Search Neutrality debate: arguments and mathematical modeling

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Search engines are more and more suspected to tamper with the ranking

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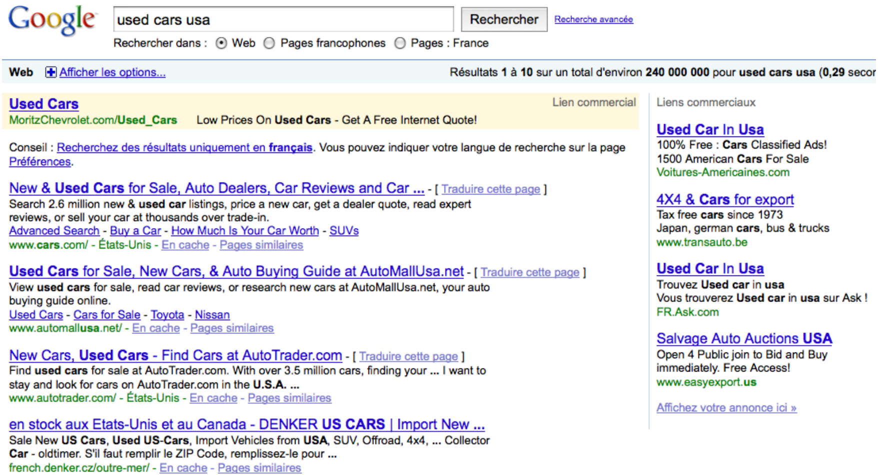

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Search neutrality would impose that all contents have the same chances of being displayed
$\Rightarrow$ a ranking based on **relevance** (to be defined objectively)

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- Competition is just one click away...

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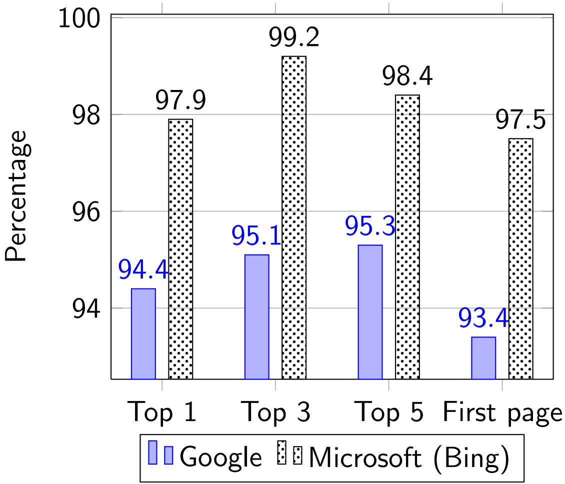

Percentage of Google or Bing search results with **own content not ranked similarly** by any rival search engine (Wright, 2012).

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Comparison between Google, Bing, and Blekko (Wright, 2012):

- Microsoft content is 26 times more likely to be displayed on the first page of Bing than on any of the two other search engines
- Google content appears 17 times more often on the first page of a Google search than on the other search engines

Search engines do favor their own content

Regulatory intervention

- The European Commission, is progressing toward an antitrust settlement deal with Google

  > *Google must be even-handed. It must hold all services, including its own, to exactly the same standards, using exactly the same crawling, indexing, ranking, display, and penalty algorithms.*

- The European Commission is running a market testing (started in April 2013) to estimate the extent to which the Google ranking algorithm respects these guidelines (Google may face a fine as large as $5 billion)

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Expected gain per search: $$g = \underbrace{\beta}_{\text{from ads}} + \sum_i \theta_{\pi_i} g_i$$

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$$\Rightarrow \text{expected revenue per time unit} = \lambda(r) \times g$$

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  Say with m candidate pages and $\lambda(r) = r$

$$\max_{\text{permutations } \pi} \left(\sum_{i=1}^{m} \theta_{\pi_i} r_i \right) \cdot \left(\beta + \sum_{i=1}^{m} \theta_{\pi_i} g_i \right)$$

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not an easy task...

An example

One keyword, three pages,
click probabilities $\theta_i = \frac{1}{2^i}$
$\lambda(r) = r$

i	Relevance r_i	Gain g_i
1	3	0
2	2	0
3	1	2

Ranking	Relevance (r)	Engine revenue per time unit
1; 2; 3	2.125	$2.125\left(\beta + \frac{1}{4}\right)$
1; 3; 2	2	$2\left(\beta + \frac{1}{2}\right)$
3; 1; 2	1.5	$1.5\left(\beta + 1\right)$

Depending on the revenues from ads (value of β),
each of these three can be the best one

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$$\text{Revenue} \quad = \quad \lambda\left(\mathbb{E}\left[\sum_{i=1}^{m} \theta_{\pi_i} R_i\right]\right) \cdot \left(\beta + \mathbb{E}\left[\sum_{i=1}^{m} \theta_{\pi_i} G_i\right]\right)$$

We have a few results regarding that problem

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- Analyze the non-neutral ranking
- Compare the performance and neutral and non-neutral policies
  - Cost of non-neutrality: loss of relevance for users
  - Cost of neutrality (for search engines): loss of revenue for search engines
- Discuss the need for regulation

This topic (and many others), in a book to appear: