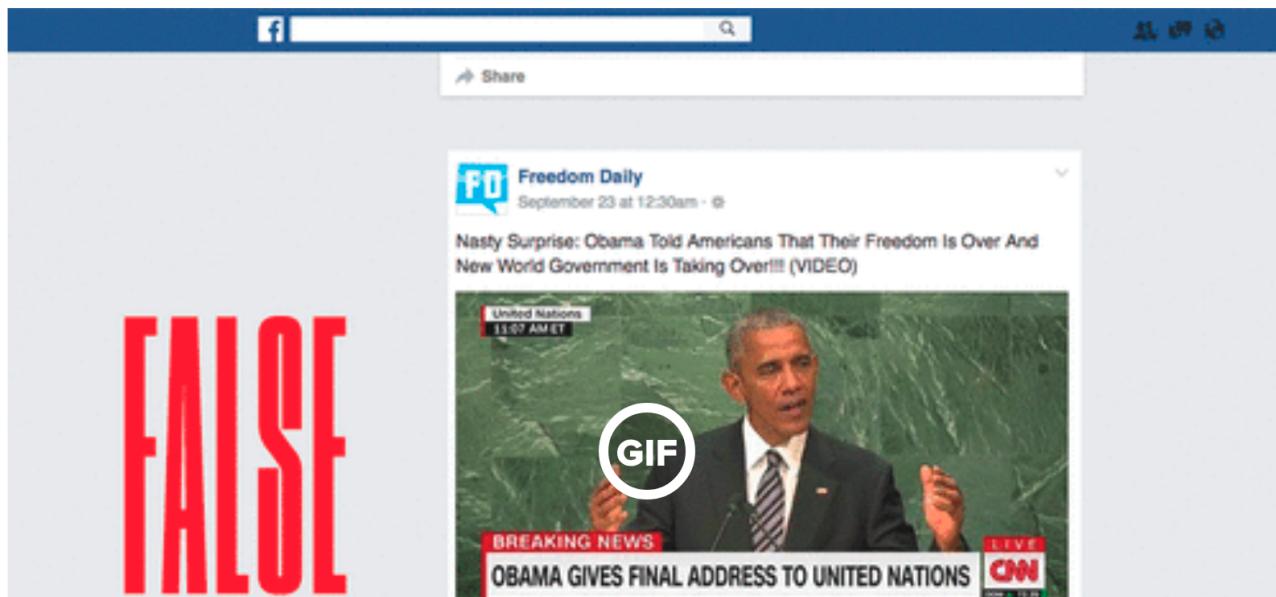
Fake News and Hyperpartisan News

BuzzFeed NEWS / REPORTING TO YOU

Hyperpartisan Facebook Pages Are Publishing False And Misleading Information At An Alarming Rate

A BuzzFeed News analysis found that three big right-wing Facebook pages published false or misleading information 38% of the time during the period analyzed, and three large left-wing pages did so in nearly 20% of posts.

By [Craig Silverman](#) (BuzzFeed Founding Editor, Canada), [Lauren Strapagiel](#) (BuzzFeed Staff), [Hamza Shaban](#) (BuzzFeed News Reporter), [Ellie Hall](#) (BuzzFeed News Reporter), [Jeremy Singer-Vine](#) (BuzzFeed News Reporter)



Why are Fake News Published by Hyperpartisan Pages?

FIRST DRAFT

MISINFORMATION MATRIX

	SATIRE OR PARODY	FALSE CONNECTION	MISLEADING CONTENT	FALSE CONTEXT	IMPOSTER CONTENT	MANIPULATED CONTENT	FABRICATED CONTENT
POOR JOURNALISM	✓	✓	✓	✓			
TO PARODY	✓				✓		✓
TO PROVOKE OR TO 'PUNK'					✓	✓	✓
PASSION				✓			
PARTISANSHIP			✓	✓			
PROFIT		✓			✓		✓
POLITICAL INFLUENCE			✓	✓		✓	✓
PROPAGANDA			✓	✓	✓	✓	✓

Image: Claire Wardle, First Draft

Why are Fake News Published by Hyperpartisan Pages?

The Misinformation Matrix is a grid diagram illustrating various reasons why fake news is published by hyperpartisan pages. The columns represent different types of misinformation, and the rows represent reasons. A vertical red line separates the first three columns from the last four.

	SATIRE OR PARODY	FALSE CONNECTION	MISLEADING CONTENT				
POOR JOURNALISM	✓	✓	✓	✓			
TO PARODY	✓				✓		✓
TO PROVOKE OR TO 'PUNK'					✓	✓	✓
PASSION				✓			
PARTISANSHIP			✓	✓			
PROFIT		✓			✓		✓
POLITICAL INFLUENCE			✓	✓		✓	✓
PROPAGANDA			✓	✓	✓	✓	✓

Image: Claire Wardle, First Draft

Fake News Detection

Knowledge-based

- ❑ Requires political knowledge base
- ❑ Unavailable ahead of time
- ❑ We cannot trust the web

Context-based

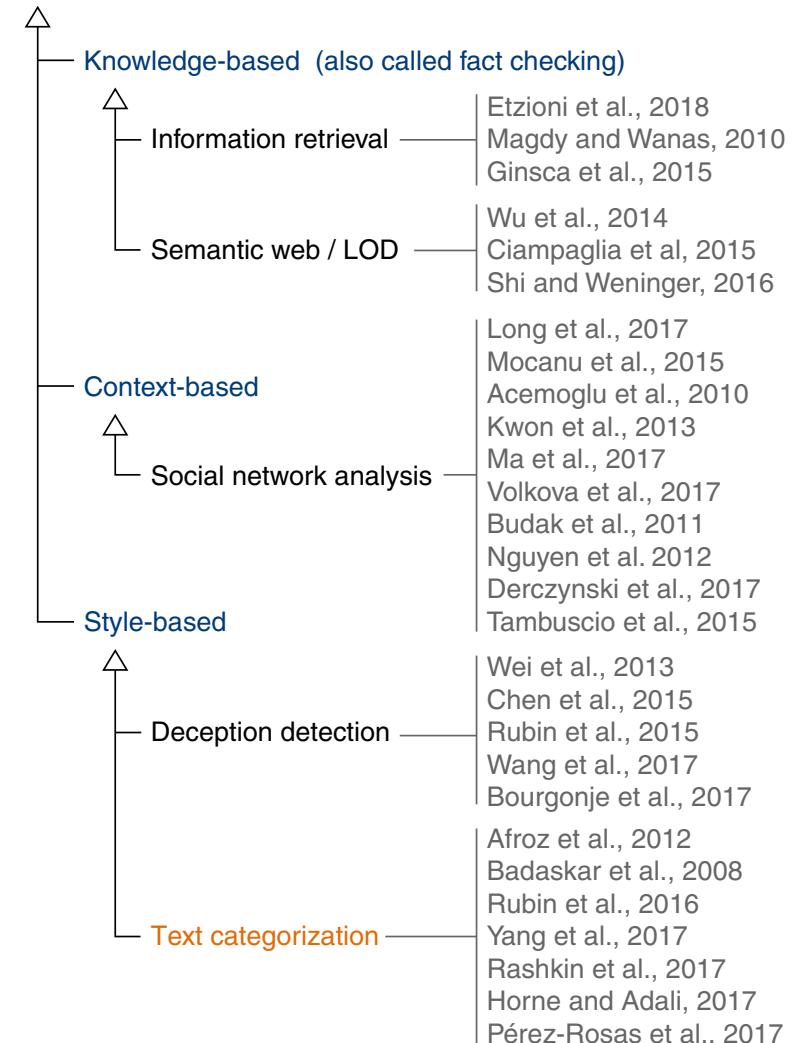
- ❑ Limited to social media platforms
- ❑ Part of damage already done

Style-based

- ❑ Allows for pre-posting check
- ❑ Real-time reaction possible
- ❑ Hard to mask
- ❑ But are style differences sufficient?

Taxonomy of Approaches

Fake news detection



Fake News and Hyperpartisan News Corpus Construction



Fake News and Hyperpartisan News Corpus Construction

Orientation Publisher	Fact-checking results				
	true	mix	false	n/a	Σ
<i>Center</i>	806	8	0	12	826
ABC News	90	2	0	3	95
CNN	295	4	0	8	307
Politico	421	2	0	1	424
<i>Left-wing</i>	182	51	15	8	256
Addicting Info	95	25	8	7	135
Occupy Democrats	59	25	7	0	91
The Other 98%	28	1	0	1	30
<i>Right-wing</i>	276	153	72	44	545
Eagle Rising	106	47	25	36	214
Freedom Daily	49	24	22	4	99
Right Wing News	121	82	25	4	232
Σ	1264	212	87	64	1627

Annotations provided by journalists at BuzzFeed

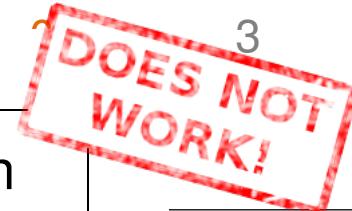
Fake News and Hyperpartisan News Selected Results

Orientation Publisher	Fact-checking results				
	true	mix	false	n/a	Σ
Center	806	8	0	12	826
ABC News	~	~	~	3	95
CNN					307
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Fake News Detection

Precision $\approx 42\%$

Recall $\approx 41\%$



Annotations provided by journalists at BuzzFeed

Fake News and Hyperpartisan News Selected Results

Orientation Publisher	Fact-checking results				
	true	mix	false	n/a	Σ
Center	806	8	0	12	826
ABC News	~	~	~	~	95
CNN					307
Political	Orientation Detection				
Left-wing	Precision $\approx 21\%$	Precision $\approx 56\%$			256
Addict	Recall $\approx 20\%$	Recall $\approx 59\%$			135
Occup					91
The O					30
Right-wing	276	153	72	44	545
Eagle Rising	106	47	25	36	214
Freedom Daily	49	24	22	4	99
Right Wing News	121	82	25	4	232
Σ	1264	212	87	64	1627

DOES NOT WORK!

Annotations provided by journalists at BuzzFeed

Fake News and Hyperpartisan News Selected Results

Orientation Publisher	Fact-checking results				
	true	mix	false	n/a	Σ
<i>Center</i> ABC News	806 ~	8 ~	0 ~	12 ~	826 95
CNN					307
Politico					424
<i>Left-wing</i> Addicting In Occupy Der The Other 9					256 135 91 30
<i>Right-wing</i> Eagle Rising Freedom Daily Right Wing News	276 106 49 121	153 47 24 82	72 25 22 25	44 36 4 4	545 214 99 232
Σ	1264	212	87	64	1627

Hyperpartisanship Detection

Precision \approx 69%
Recall \approx 89%

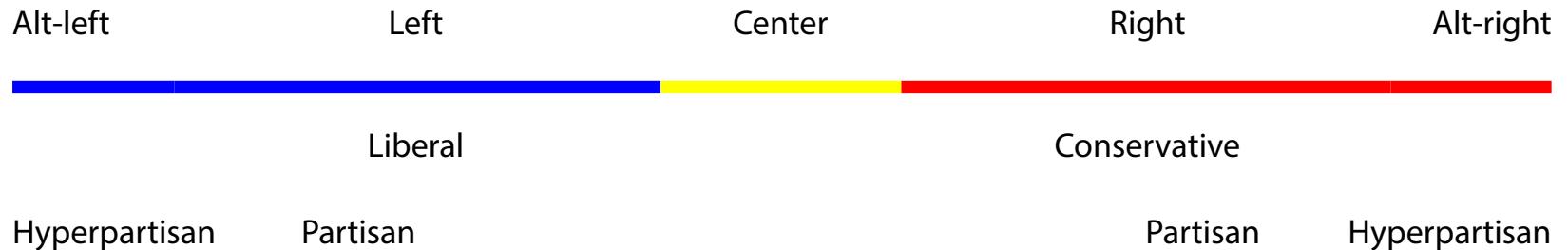


WORKS!

Annotations provided by journalists at BuzzFeed

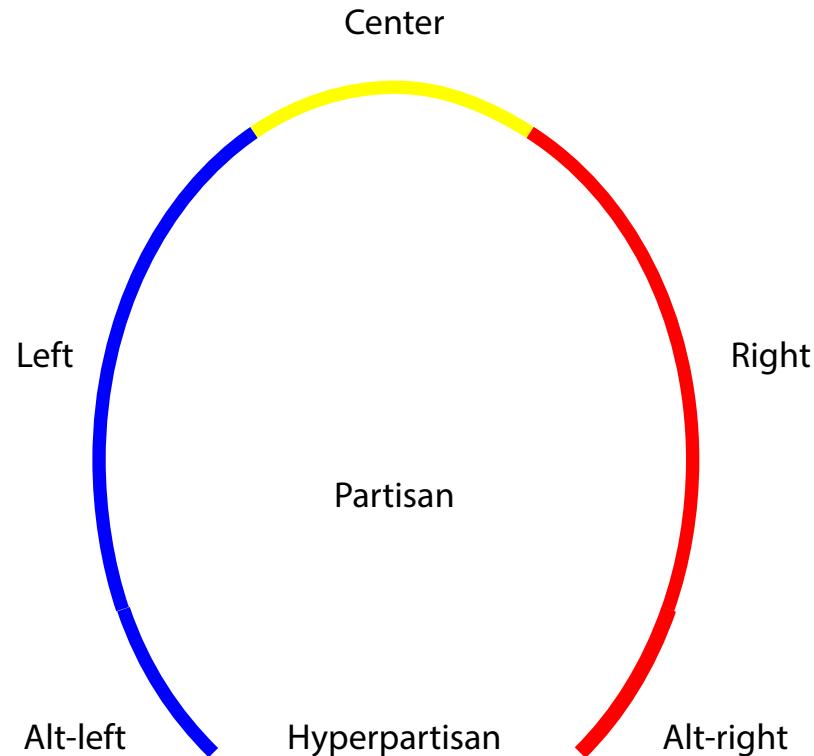
Fake News and Hyperpartisan News

How can it be that the alt left and the alt right cannot be distinguished from the mainstream, when both together (hyperpartisan news) can be?



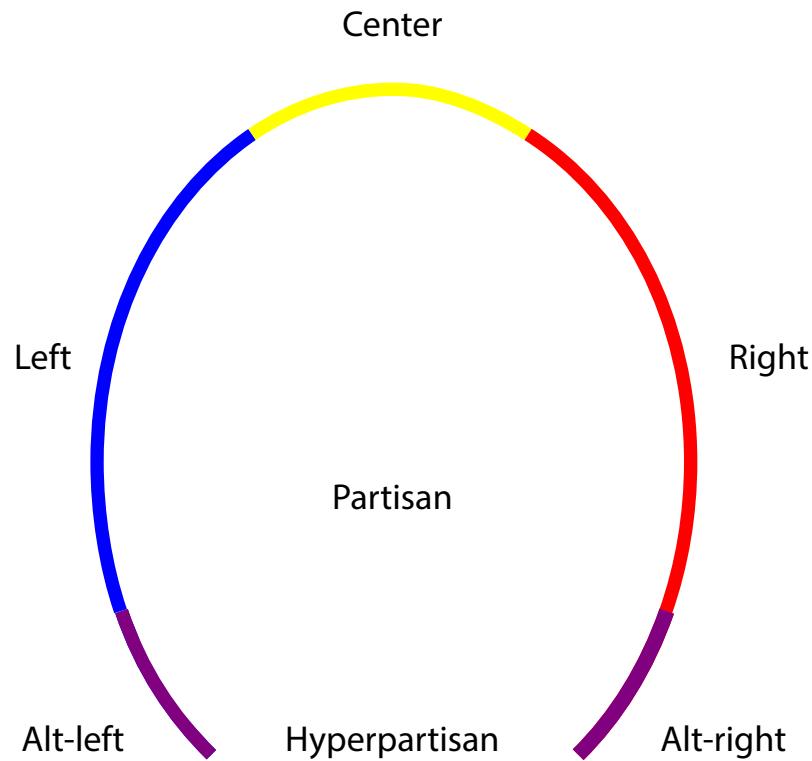
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Fake News and Hyperpartisan News

How can it be that the alt left and the alt right cannot be distinguished from the mainstream, when both together (hyperpartisan news) can be?



The horseshoe theory asserts that the alt left and the alt right, rather than being at opposite and opposing ends of a linear political continuum, in fact closely resemble one another, much like the ends of a horseshoe. [\[Wikipedia\]](#)

Horseshoe Validation Experiment I Leave-out Classification



left-wing



center



right-wing

Horseshoe Validation Experiment I Leave-out Classification



left-wing



center



right-wing

- ❑ Classifier is trained to distinguish left-wing and center articles
- ❑ Right-wing articles are used for testing

Horseshoe Validation Experiment I Leave-out Classification



left-wing



center



right-wing

74% | 26%

- Classifier is trained to distinguish left-wing and center articles
- Right-wing articles are used for testing
- Majority of right-wing articles are classified as left-wing rather than center

Horseshoe Validation Experiment I Leave-out Classification



left-wing



center



right-wing

74% | 26%

- Classifier is trained to distinguish left-wing and center articles
- Right-wing articles are used for testing
- Majority of right-wing articles are classified as left-wing rather than center



left-wing

34% | 66%

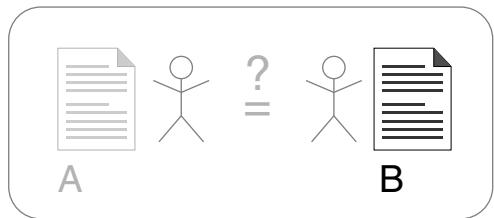


center

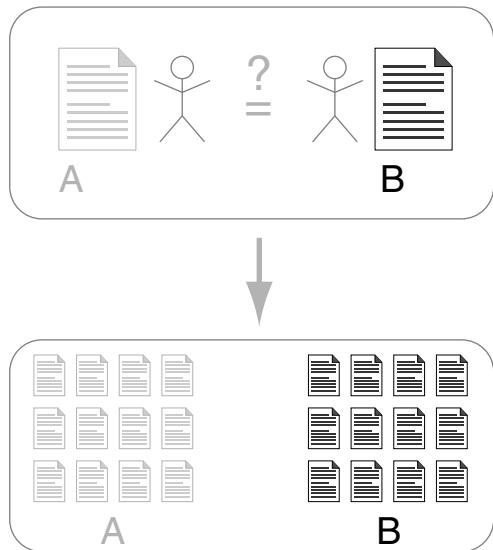


right-wing

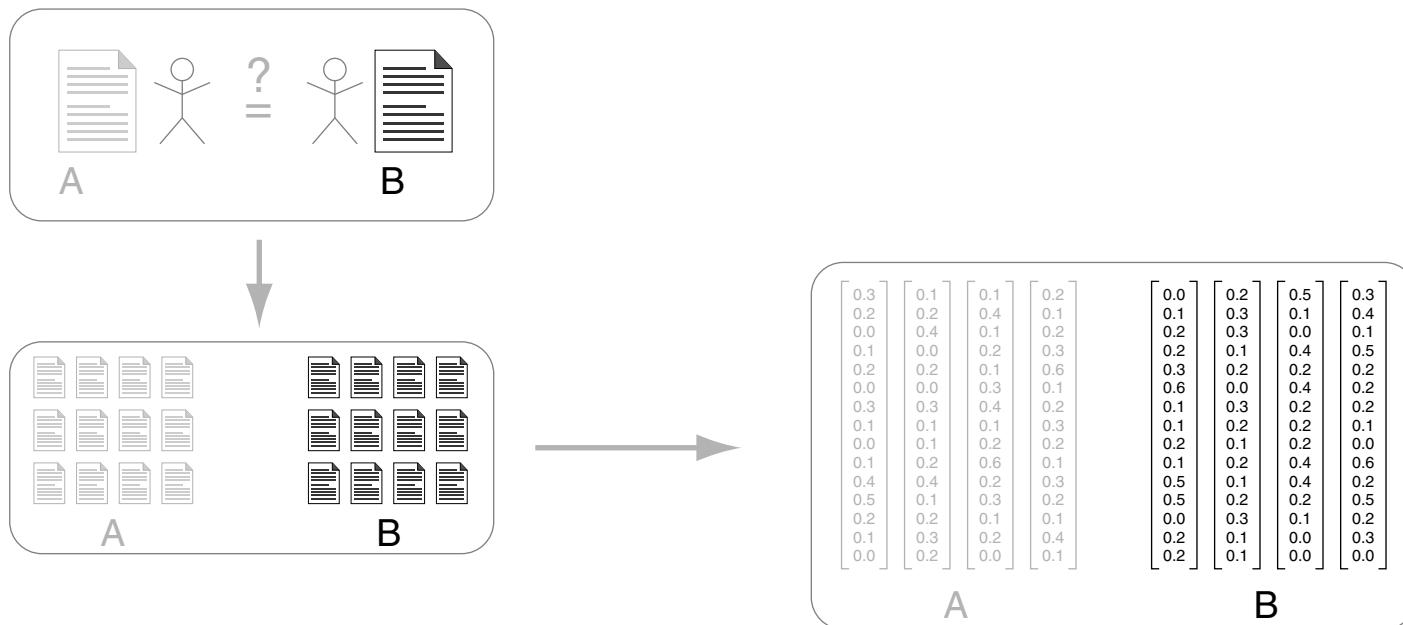
Horseshoe Validation Experiment II Unmasking [Koppel/Schler 2004]



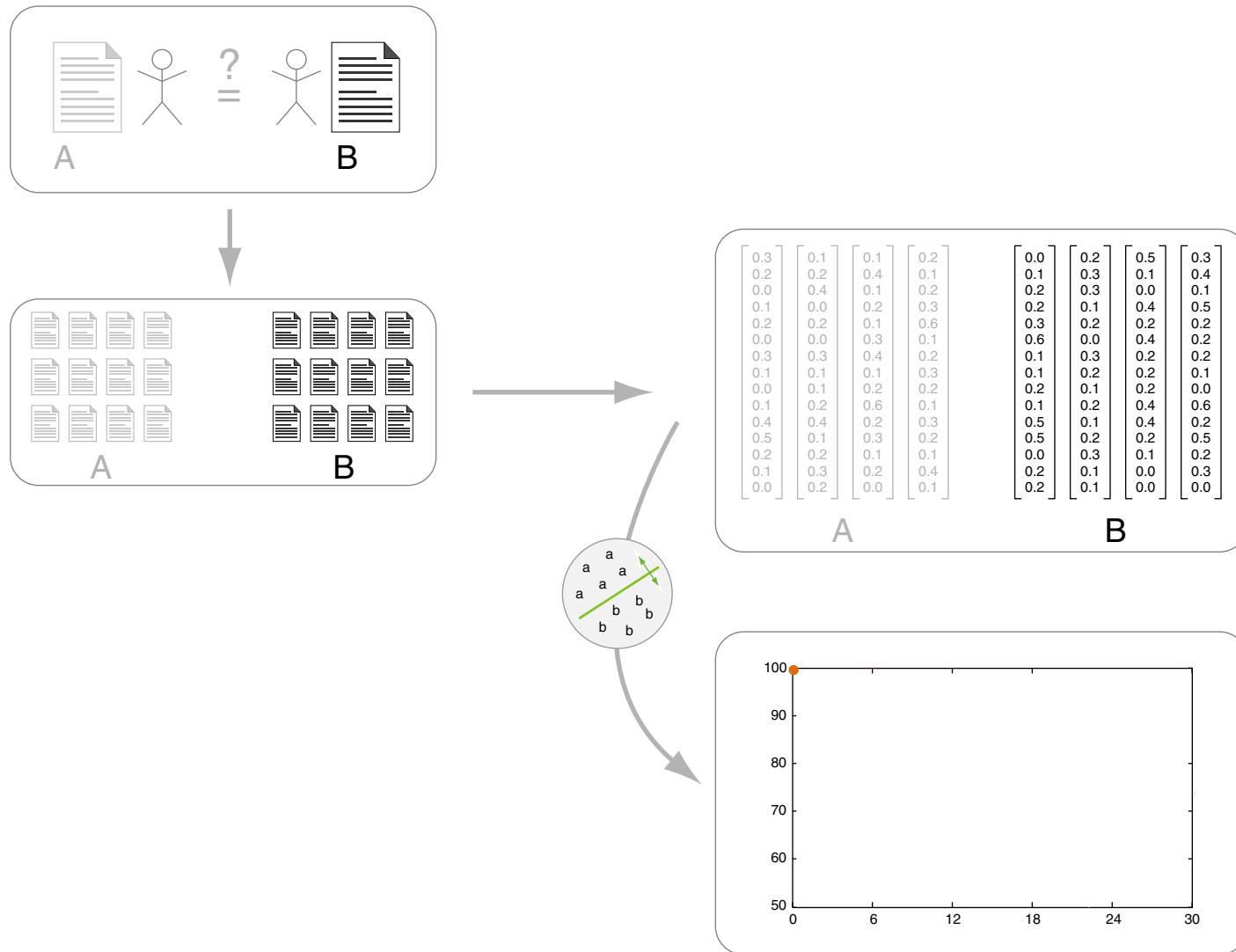
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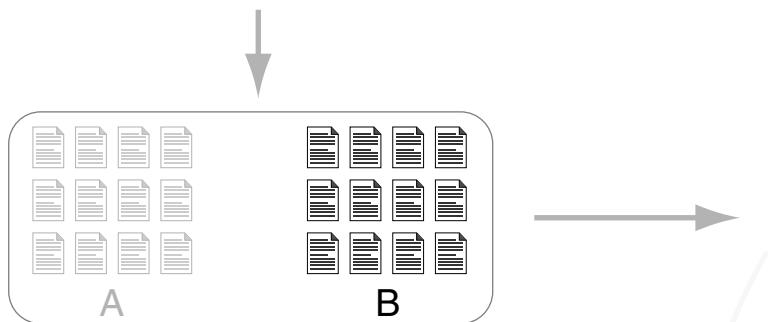
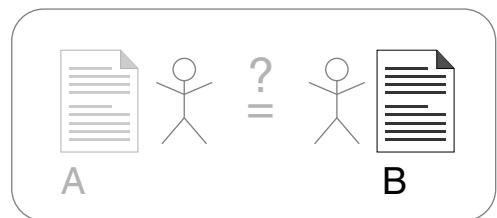
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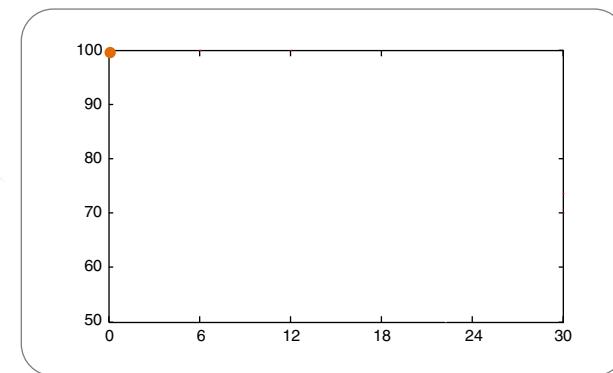


A diagram showing the unmasking process. It displays two tables, one labeled 'A' and one labeled 'B'. Table A has a blue horizontal bar at row 10. Table B has a blue horizontal bar at row 10 and a blue vertical bar at column 10. Arrows point from the tables to a circular inset and a scatter plot.

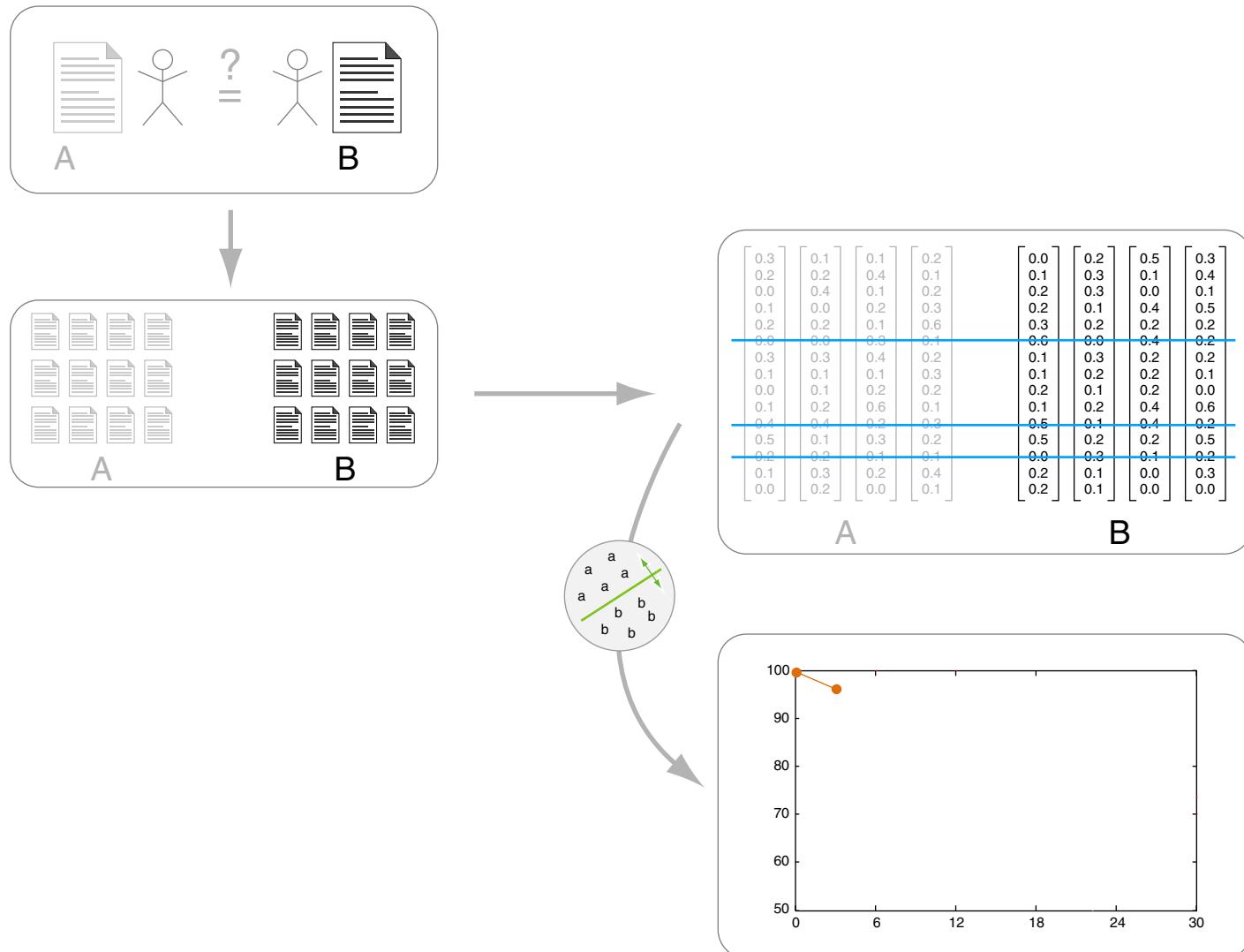
[0.3 0.2 0.0 0.1 0.2]	[0.1 0.2 0.4 0.0 0.2]	[0.1 0.4 0.1 0.2 0.6]	[0.2 0.1 0.3 0.0 0.6]
[0.0 0.0 0.3 0.1 0.0]	[0.0 0.0 0.3 0.1 0.0]	[0.1 0.2 0.1 0.2 0.1]	[0.0 0.0 0.4 0.2 0.0]
[0.3 0.3 0.1 0.1 0.2]	[0.3 0.3 0.1 0.1 0.2]	[0.4 0.2 0.6 0.2 0.1]	[0.1 0.2 0.2 0.1 0.4]
[0.0 0.1 0.0 0.1 0.1]	[0.0 0.1 0.2 0.2 0.1]	[0.2 0.2 0.6 0.1 0.4]	[0.0 0.1 0.2 0.1 0.6]
[0.1 0.1 0.5 0.2 0.2]	[0.1 0.1 0.3 0.2 0.2]	[0.5 0.5 0.2 0.2 0.2]	[0.4 0.4 0.2 0.2 0.5]
[0.2 0.2 0.1 0.1 0.0]	[0.2 0.2 0.1 0.1 0.0]	[0.0 0.0 0.3 0.1 0.0]	[0.1 0.1 0.2 0.1 0.3]
[0.1 0.3 0.2 0.0 0.2]	[0.2 0.1 0.0 0.0 0.1]	[0.2 0.1 0.0 0.1 0.0]	[0.0 0.0 0.0 0.0 0.0]

A

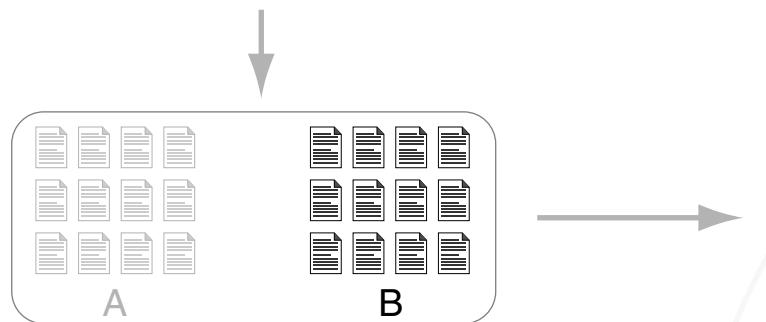
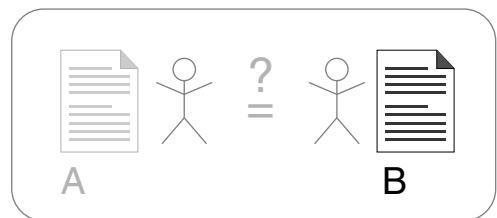
B



Horseshoe Validation Experiment II Unmasking [Koppel/Schler 2004]



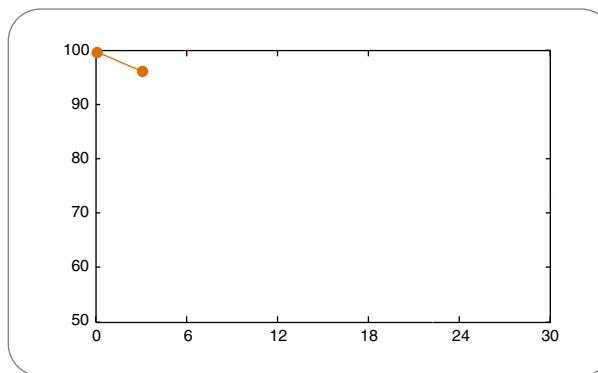
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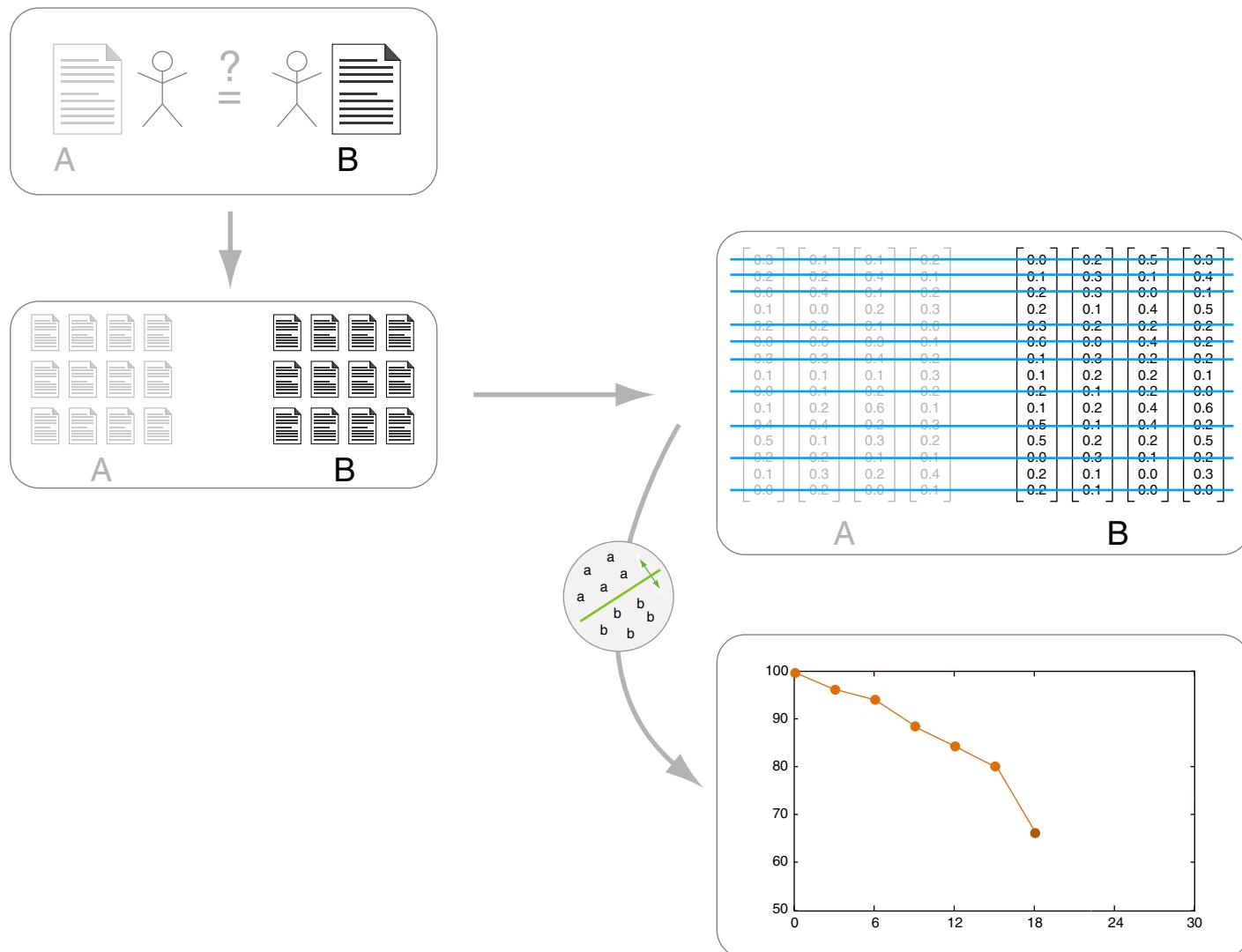
A diagram showing two matrices labeled 'A' and 'B'. Matrix A is a 10x4 matrix and Matrix B is a 5x4 matrix. Both matrices have blue horizontal lines through them, indicating specific rows are being analyzed.

[0.3]	[0.1]	[0.1]	[0.2]
0.2	0.2	0.4	0.1
0.0	0.4	0.1	0.2
0.1	0.0	0.2	0.3
0.2	0.2	0.1	0.6
0.0	0.0	0.3	0.1
0.3	0.3	0.4	0.2
0.1	0.1	0.1	0.3
0.0	0.1	0.2	0.0
0.1	0.2	0.6	0.1
[0.4]	[0.4]	[0.2]	[0.2]
0.5	0.1	0.3	0.2
0.2	0.2	0.1	0.1
0.1	0.3	0.2	0.4
0.0	0.2	0.0	0.1

[0.0]	[0.2]	[0.5]	[0.3]
0.1	0.3	0.1	0.4
0.2	0.3	0.0	0.1
0.3	0.2	0.2	0.2
0.0	0.0	0.4	0.2
0.1	0.3	0.3	0.2
0.2	0.2	0.2	0.1
0.1	0.2	0.4	0.6
0.5	0.1	0.4	0.2
0.2	0.2	0.2	0.5

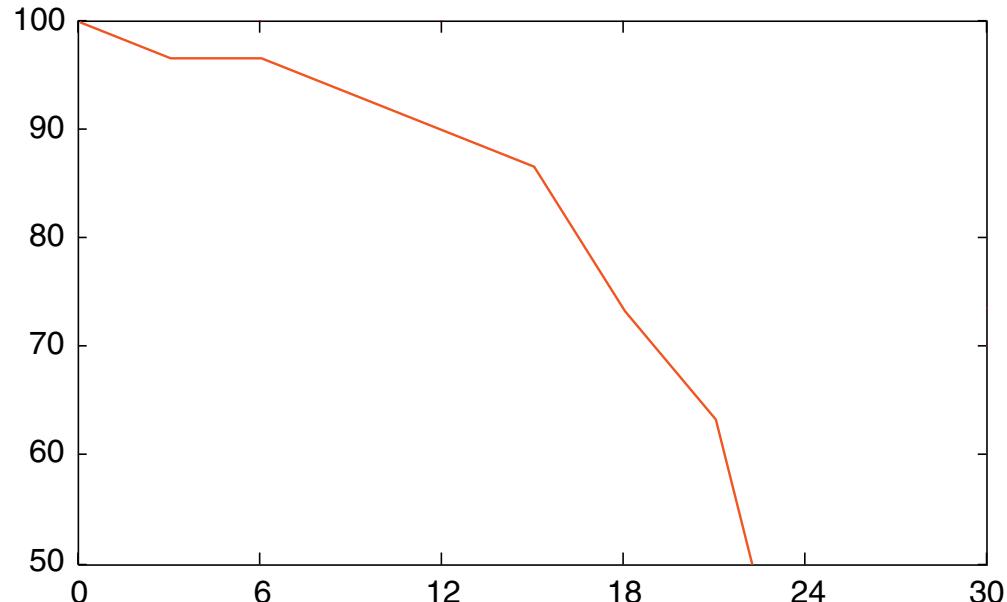


Horseshoe Validation Experiment II Unmasking [Koppel/Schler 2004]



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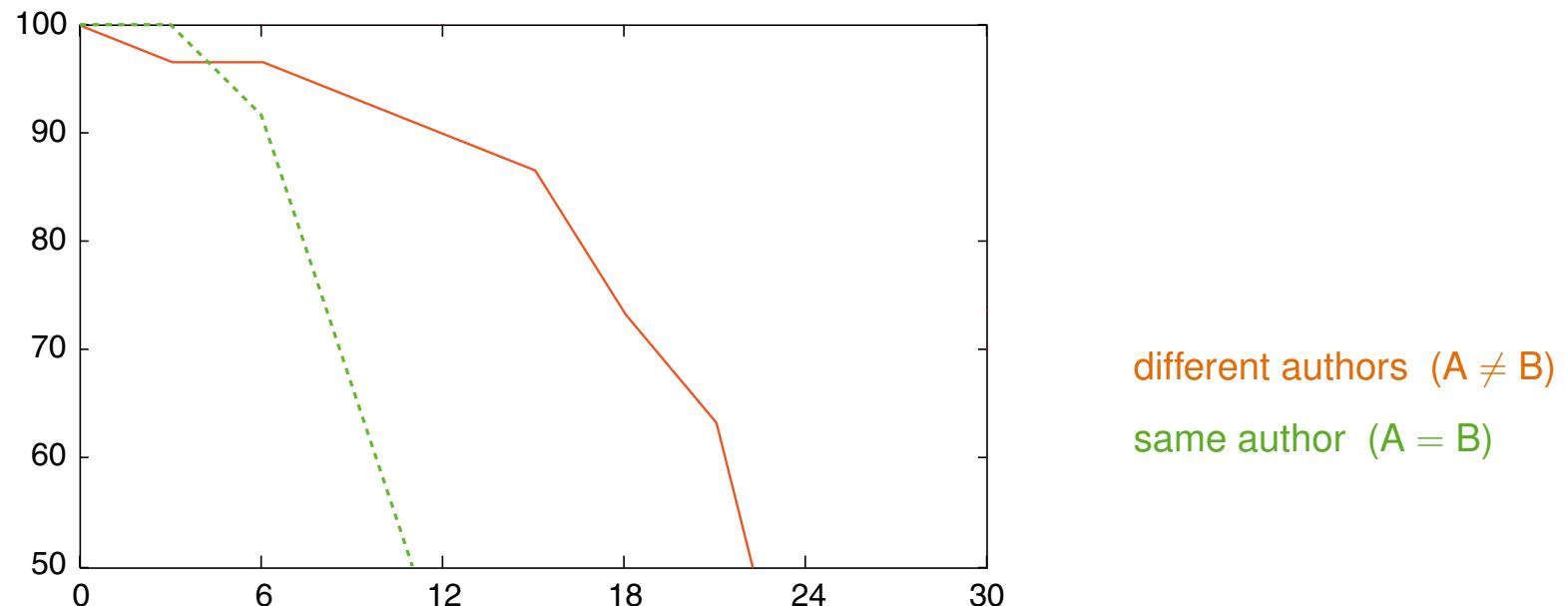
Typical learning characteristic for ...



different authors ($A \neq B$)

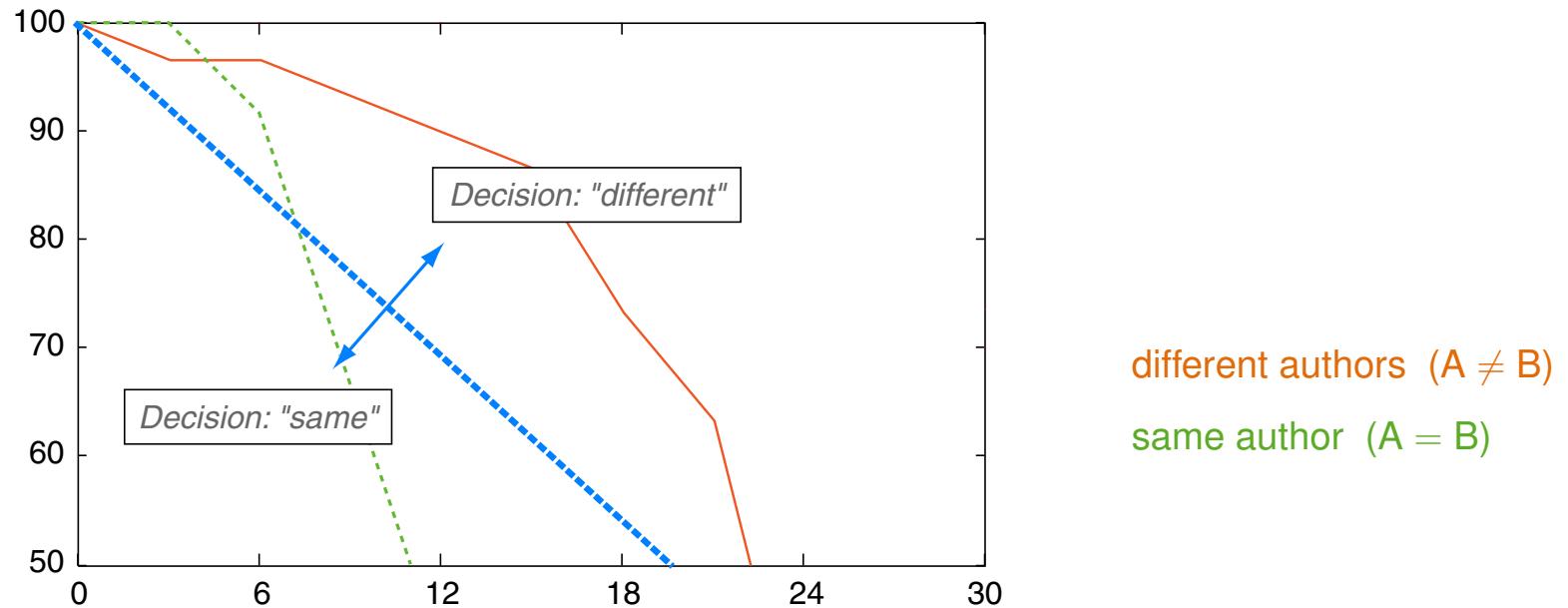
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Horseshoe Validation Experiment II Unmasking [Koppel/Schler 2004]

Typical learning characteristic for ...

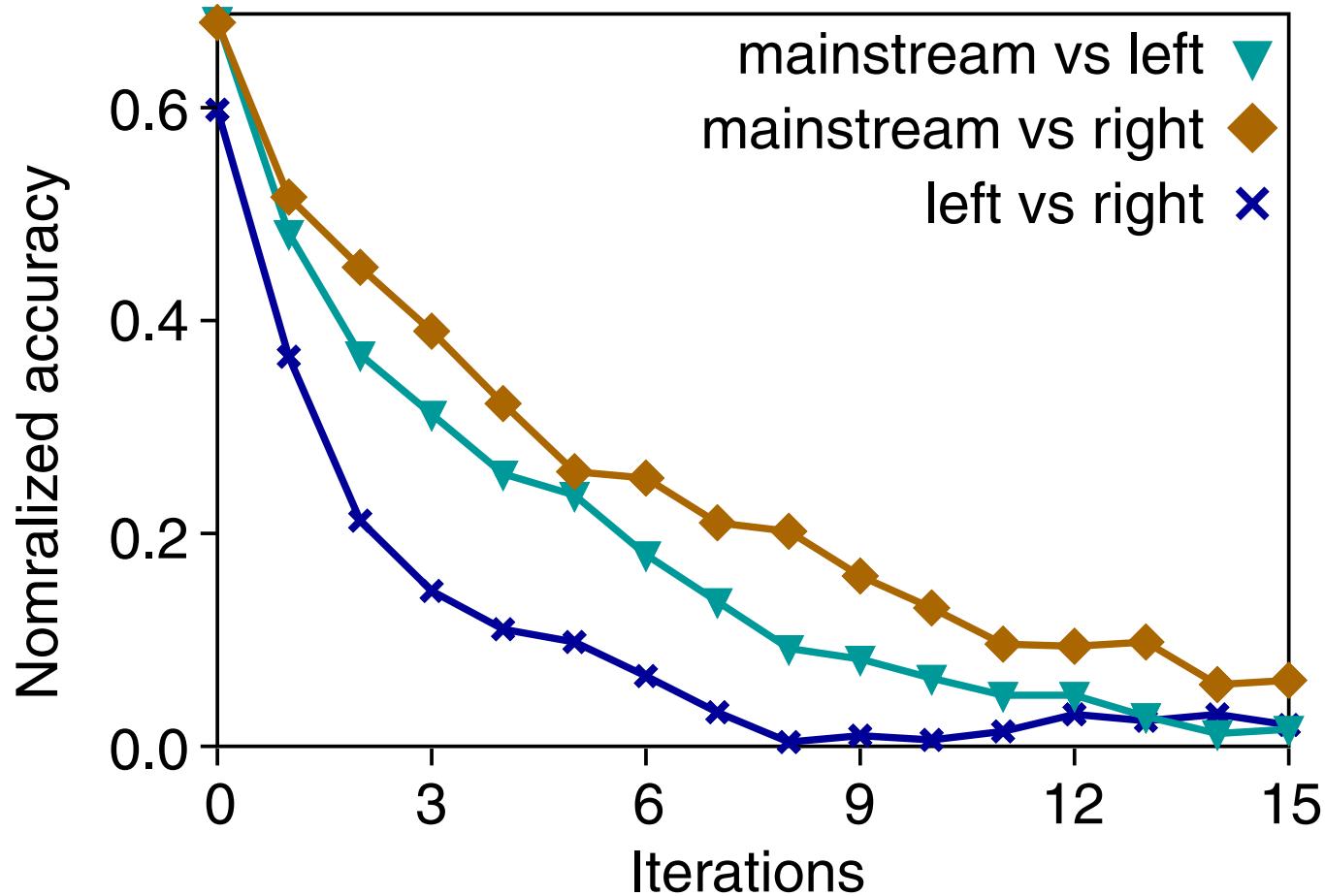


The typical learning characteristic can be learned. → “Meta Learning”

We apply Unmasking to distinguish style genres.

Horseshoe Validation Experiment II

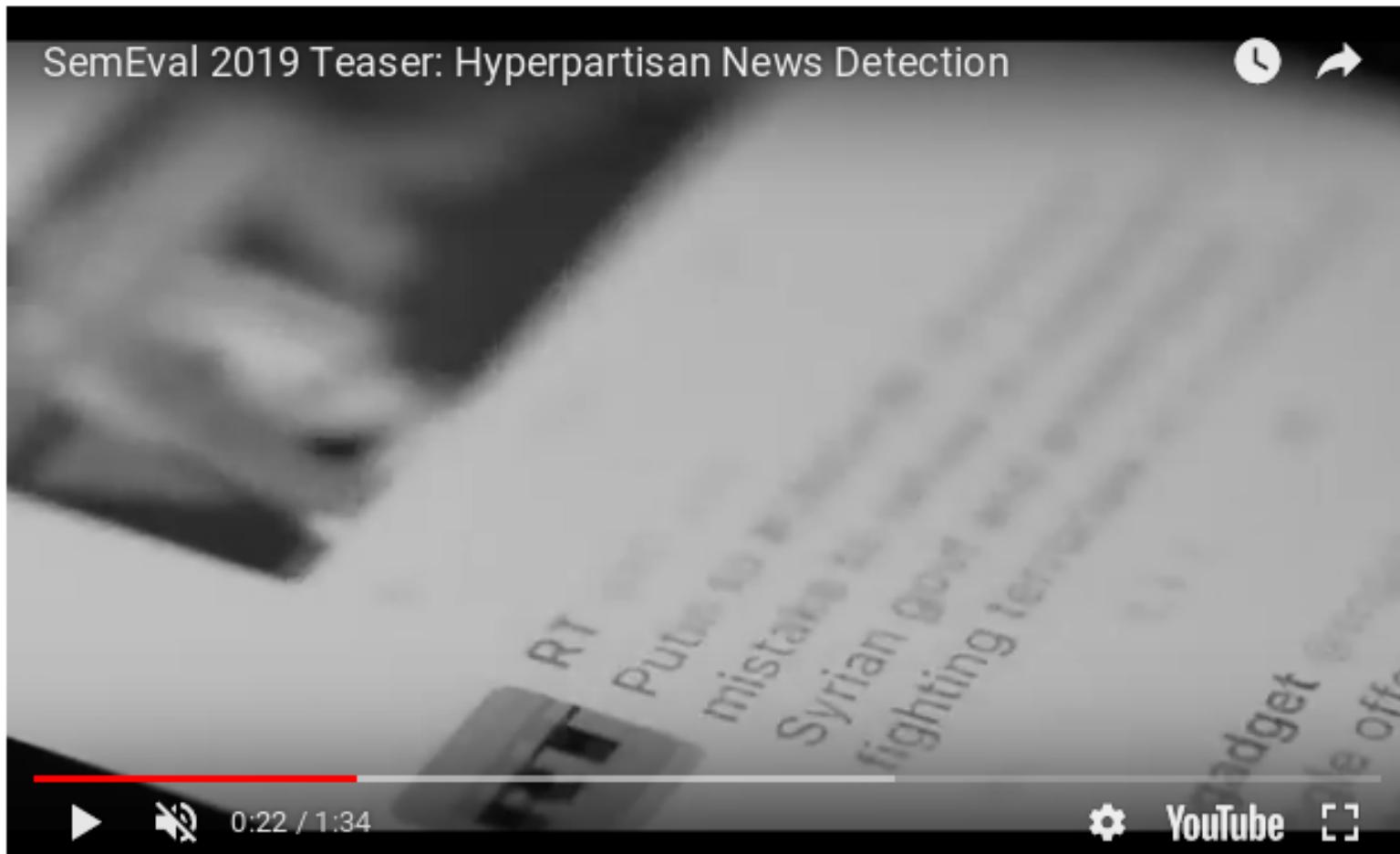
Unmasking [Koppel/Schler 2004]



Summary and Outlook

- Hyperpartisan news pages produce relatively many fake news articles
 - Hyperpartisan news can be distinguished quite well based on style
 - Style-based detection allows for real-time detection
 - Political extremism in news can be ousted or at least flagged
-
- The style of alt left and alt right news is very similar
 - Linguistic evidence for the horseshoe theory of the political spectrum?
 - Large-scale analysis required

Hypopartisan News Detection



Hypopartisan News Detection



Style Model

Features

- n-grams with $n \in [1, 3]$ of characters, stop words, parts-of-speech
- 10 readability scores
- Dictionary features based on General Inquirer
- Ratios of quoted words, external links, number of paragraphs, and their average length

Feature selection

- Discard word features (n-gram features) occurring in less than 2.5% (10%) of documents

Training set

- Balancing using oversampling
- Publishers are not represented in both training and test set

Learning algorithm

- WEKA's random forest with default parameters