Quantifying Search Bias: Investigating Sources of Bias for Political Searches in Social Media

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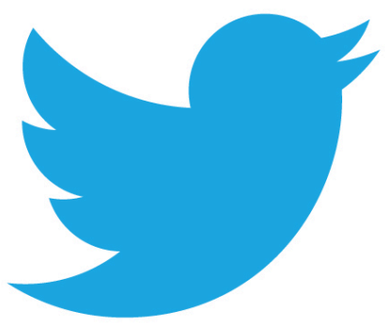
with Juhi Kulshrestha, Motahhare Eslami, Johnnatan Messias, Saptarshi Ghosh, Krishna Gummadi and Karrie Karahalios

Social media as search platform

- Two-thirds of Americans on social media use it to get news (informational queries)



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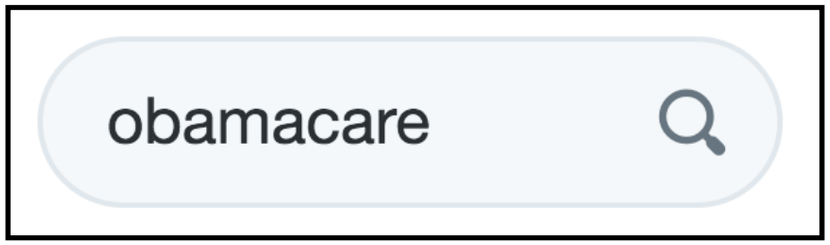

Social media as search platform

- Two-thirds of Americans on social media use it to get news (informational queries)

Ranked list (importance)

Potential bias in search results

obamacare

Steven Crowder
@scrowder

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Ouch => Tucker Carlson Obliterates ObamaCare Architect: 'Nobody believes you, doctor'

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mia farrow
@MiaFarrow

Follow

My daughter in law is a pediatric cardiologist in a Detroit hosp. Says Obamacare is a lifeline for her patients

Search rankings can shape user opinion

- Users place greater trust in higher ranked items *[Pan et al., 2007]*
- Biased search results can influence voting patterns *[Epstein & Robertson, 2015]*

This talk:

Study sources of bias in social media search

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- Quantifying bias in each source
- Studying bias in political searches in Twitter

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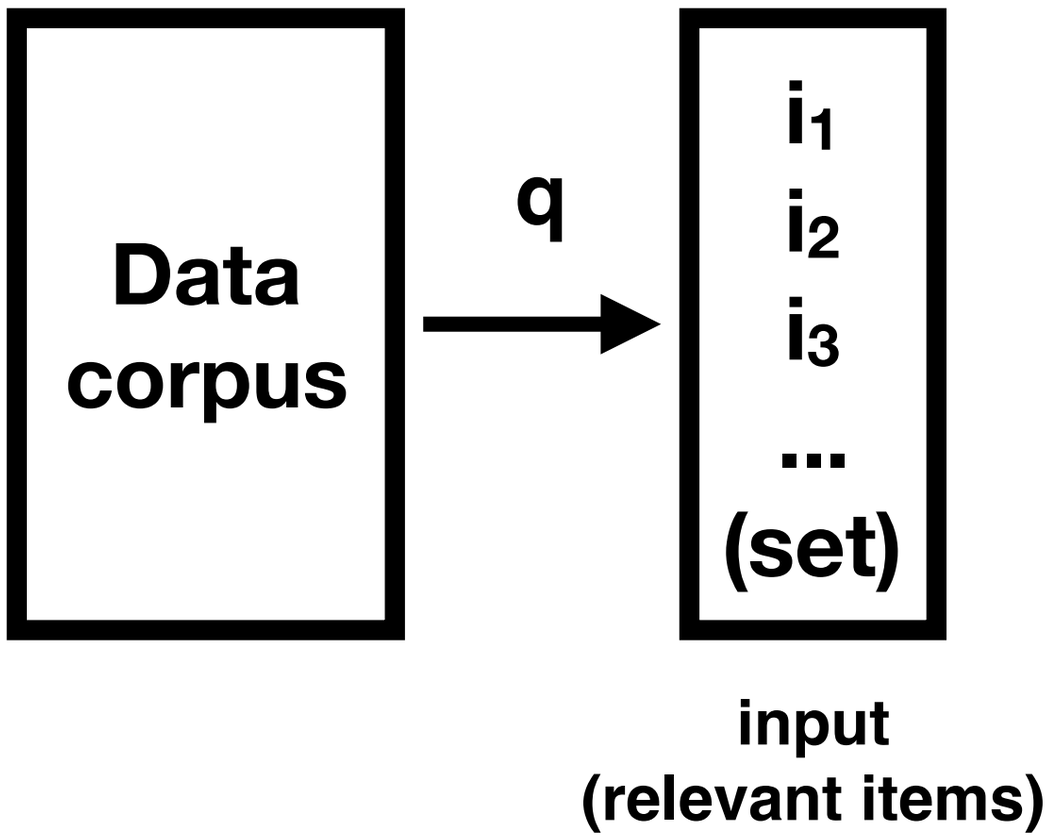
Social media search engine design

Data corpus

Social media search engine design



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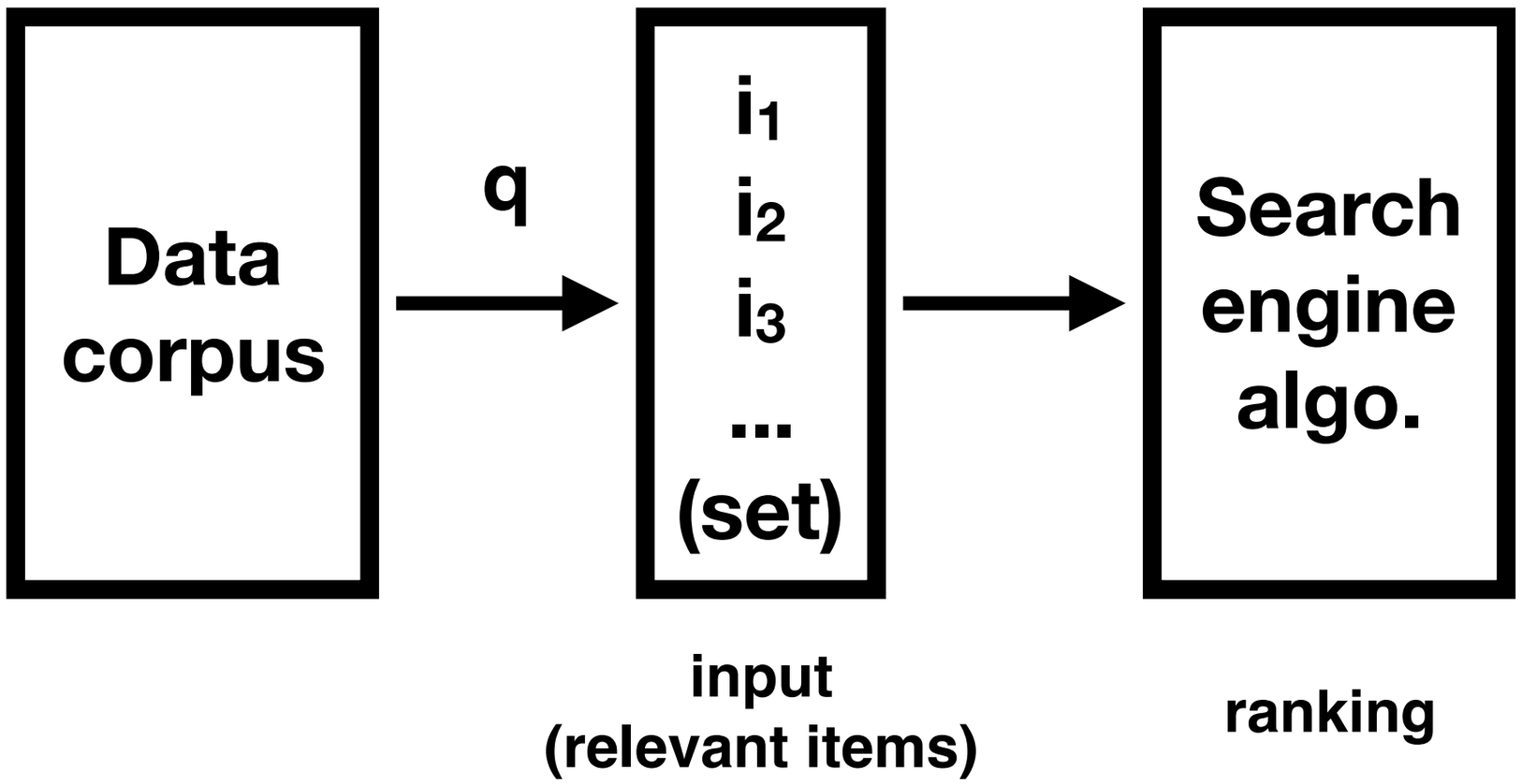

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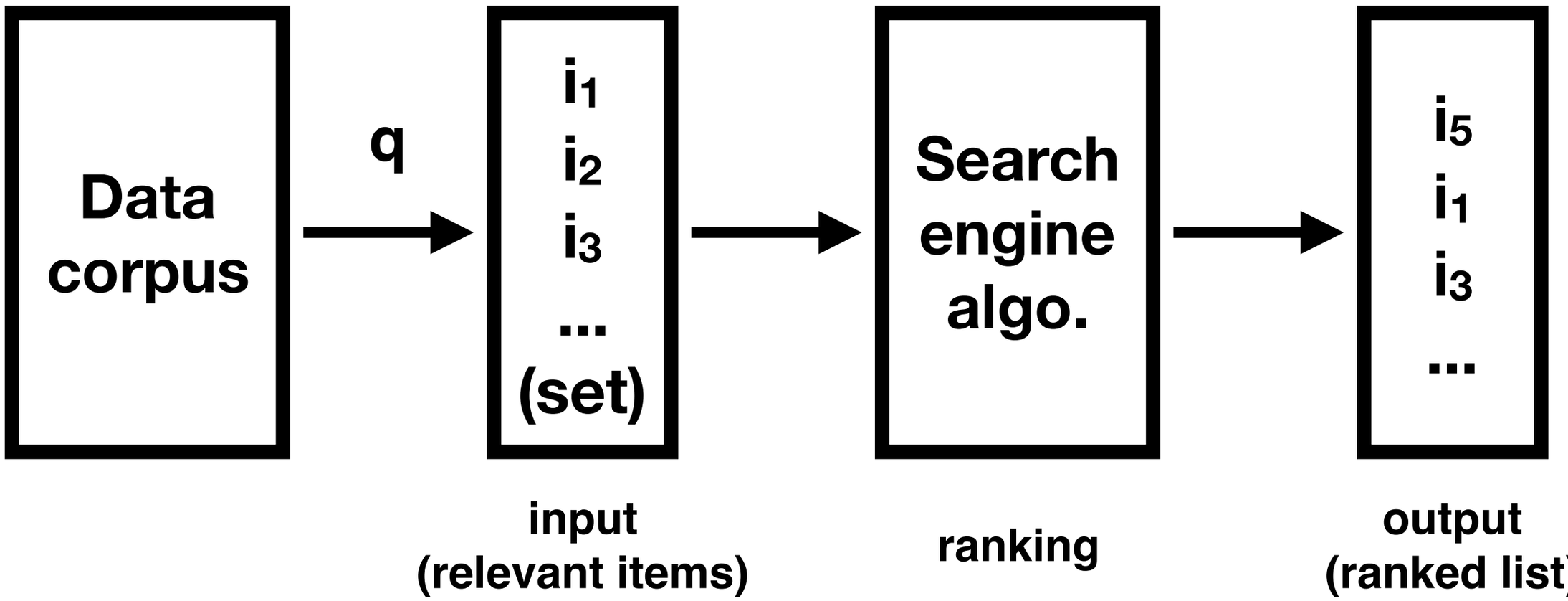

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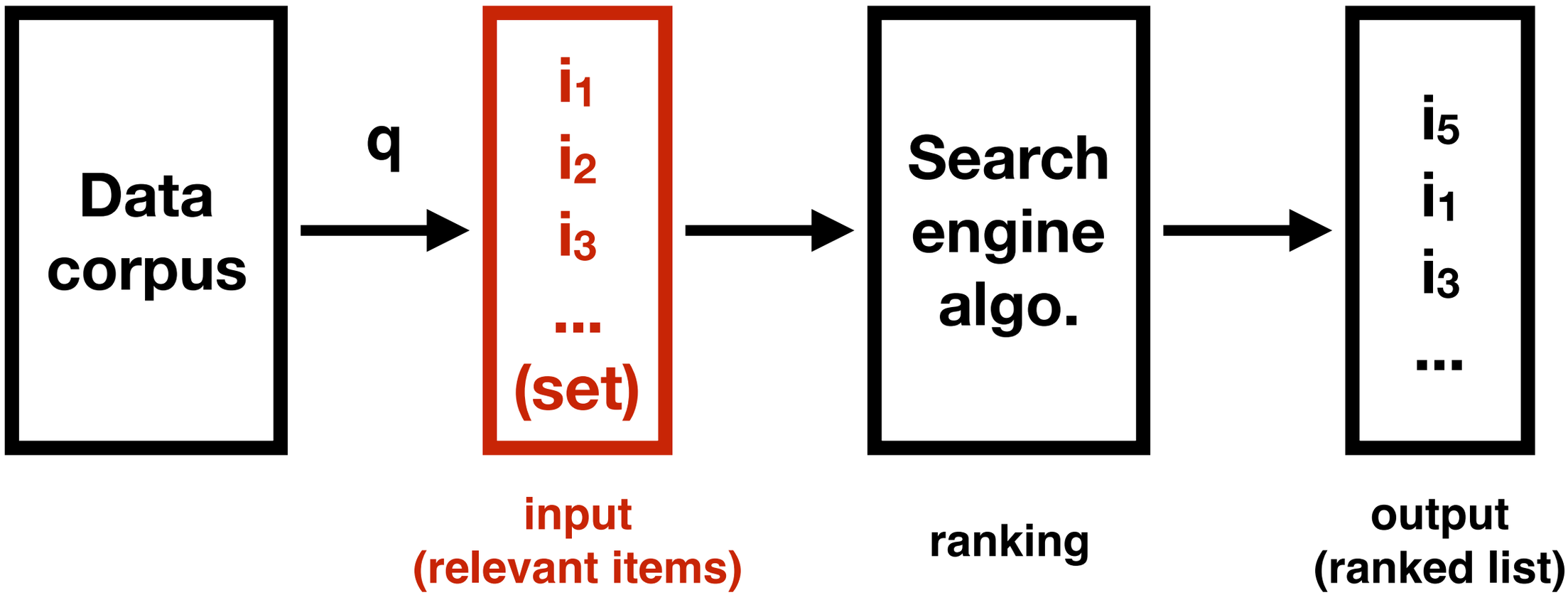
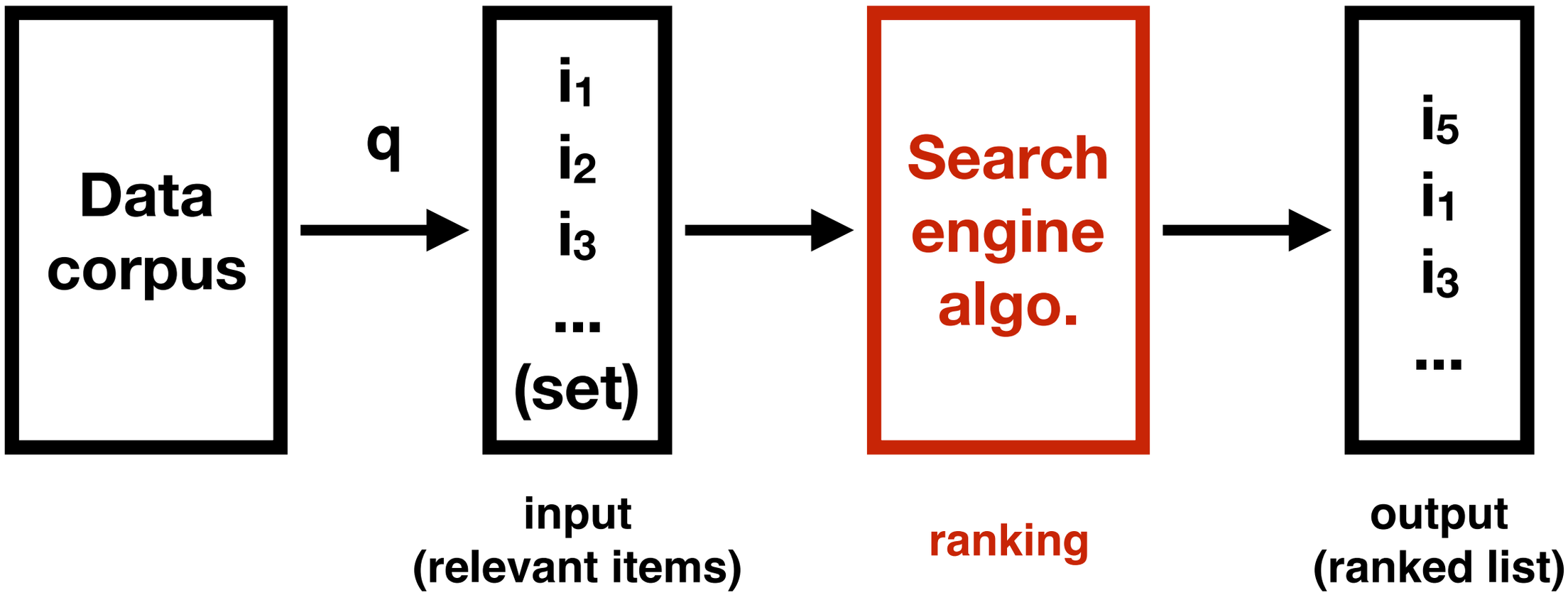


- Output bias may stem from
  - Bias in the (input) relevant item set

Social media search engine design



- Output bias may stem from
  - Bias in the (input) relevant item set
  - Bias introduced by the ranking algorithm

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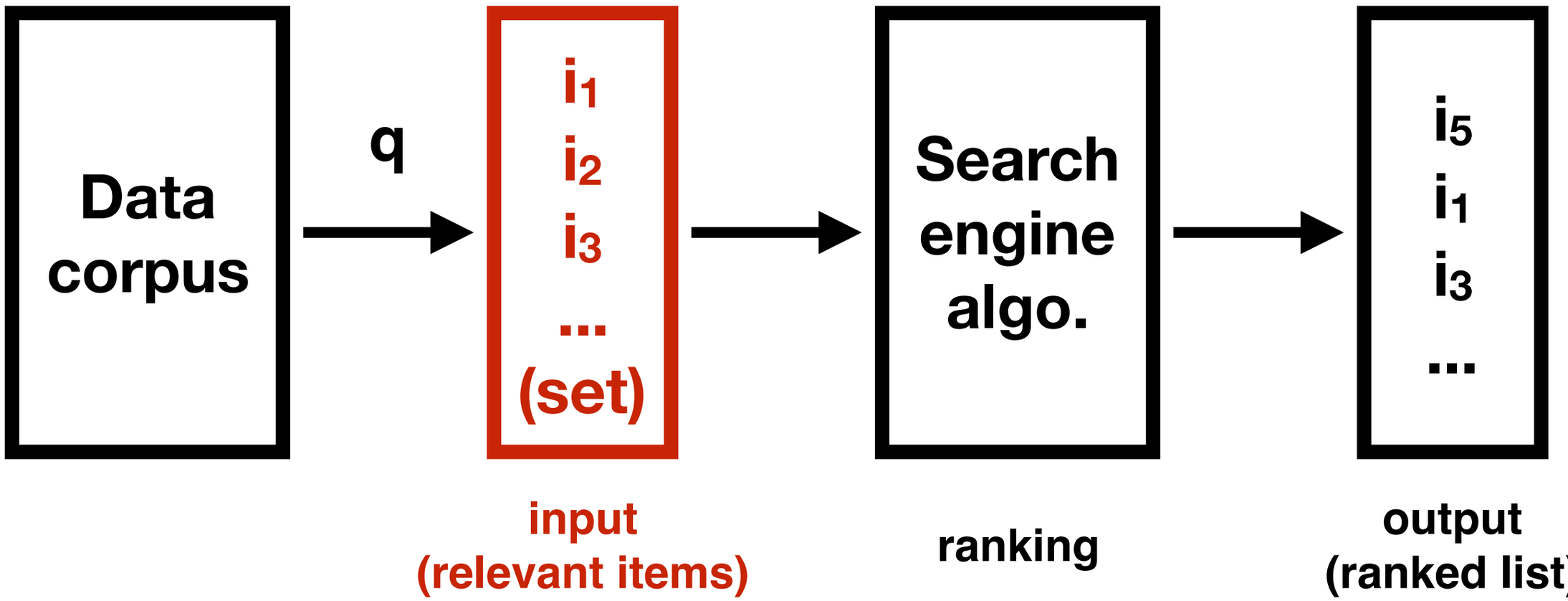
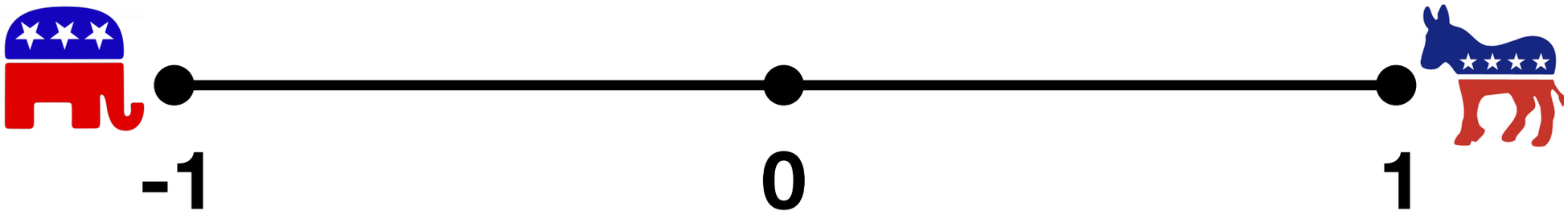
- Identifying sources of search bias
- **Quantifying bias in each source**
- Studying bias in political searches in Twitter

Quantifying bias in each source



- Quantify bias of each individual item

Quantifying bias of individual items



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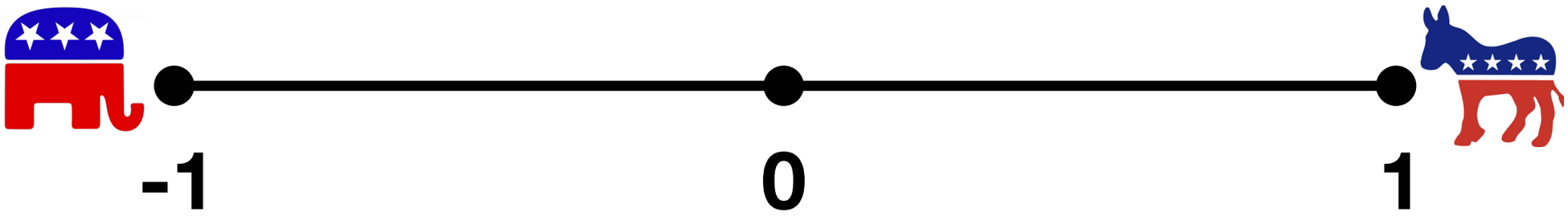
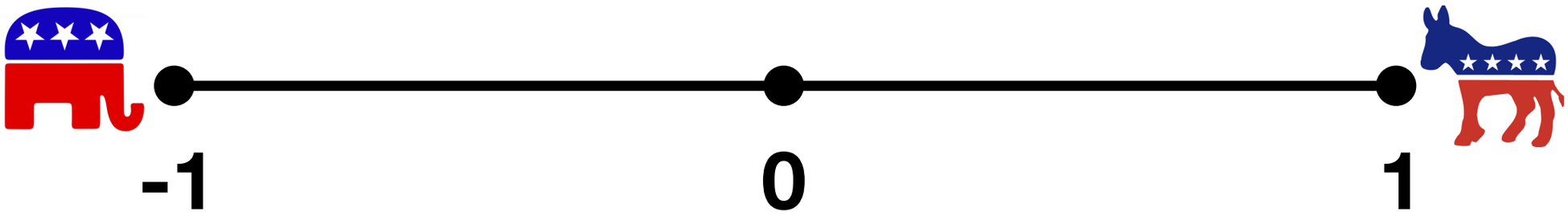


- Our method: Infer bias of each individual item from the bias of the author

Quantifying bias of individual items



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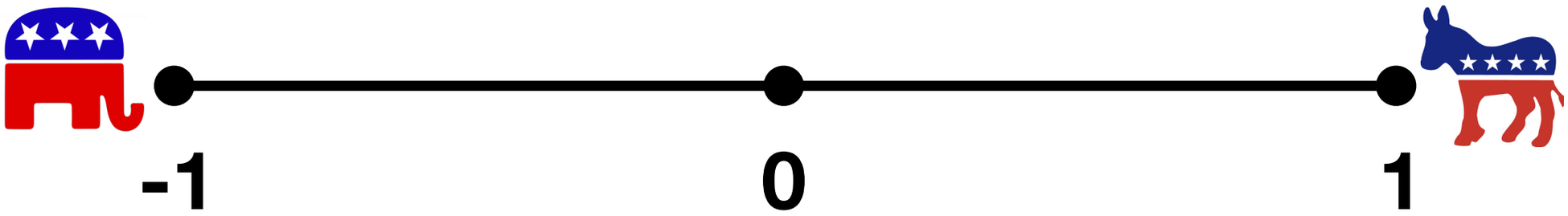

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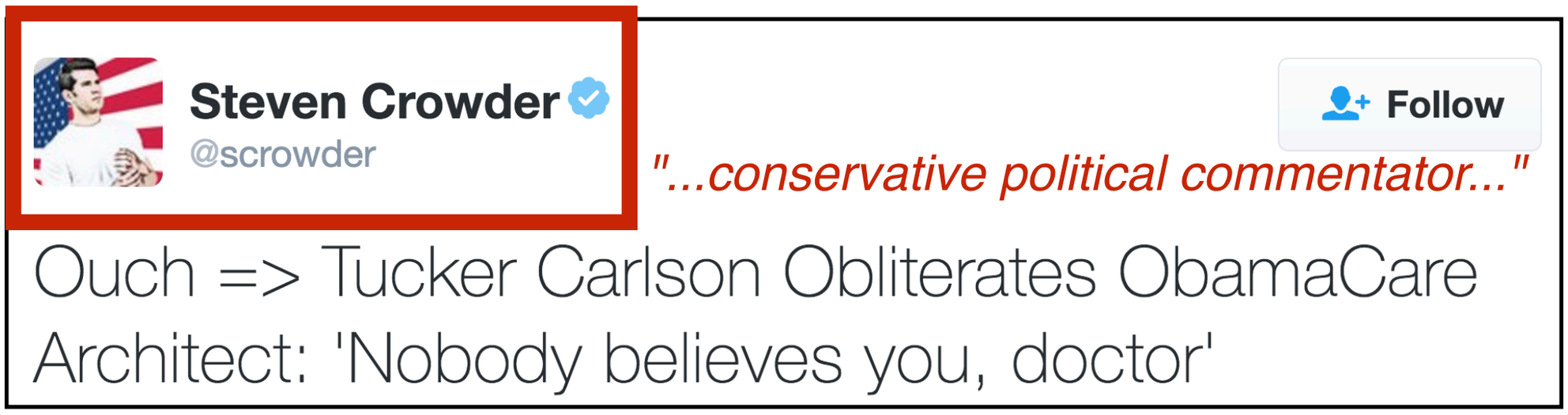
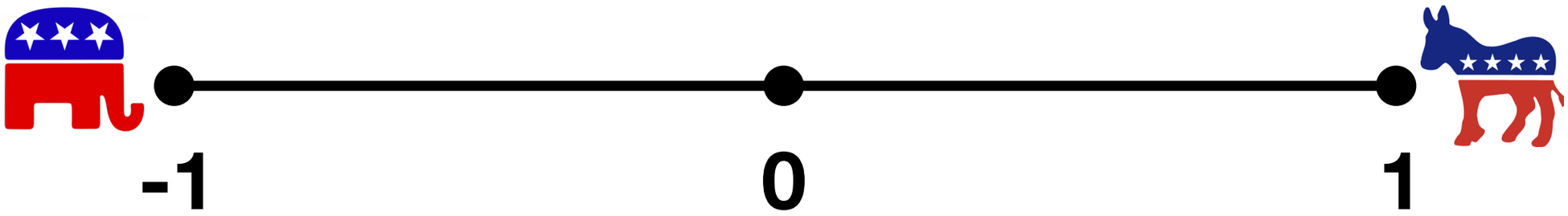
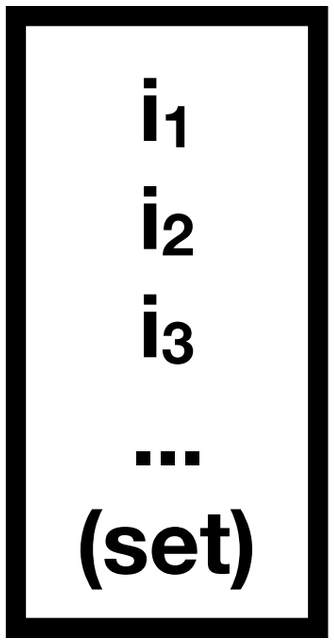


Quantifying bias of individual items



- Our method: Infer bias of each individual item from the bias of the author
- 75% accuracy
- Highly scalable, high coverage
- Other measures can be used [Zafar et al., 2016]

Quantifying bias in inputs (relevant item set)

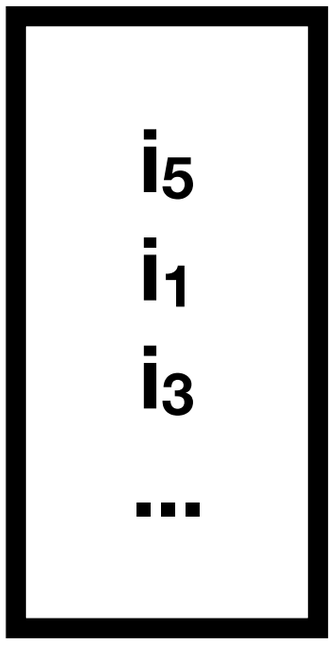


input
(relevant items)

- Compute bias for each item
- Take the average over the whole set

$$IB(q) = \frac{\sum_{i=1}^{n} s_i}{n}$$

Quantifying bias in outputs (ranked list)



output (ranked list)

- MAP-style measure
- Bias till rank *r*

$$B(q,r) = \frac{\sum_{i=1}^{r} s_i}{r}$$

- Output bias

$$OB(q,r) = \frac{\sum_{i=1}^{r} B(q,i)}{r}$$

Quantifying bias in ranking algorithm

Search engine algo.

ranking

Ranking bias = Output bias - Input bias

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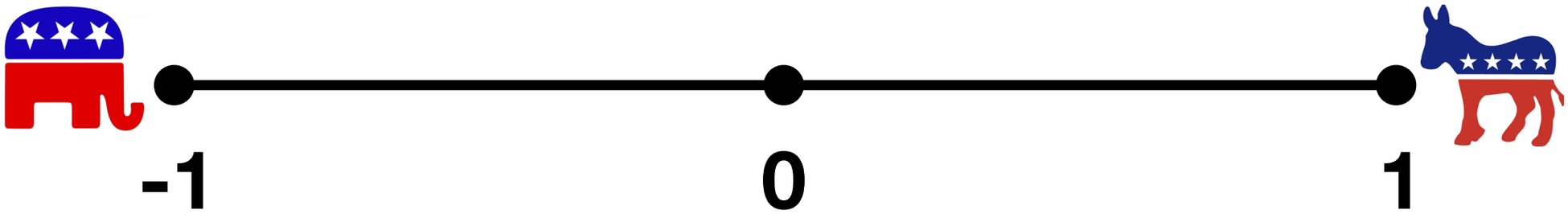
Studying bias in political searches in Twitter

- Search queries for
  - 2016 Democratic and Republican debates (dem debate, #demdebate, ...)
  - Presidential candidates (Hillary Clinton, Donald Trump, ...)

Key takeaways

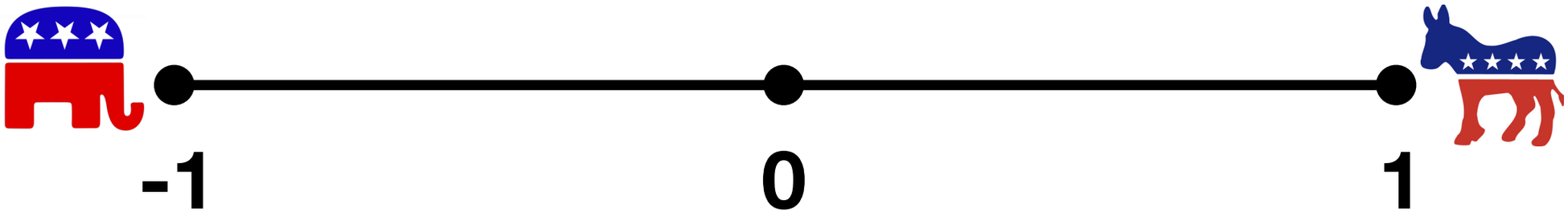
- It is not just the algorithm, input data also matters

High ranking bias



Query	Input Bias	Ranking bias
Hillary Clinton	0.03	0.18
Ted Cruz	-0.11	-0.37

High input bias



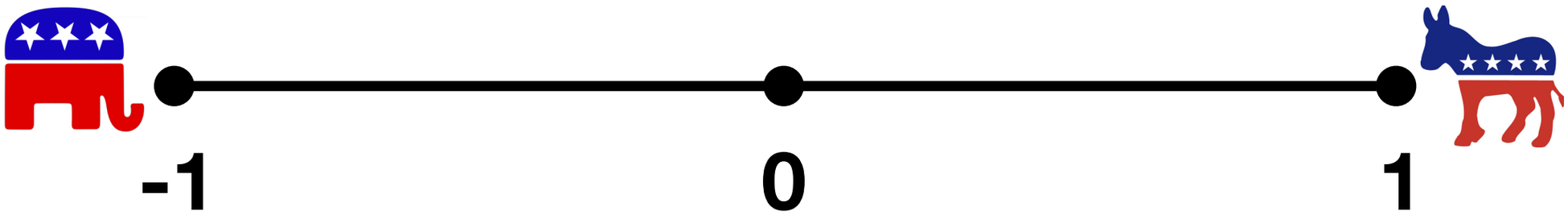
Query	Input Bias	Ranking bias
Bernie Sanders	0.55	0.16
Donald Trump	0.19	0.10

Key takeaways

- It is not just the algorithm, input data also matters

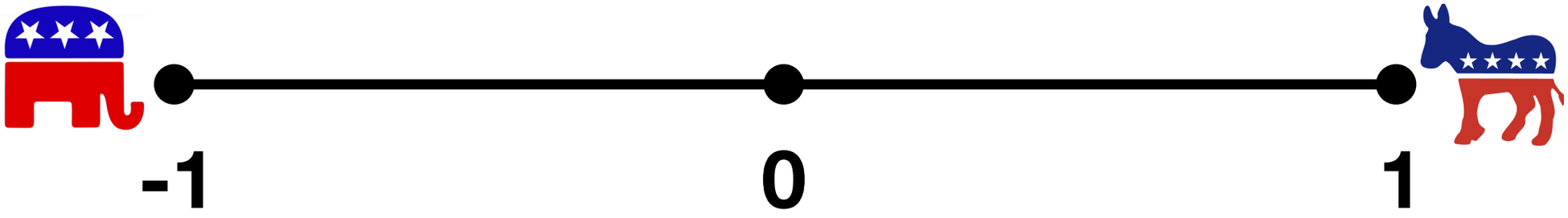
- Analyzing the input bias
  - Search topic matters

Effect of search topic



Query	Input Bias
Hillary Clinton (D)	0.03
Bernie Sanders (D)	0.55
Martin O'Malley (D)	0.64
Donald Trump (R)	0.19
Ted Cruz (R)	-0.11
Marco Rubio (R)	-0.12

Effect of search topic



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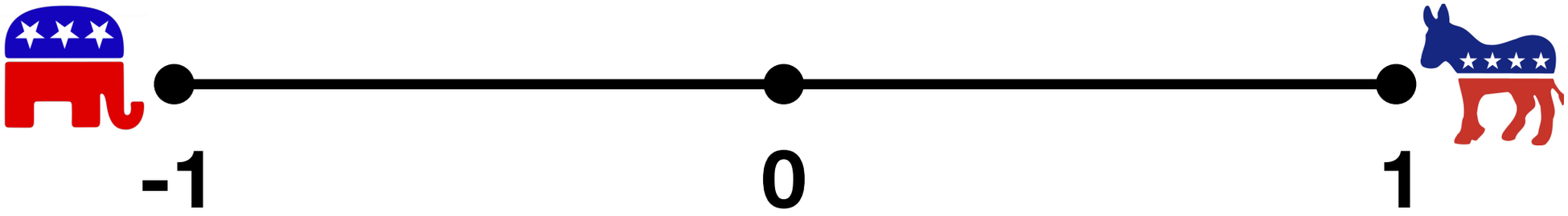
Key takeaways

- It is not just the algorithm, input data also matters

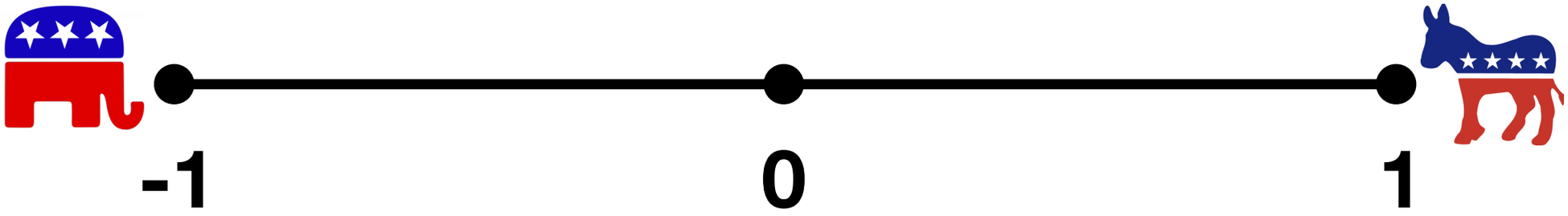
- Analyzing the input bias
  - Search topic matters
  - Query phrasing can make a big difference

Query phrasing and search bias



Query	Input Bias
democratic debate	0.38
#democraticdebate	0.19
#demdebate	0.56

Query phrasing and search bias



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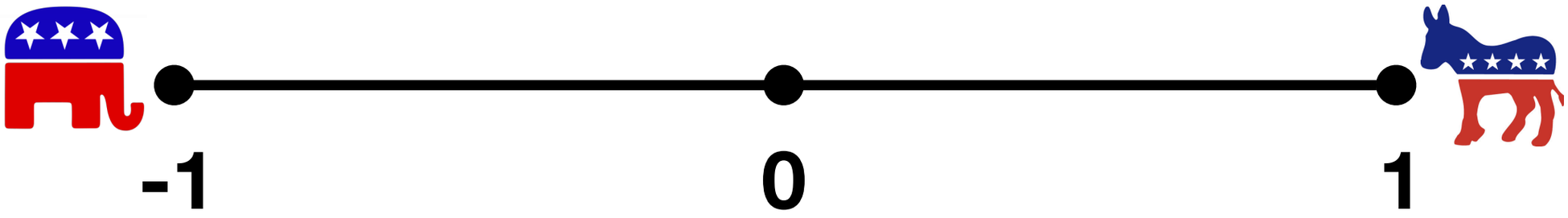
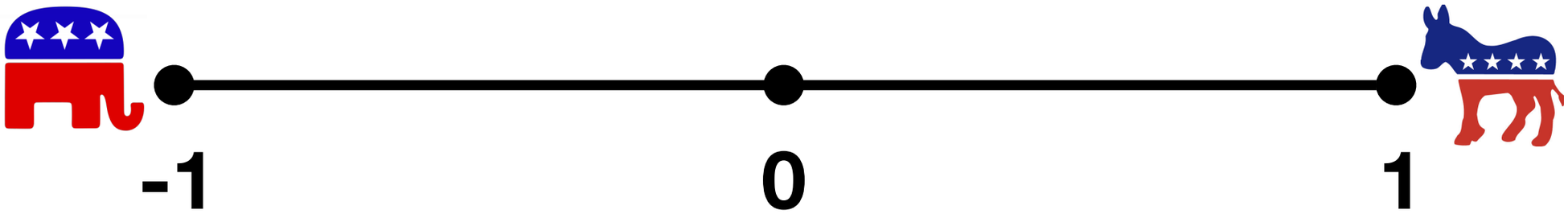


Query	Input Bias
republican debate	0.27
#gopdebate	0.10
rep debate	0.40

Even for the same topic, query phrasing can greatly affect the input bias

Query phrasing and search bias



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Future work: Addressing search bias

- Alter the ranking algorithm
  - Might lead to reduction in quality of results or lead to unforeseen biases
- Make the bias transparent
  - Keep the current ranking
  - Inform the users about what they are seeing
  - Make biases related to query phrasing transparent

Questions

Paper at:

http://tinyurl.com/se-bias