11. Intervention Effectiveness Case Study - Misinformation and Search Rankings

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Link schemes increase traffic to target sites by spamming low-quality links into their HTML

- Crains New York
- Crave On-Line
- Creator empire
- Creator Project
- Crimes of Empire
- Crooks and Liars
- Crosscut
- Crush The Street
- Crypto Globe
- Crypto potato

historical significance instead of being the failed son of Kareem. young Adam also is known for being on the Family Feud with the cream family and making a total ass of himself numerous times in front of Steve Harvey who humiliated his ass and later joked about how stupid Kareem Abdul-Jabbar's son was in his appearances on the guest celebrity of Family Feud

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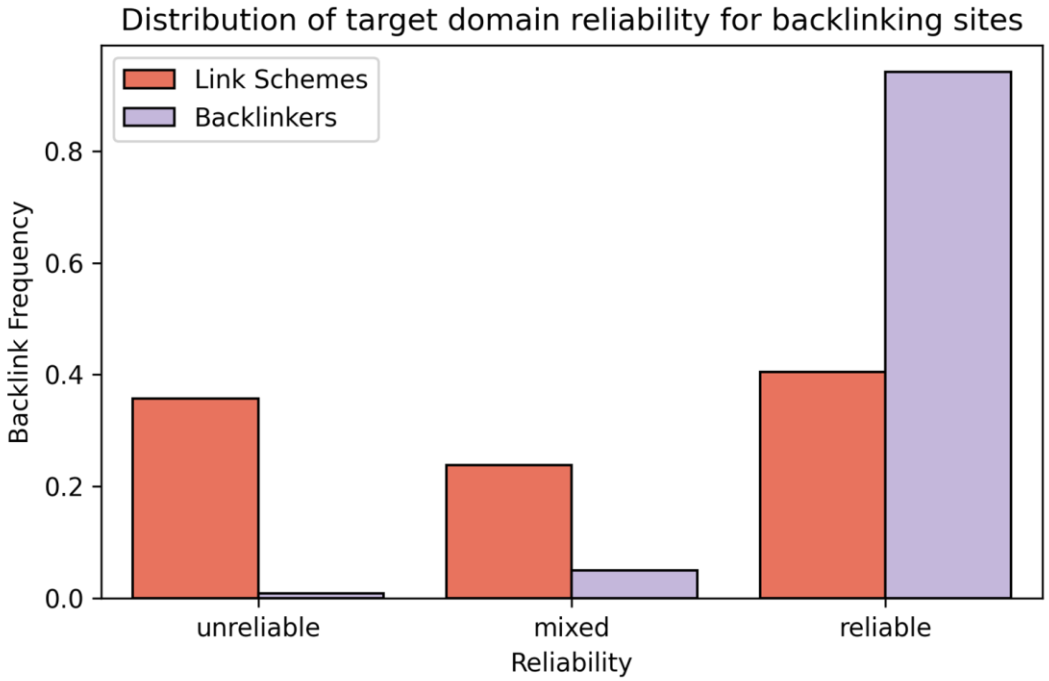
- Defense News
- The Shaderoom.com
- Nation News
- New York Breaking

Evan M. Williams, Kathleen M. Carley. 2023. "Search engine manipulation to spread pro-Kremlin propaganda" in Harvard Kennedy School Misinformation Review, 2023

Link schemes disproportionately link to unreliable news



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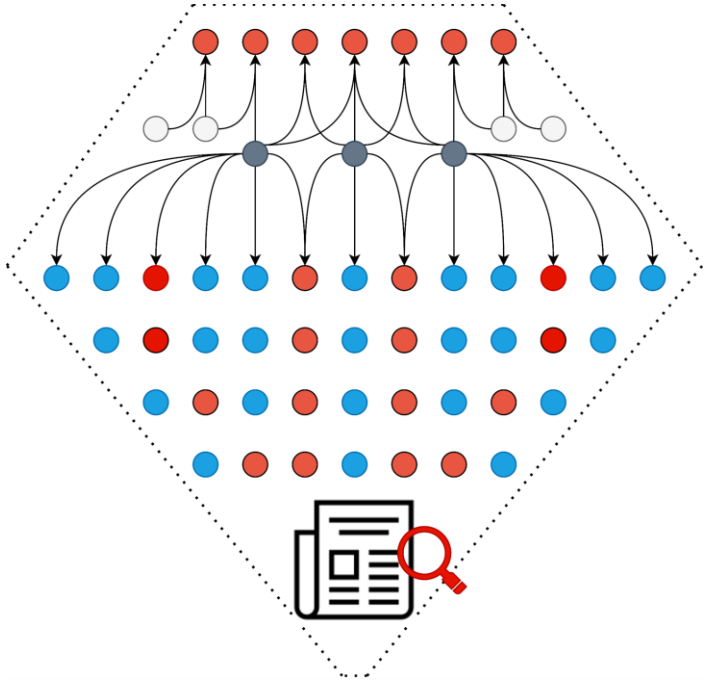
Proactive intervention: Discovery of unreliable sites in the webgraph

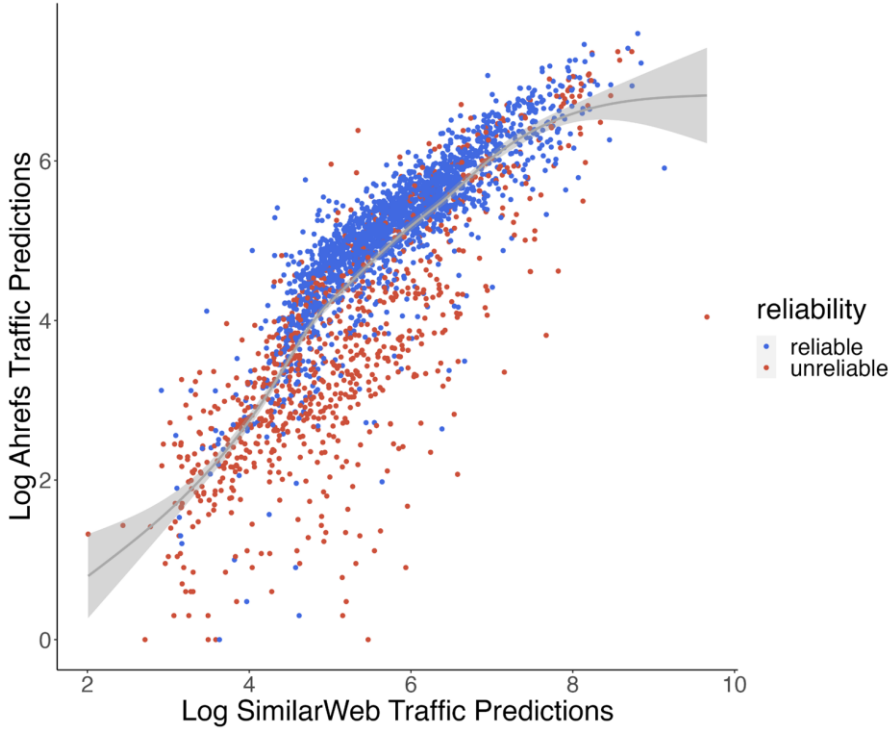


Peter Carragher, Evan M. Williams, Kathleen M. Carley. 2024.
"Detection and Discovery of Misinformation Sources using Attributed Webgraphs" upcoming in ICWSM 2024.

Reactive intervention: Reducing the rankings of unreliable sites

- Method: remove link scheme sites
- Small-Scale Experiment
  - Data: SEO backlinks + traffic estimates
  - Metric: predict traffic reduction
  - Mitigation: bias removal, multiplicity
- Large-Scale Experiment
  - Data: commoncrawl + PageRank
  - Metric: compute PageRank reduction
  - Mitigation: Multi-Category Link Schemes
- Challenges & Principles of intervention design
- Future work

Traffic estimates from different sources agree (despite lack of ground truth)

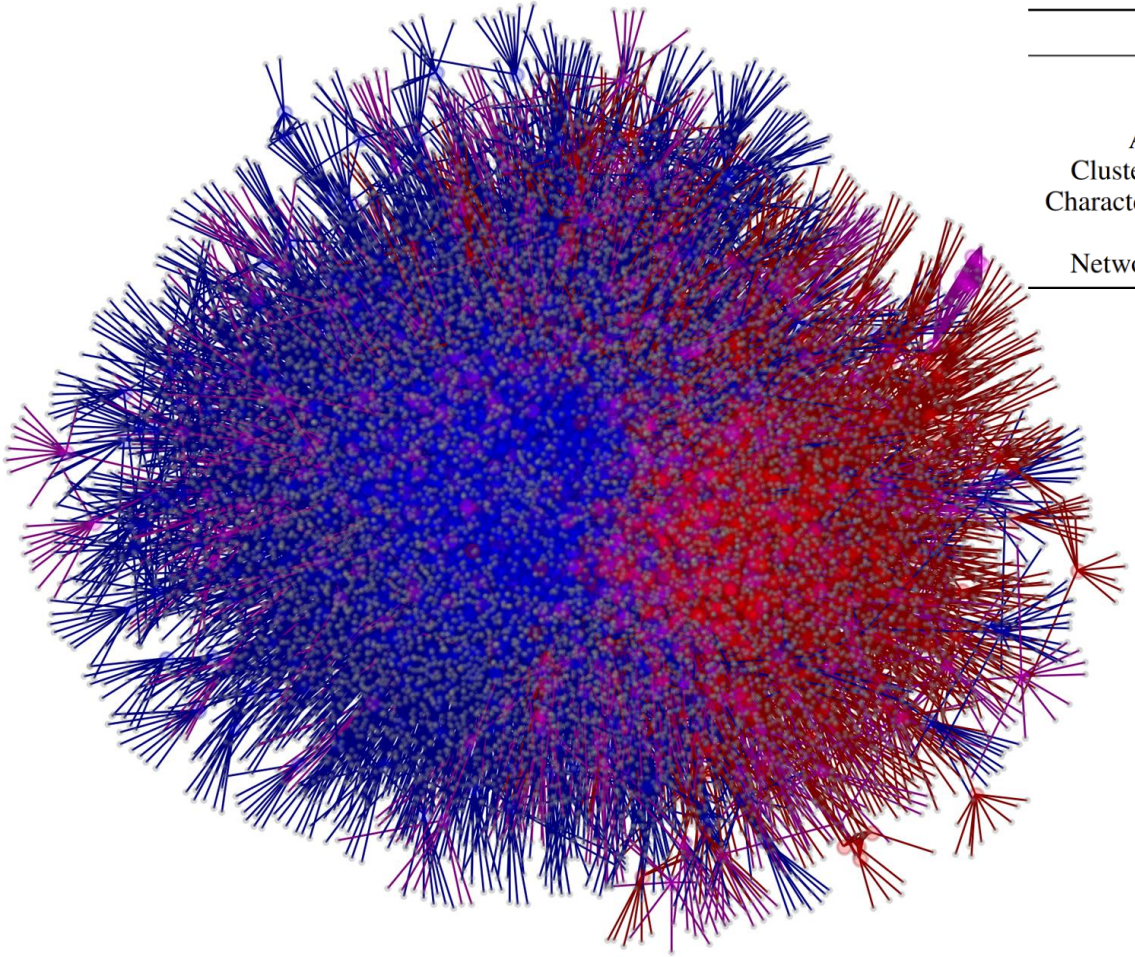


SEO attributes predict traffic estimates + enable intervention design via regression

Dependent Variable	R^2	Backlinks	HTML Pages	Links External
Log(Traffic)	0.907	0.422**	0.586**	-0.139**
Log(Traffic) Debiased	0.892	0.719**	-0.338**	0.323**
Log(Rank)	0.960	0.276**	-0.081**	0.067**
Log(Rank) Debiased	0.973	0.262**	-0.132**	0.116**

$$ln(y^*) = \beta_0 + \beta_1 ln(X_1(1-\delta)) + \beta_2 ln(X_2) + \beta_3 ln(X_3)$$

Limitation: simulation with a regression model vs real-life intervention



Statistic	Backlinks
Nodes	14959
Edges	32110
Avg Degree	4.29
Clustering Coefficient	0.016
Characteristic Path Length	0.401
Density	1.4e-4
Network Assortativity	-0.104

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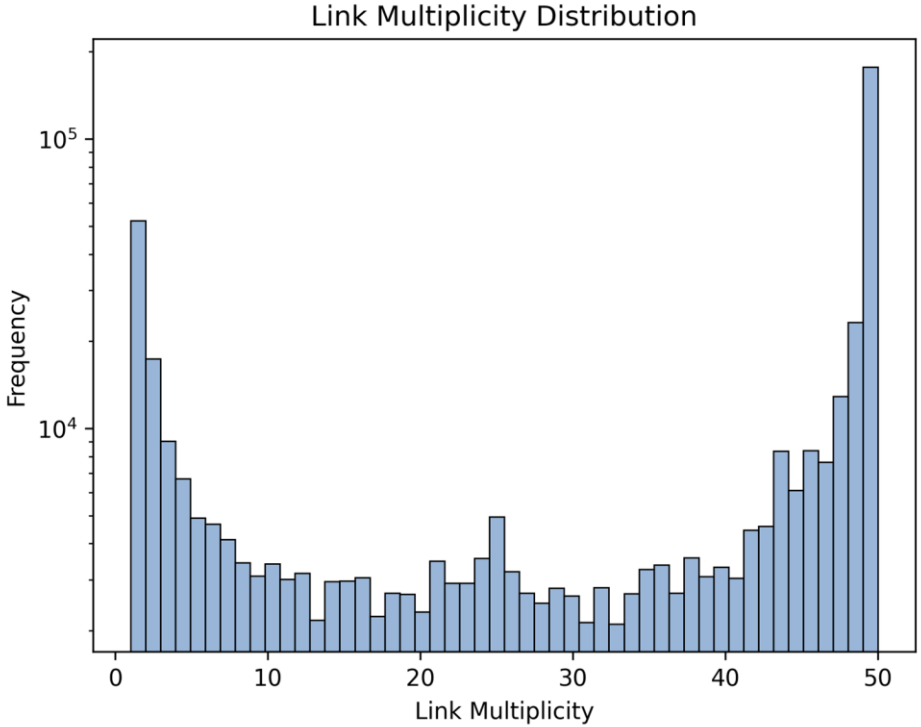
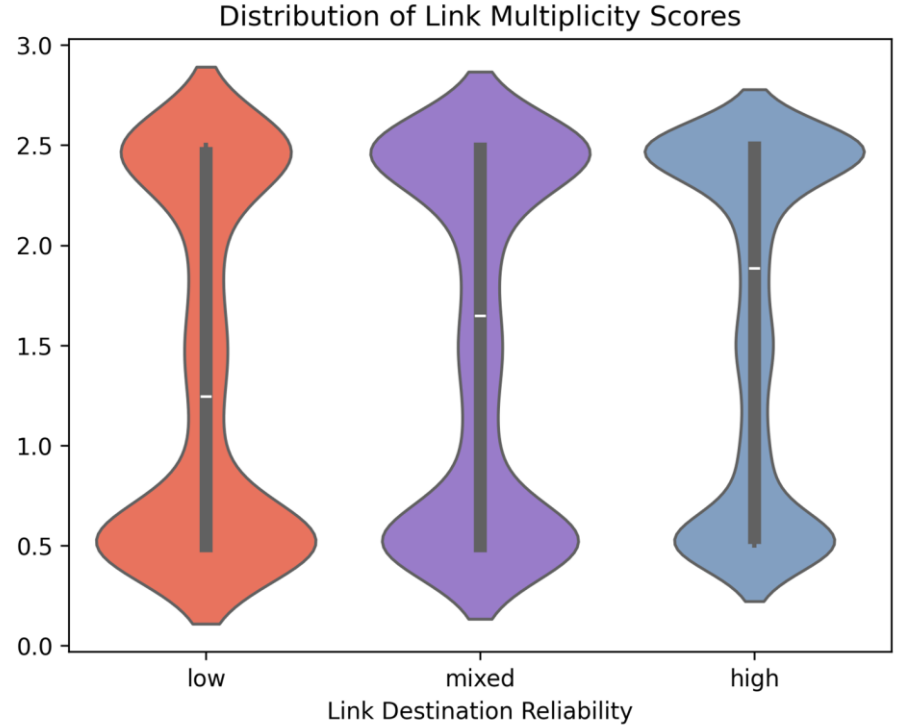
Small-scale interventions reduce predicted traffic to unreliable sites

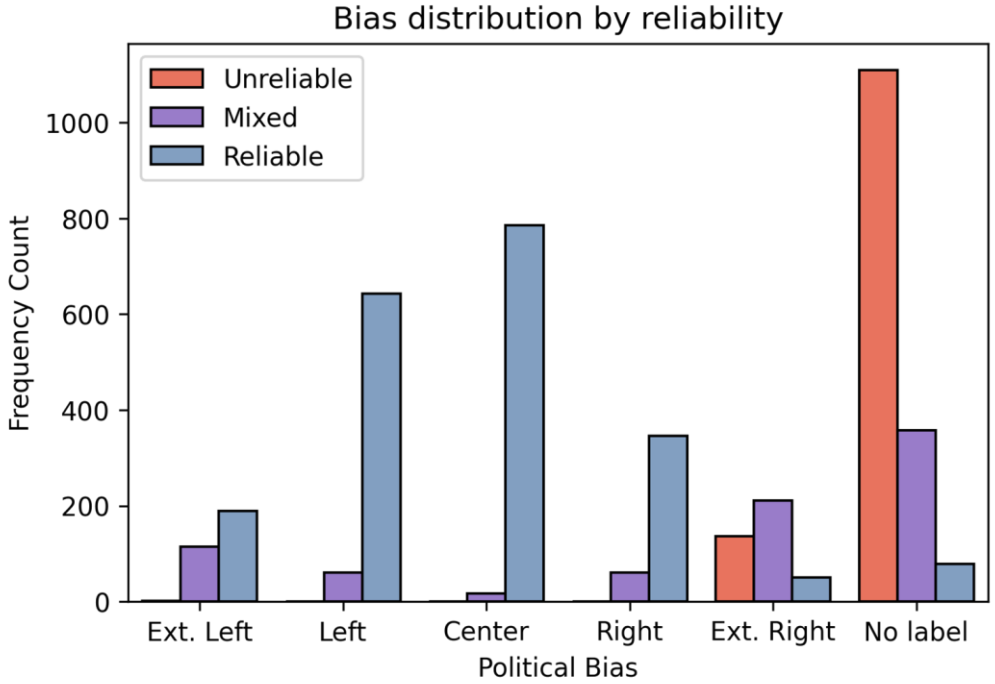
Intervention	Traffic				Rank			
	Unreliable	Mixed	Reliable	RIS	Unreliable	Mixed	Reliable	RIS
Original Attributes								
Link Scheme	0.81	0.79	0.90	0.10	0.88	0.87	0.94	0.07
Multiplicity	1.03	1.06	1.10	0.05	1.00	1.02	1.04	0.02
L+M Combined	0.84	0.83	0.99	0.16	0.89	0.88	0.97	0.09
Debiased Attributes								
Link Scheme	0.78	0.76	0.89	**0.12**	0.88	0.87	0.94	0.07
Multiplicity	1.05	1.08	1.13	**0.07**	1.00	1.02	1.04	0.02
L+M Combined	0.83	0.81	1.00	**0.18**	0.89	0.88	0.97	0.09

Small-scale Mitigation 1: Link Multiplicity Intervention





Small-scale Mitigation 2: Bias Removal on Political Leaning



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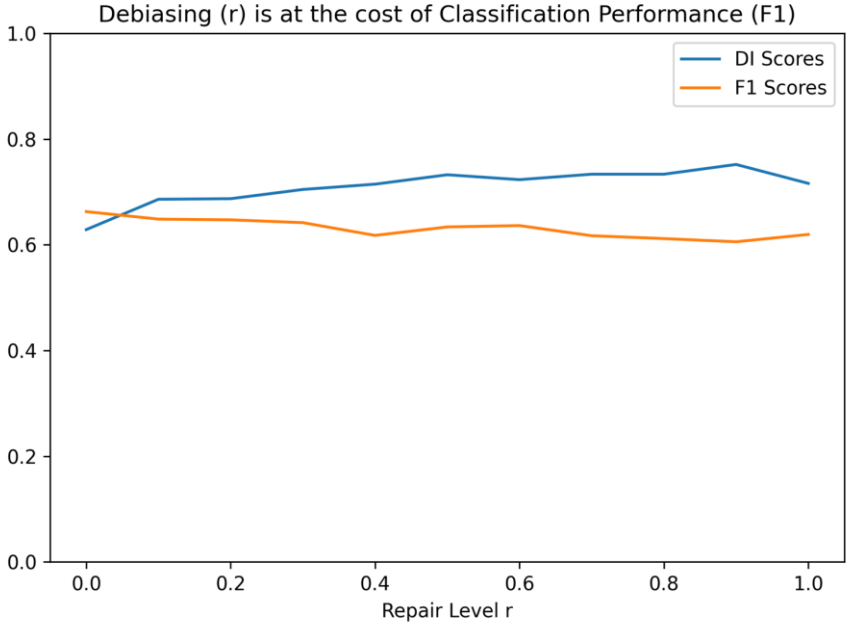
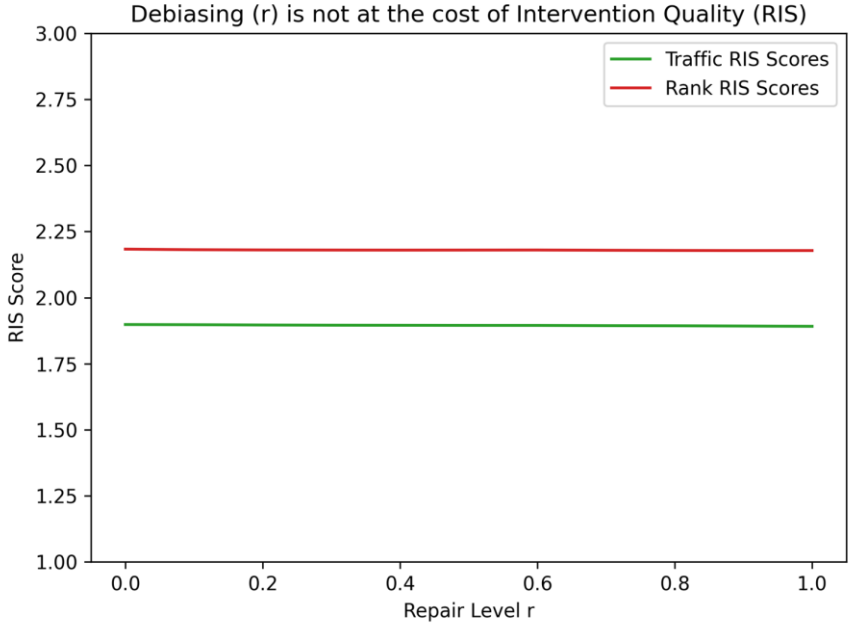
Bias removal impacts classification accuracy, but not intervention effectiveness





Addressing limitations of Small-scale interventions

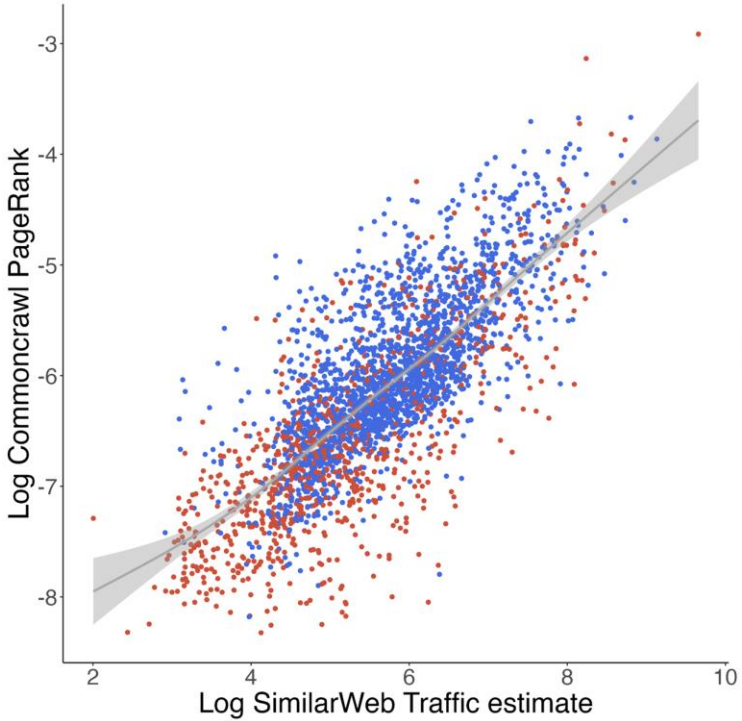
Mitigations:

- Bias removal prevents model learning “all right leaning sites are unreliable”
- Multiplicity enables us to intervene without use of reliability labels

Limitations:

- Small-scale relies on a traffic prediction model
  - Can we compute ranking on the whole webgraph?
- Link scheme sites can link to any target domain
  - What are the unintended effects of interventions on OOD sites?

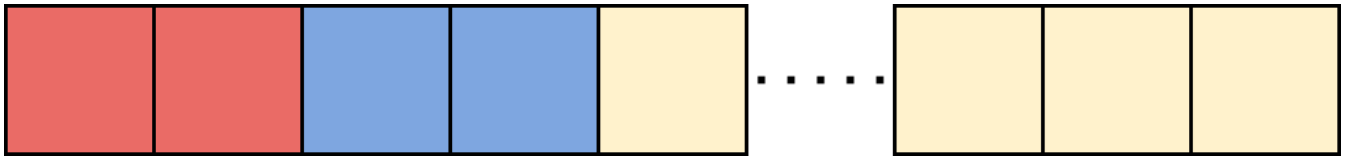
Commoncrawl PageRank agrees with SimilarWeb Traffic Estimates



nodes	93.9M
edges	1.6B
mean degree	17.3
largest connected component	37.7M nodes (40.09%)

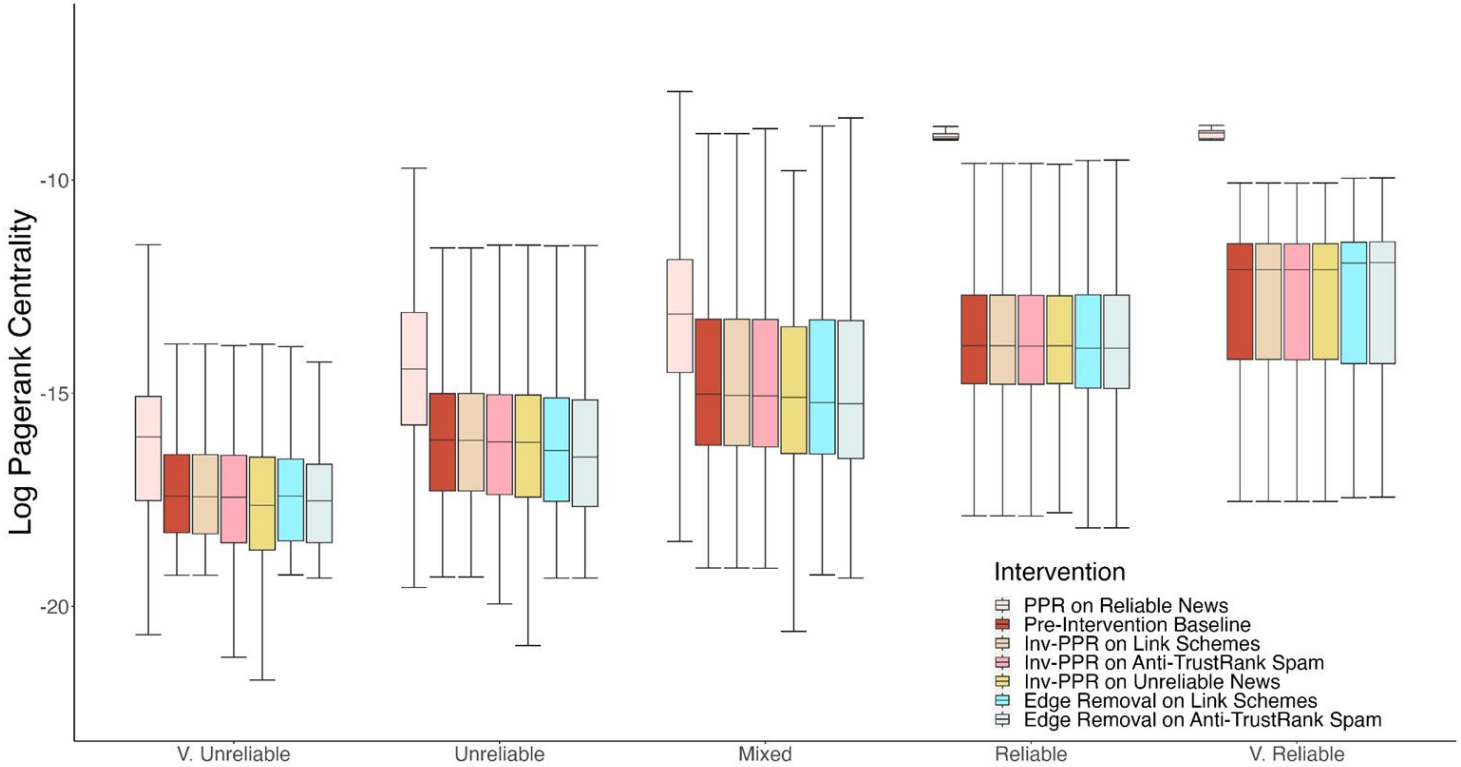
PR, PPR, Inv-PPR, ATR

$$PR(p_i) = \frac{1-d}{N} + d \sum_{p_j \in M(p_i)} \frac{PR(p_j)}{L(p_j)}$$



PR	1/N	1/N	1/N
PPR	0	1/R	0
Inv-PPR	0	1/(N-U)	1/(N-U)
ATR	1/U	0	0

Large-scale interventions have (reduced) effectiveness



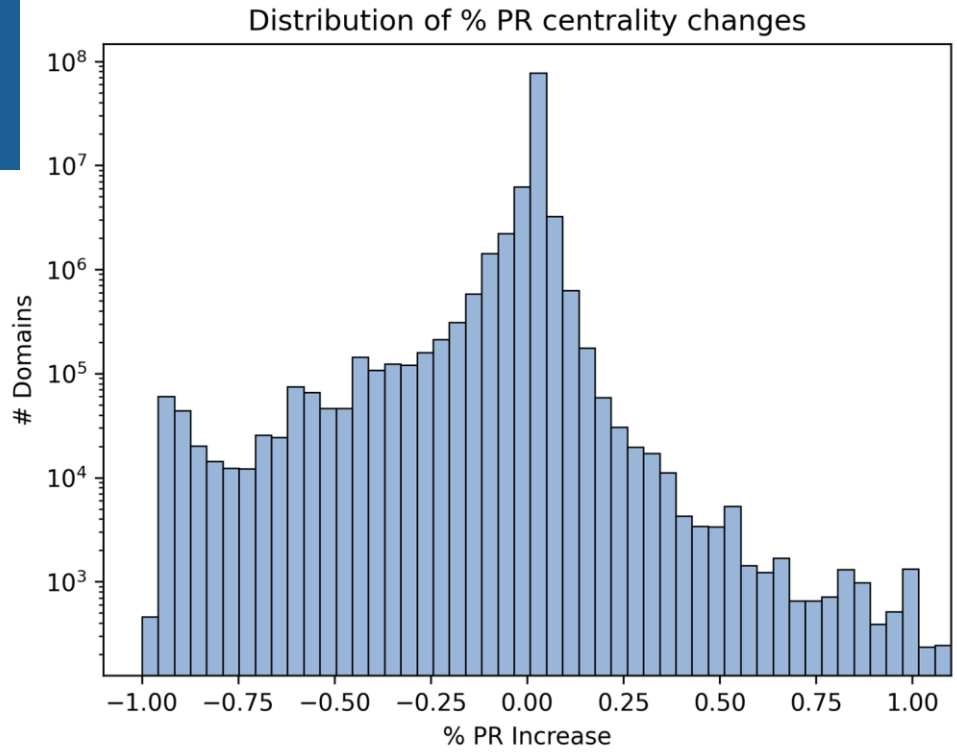
While unintended effects are limited, certain categories of sites are more impacted

Categories with biggest reductions include:

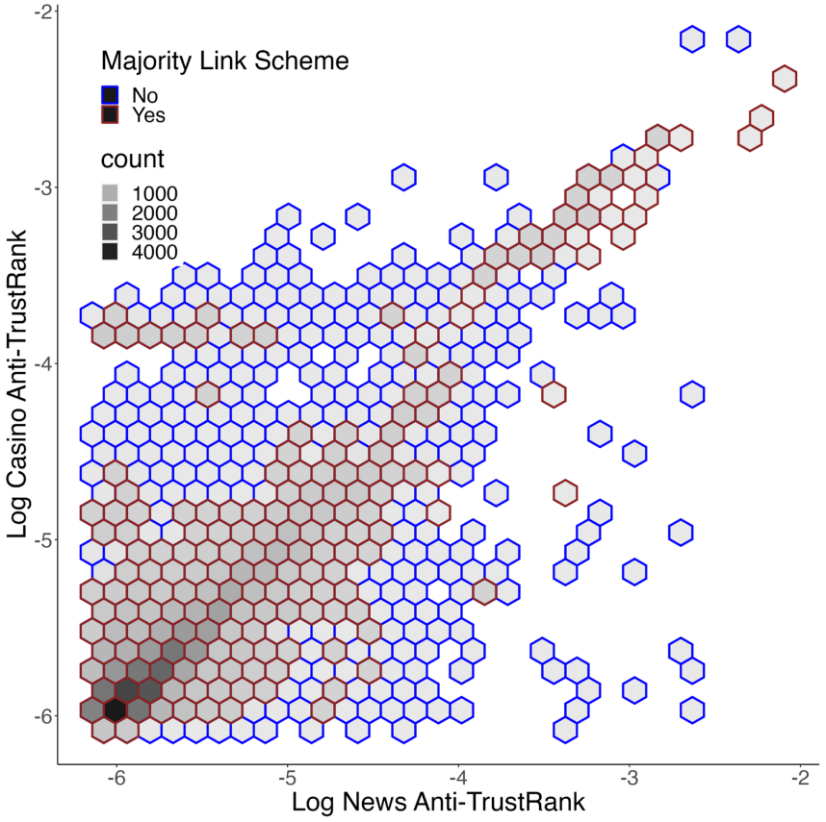
- Gambling
- Sports-betting
- Alternative health

But also…

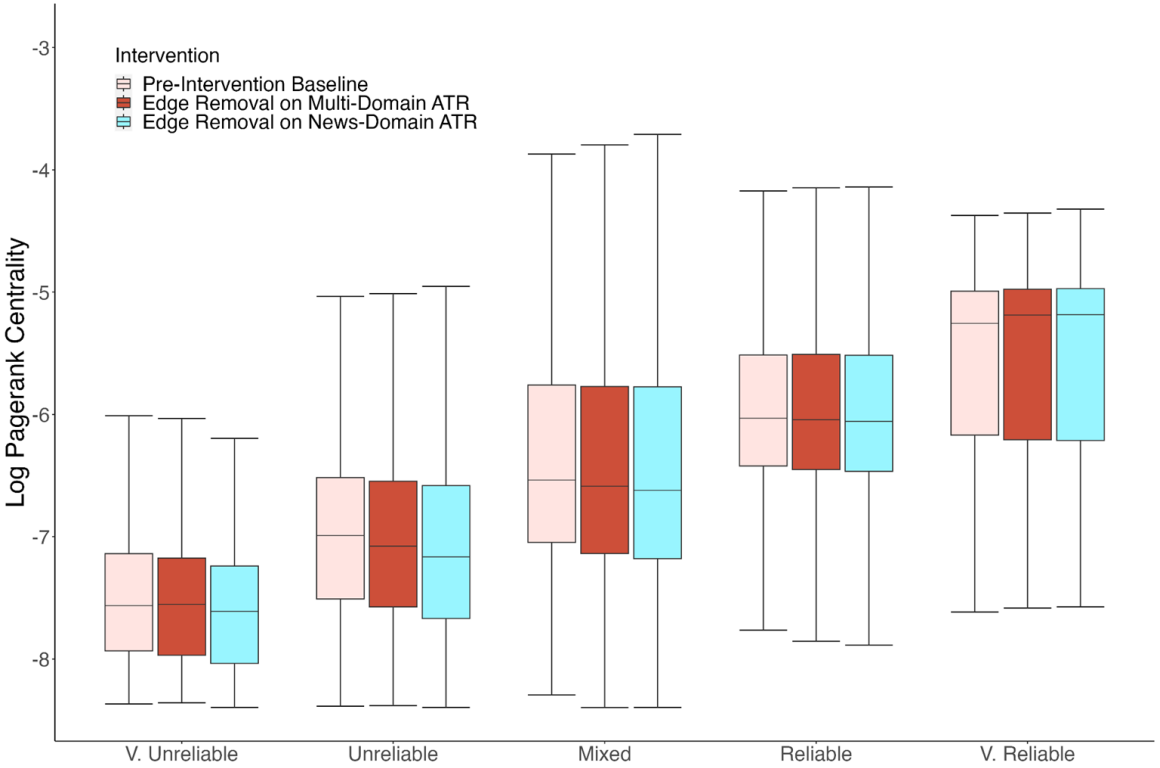
- News & Media
- Law & Government
- University & College



Multi-Category Link Schemes serve ‘undesirable’ customers across site categories



“Multi-Category” link scheme removal has higher *precision*, but lower *recall*



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SEO backlinks

Package	$5 **Basic** 1 GUEST POST 1 guest post with 1 dofollow backlink	$50 **Standard** 10 GUEST POST 10 guest post with 10 dofollow backlinks	$100 **Premium** 20 GUEST POST 20 guest post with 20 dofollow backlink
Off-page strategy	✓	✓	✓
Backlink analysis	✓	✓	✓
Delivery Time	◉ 3 days ○ 1 day (+$5)	◉ 4 days ○ 1 day (+$10)	◉ 5 days ○ 2 days (+$15)
Total	$5 Select	$50 Select	$100 Select

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Challenges in intervention design

- Traffic Regression - predictive model (over-estimate)
  - May learn bias against extreme political leanings
- PageRank Computation - analytic model (under-estimate)
  - binarized webgraph, snapshot
- Platform access for real-world experiments
  - Understudied interventions: redirection, proactive warnings

Principles for designing Search algorithm interventions

Interventions should (where possible):

- not penalize the link destination directly (Fairness)
- not be aware of reliability labels (Generality)
- increase the cost or complexity of adversarial behavior (Cost)
- have the potential for web-scale implementation (Scalability)

Future work

- Mapping the paths from Social Media to Search Engines
  - Data voids & Search Directives
  - Rise of alternative Search Engines
- Impact of recommendation systems on News Producer diversity
  - Recommender systems expose individuals to a wide range of items, while selecting those items only from a small set of sources [1]
- Can media literacy interventions improve how we use search engines?

1. Priyanjana Bengani, Jonathan Stray, Luke Thorburn. 2023. “What is Media Diversity and Do Recommender Systems Have It?” link

More Information →

- Paper: under review (TIST)
- NewsSEO Dataset (Small-scale)
- NewsSEO Dataset paper
- Commoncrawl Webgraph Dataset
- Webgraph Framework

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Robertson, Ronald E., et al. 2023. "Identifying Search Directives on Social Media." Journal of Online Trust and Safety 2.1, 2023.