A Comparative evaluation between sequential and parallel PageRank algorithm

João Vitor do Amaral Spolavore, Thiago dos Santos Gonçalves

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Description of the Computational Object

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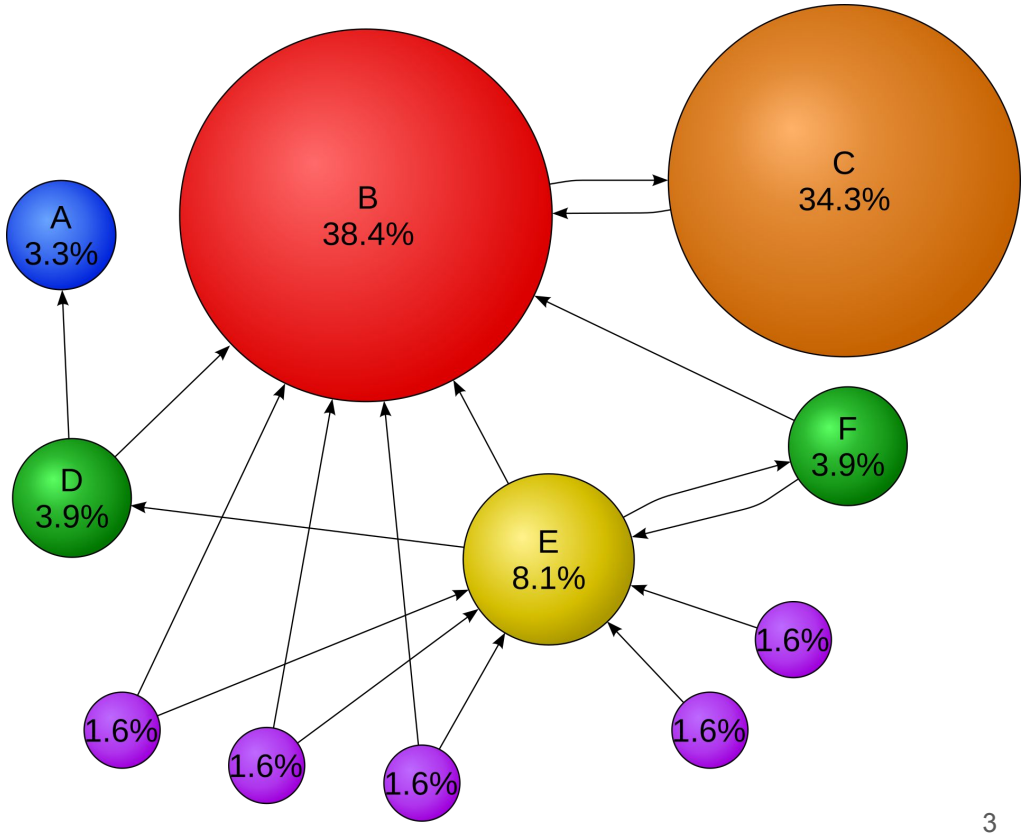

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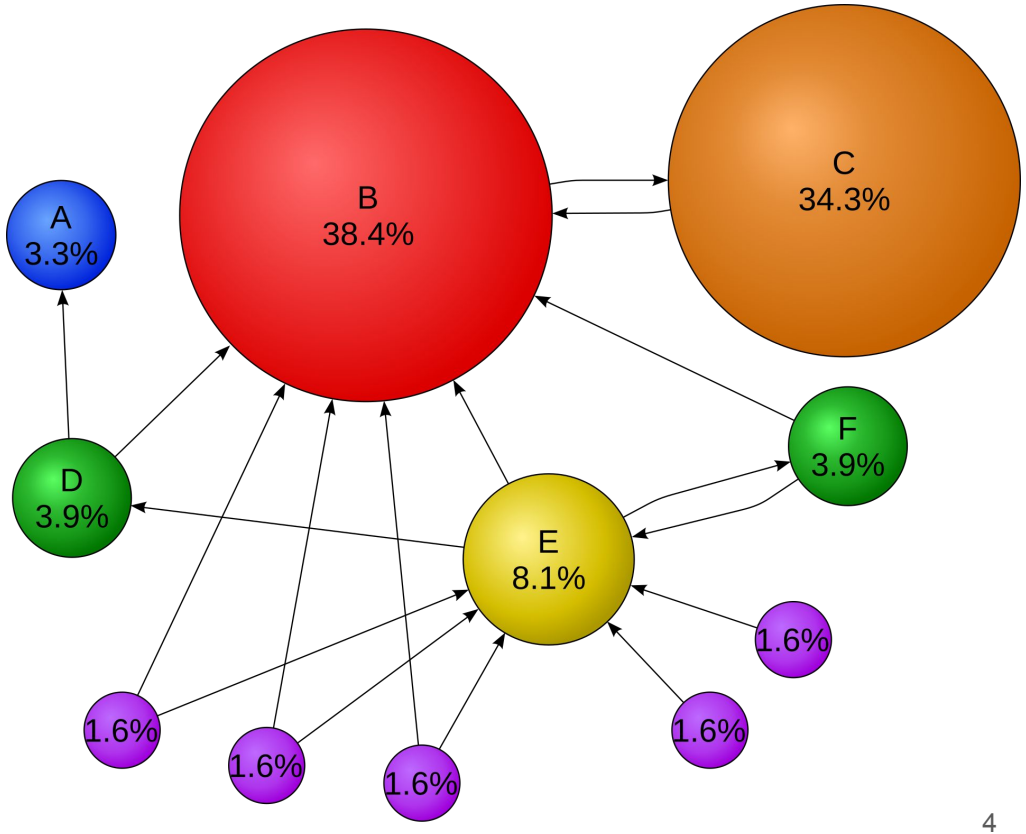
- The PageRank of any given page is defined recursively and depends on the number and PageRank metric of all pages that link to it.



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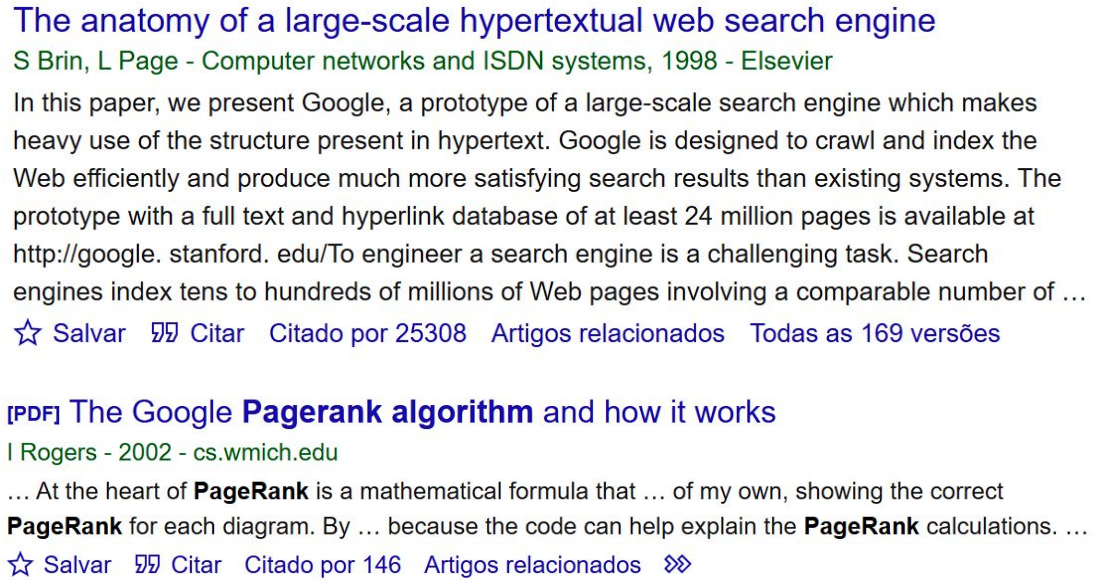
- With this in mind, there have been many implementations and variations of the PageRank algorithm and scientific papers that discuss its efficiency.



The anatomy of a large-scale hypertextual web search engine

S Brin, L Page - Computer networks and ISDN systems, 1998 - Elsevier

In this paper, we present Google, a prototype of a large-scale search engine which makes heavy use of the structure present in hypertext. Google is designed to crawl and index the Web efficiently and produce much more satisfying search results than existing systems. The prototype with a full text and hyperlink database of at least 24 million pages is available at http://google. stanford. edu/To engineer a search engine is a challenging task. Search engines index tens to hundreds of millions of Web pages involving a comparable number of …

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- Most importantly, it was the main algorithm used by Google to rank its pages to order search results until a few years ago.

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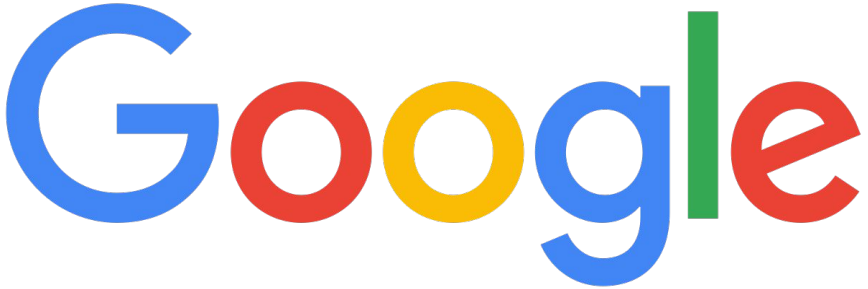

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Choice of analysis method

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- To do that, we have decided to take a **measurement** approach to compare the algorithm’s efficiency.

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- To do that, we have decided to take a **measurement** approach to compare the algorithm's efficiency.
- We want to visualize how the parallelization can *(if possible)* reduce the time taken by the sequential PageRank, and by how much the time can be reduced.
- And while doing that, we want to collect system metrics to figure out how the parallelization affects cache hits, misses, and CPU usage.

Choice of analysis method

- We plan on using a computer from the *Laboratório de Computação Paralela e Distribuída*'s available computers (PCAD).
- We will run the benchmark 10 times. 5 times profiling with the Intel® VTune™ Profiler, and 5 times without the Intel® VTune™ Profiler to get the time spent and energy consumption metrics.

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- We want to use the Intel® VTune™ Profiler to collect the following metrics:
  - Estimated Energy Consumption (Watts)
  - L1, L2, L3 Cache Hit Rate (%)
  - CPU usage (%)
- If needed, we will consider more metrics as we get further into our project.

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- And for graphs to use as input, we will use Stanford University's Large Network Dataset Collection.

3

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- We chose this specific algorithm because we are having another class named Parallel and Distributed Programming (INF-01008), and we learn different methods to parallelize algorithms.
- Because of that, we prefer to conduct research on an algorithm that we feel most comfortable with and that will allow us to complete the projects of both courses at once.

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- Also, Thiago used to be a research intern on LPPD, and worked directly on PCAD and CPU metrics collection.

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2025-11-17 to **2025-11-23 (6 days):** Finalize the report, organize the relevant archives and objects of our project, send to evaluation.

References

- PageRank Algorithm Explained https://medium.com/biased-algorithms/pagerank-algorithm-explained-5f5c6a8c6696
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