CSCI572 HW4 Report

Comparing Search Engine Ranking Algorithms

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❖ Introduction
➢ In this exercise you will use the Apache Solr software to import a set of web pages and investigate different ranking strategies.

❖ Steps
➢ Preparation
- Since my development environment is on Macbook, I do not need to install Ubuntu.
- Download sorl-7.5.0 and then install Sorl.

➢ Indexing HTML files in Sorl
- Start the Solr server, and go to the directory of sorl-7.5.0 to start server by using command "bin/solr start."
- Create a new core named "myexample" by using command "bin/solr create -c myexample."
- Examine the directory structure of the folder.
- Edit the configuration file "managed-schema", to add a field tag with required information:
  - `<fieldType name="external" keyField="id" defVal="0" class="solr.ExternalFileField"/>`
  - `<field name="pageRankFile" type="external" stored="false" indexed="false"/>`
- Edit another configuration file "solfconfig.xml", to update class names for two specific events:
  - `<listener event="newSearcher" class="org.apache.solr.schema.ExternalFileFieldReloader">`
  - `<listener event="firstSearcher" class="org.apache.solr.schema.ExternalFileFieldReloader">`
- Try to index some html pages by using the given example.
- Go to http://localhost:8983/solr/ to check the initial page Solr, go to "myexample" and try to query some examples.

➢ Write Java Code to create edge list
- I use IntelliJ as my development IDE.
- Download "jsoup" library and import this library to my IDE
- For coding details:
  - Build two mapping relationships: file to url and url to file
  - Create edge list results file based on these mapping relationship as well as csv mapping relationship and nypost data
  - Generate results file with edge list between every two page

➢ Write Python Code to generate pageRank file
- After getting edge list, we need to calculate their page ranks.
- For coding details:
  - Open the edgeList file that we generated by Java code, and set nx.pagerank by given parameters.
  - I use "DiGraph()" API from "networkx" library to compute PageRank.
  - Initial configuration of PageRank algorithm:

- ◆ pr = nx.pagerank(G, alpha=0.85, personalization=None, max_iter=30, tol=1e-06, nstart=None, weight='weight', dangling=None);
    - Open a new pageRank.txt file, iteratively generate a final output with parallel of rows of every html key corresponding with its page rank value.
  - Move the output file to the correct data directory, and then rename to "external_pageRankFile.txt" as required.
- ➢ Write PHP Code to implement frontend page
  - I use MAMP to start a PHP server, and create an "index.txt" in the "htdocs" directory.
  - For coding details:
    - Write HTML code with a form and result block to render frontend page.
    - Set data of csv file as key value mapping array.
    - Write PHP code to iteratively print the first 10 results that user queried.
      - ◆ Title is from "title" attribute of JSON file.
      - ◆ Url is from "og_url" attribute of JSON file by default. If "og_url" is null, we need to find mapping value of csv array that we initialized before by html id. Otherwise, print "N/A"
      - ◆ Id is the filted html id without path.
      - ◆ Description is from "og_description" attribute of JSON file by default. If "og_description" is null, we could get "description" attribute again from JSON file. Otherwise, print "N/A"
- ➢ Check results and proof read
  - Use eight different queries with two different ranking algorithms to show my searching results.
    - Solr option uses Lucene to facilitate ranking
    - Page Rank option use our generated "external_pageRankFile.txt" file with every page ranking value to get the results. I use descending order in this case.
  - Use "myexample" on Solr to make same query to make sure whether I got the correct outputs.
    - Eg: check corresponding attribute value, or query by html id, and check with JSON results again

❖ Explanation
- ➢ Some pages have higher PageRank values than others maybe because of three reasons. Firstly, the page with higher page rank have more incoming links than others with lower page rank. They are considered more "important." For instance, the main domain may have more incoming links than its subdomains. Secondly, some pages may have more relevant topic and important keywords related to query than other pages. Thirdly, some webpage could contain so many common/general topics. It usually has higher page rank, regardless our queries, because the site may contain different category of possible keywords when we search for different queries.

❖ Screenshots of Search Results

➢ Initial Page

Comparing Search Engine Ranking Algorithms

Search Query: [   ]
Ranking Method: 🔘 Solr Lucene ⚪ Page Rank [SUBMIT]

Search Results:

➢ Results for Lucene (Default)

Comparing Search Engine Ranking Algorithms

Search Query: [Donald Trump]
Ranking Method: 🔘 Solr Lucene ⚪ Page Rank [SUBMIT]

Search Results:

Results 1 - 10 of 8041:

1. **Title: Donald and Melania Trump tour towns destroyed by Hurricane Michael**
   Url: https://nypost.com/2018/10/15/donald-and-melania-trump-begin-tour-of-towns-destroyed-by-hurricane-michael/
   ID: 3ebce63e-fba7-403d-b0b8-50f1db9e67b4.html
   Description: President Trump got a firsthand look at the path of destruction Hurricane Michael carved out along the Florida Panhandle and Georgia during a day of aerial tours Monday. In Marine One, Trump, accom…

2. **Title: Donald and Melania Trump tour towns destroyed by Hurricane Michael**
   Url: https://nypost.com/2018/10/15/donald-and-melania-trump-begin-tour-of-towns-destroyed-by-hurricane-michael/
   ID: b02d11fc-24b7-4eab-917d-83905c542d1e.html
   Description: President Trump got a firsthand look at the path of destruction Hurricane Michael carved out along the Florida Panhandle and Georgia during a day of aerial tours Monday. In Marine One, Trump, accom…

3. **Title: Donald Trump has invented a new way to win**
   Url: https://nypost.com/2016/02/15/donald-trump-has-invented-a-new-way-to-win/
   ID: 51f46b36-0e7b-4d6a-837d-938d9587b16e.html
   Description: The other GOP candidates are finally starting to fight on Donald Trump's terms, to judge by the slugfest that was Saturday night's debate. But it speaks volumes — whole encyclopedias — about the ig…

4. **Title: November 9, 2016 | New York Post**
   Url: https://nypost.com/2016/11/09/
   ID: 1e666eac-ab65-4885-869e-3d057deeb87c.html
   Description: Read the news from November 9, 2016 on the New York Post.

5. **Title: How Donald Trump manipulated Bon Jovi out of Bills purchase**
   Url: https://nypost.com/2017/11/06/how-donald-trump-manipulated-bon-jovi-out-of-bills-purchase/
   ID: 4882c3e5-f749-4528-8082-8df47c4c48e5.html
   Description: BUFFALO — Was Donald Trump the secret force behind the seemingly grassroots 2014 campaign to block Jon Bon Jovi from buying the NFL's Buffalo Bills? That's what those involved are sayin…

6. **Title: [President Trump pays tribute to Mets great David Wright](https://nypost.com/2018/10/01/donald-trump-pays-tribute-to-friend-david-wright/)**
   Url: https://nypost.com/2018/10/01/donald-trump-pays-tribute-to-friend-david-wright/
   ID: 05473ac2-f9ed-4a02-888b-7ee35ac52868.html
   Description: Everyone loves David Wright. The president of the United States is apparently part of that not-so-exclusive group. President Trump made a video congratulating Wright on his career that Wright's age…

7. **Title: [With Trump's win, it's time for GOP to unite against Hillary](https://nypost.com/2016/05/03/donald-trump-is-the-nominee-cruz-and-kasich-should-drop-out/)**
   Url: https://nypost.com/2016/05/03/donald-trump-is-the-nominee-cruz-and-kasich-should-drop-out/
   ID: 9e047f06-6dbc-4081-827e-4f836023df50.html
   Description: Ted Cruz did the right and honorable thing by suspending his presidential campaign Tuesday night. John Kasich should follow suit. It's time for the party to unite against Hillary Clinton. Donald Tr…

8. **Title: [November 10, 2016 | New York Post](https://nypost.com/2016/11/10/)**
   Url: https://nypost.com/2016/11/10/
   ID: be115371-1223-4866-ba39-e5668c9b6456.html
   Description: Read the news from November 10, 2016 on the New York Post.

9. **Title: [January 20, 2017 | New York Post](https://nypost.com/2017/01/20/)**
   Url: https://nypost.com/2017/01/20/
   ID: bd1848eb-fd9e-4ff8-88f2-cdd4ff166856.html
   Description: Read the news from January 20, 2017 on the New York Post.

10. **Title: [November 11, 2016 | New York Post](https://nypost.com/2016/11/11/)**
    Url: https://nypost.com/2016/11/11/
    ID: ae6b0482-148d-46ef-b070-1c520f1bd5a6.html
    Description: Read the news from November 11, 2016 on the New York Post.

➢ Results for PageRank

Comparing Search Engine Ranking Algorithms

Search Query: Donald Trump
Ranking Method: ○ Solr Lucene ● Page Rank SUBMIT

Search Results:

Results 1 - 10 of 8041:

1. **Title: [Fashion News, Photos, and Video | New York Post](https://nypost.com/fashion/)**
   Url: https://nypost.com/fashion/
   ID: 6bc5ab6f-4ca4-4588-a3a8-f9a6bb45f6ab.html
   Description: Get the latest fashion news including local and worldwide trends on the New York Post.

2. **Title: [Technology News & Reviews | New York Post](https://nypost.com/tech/)**
   Url: https://nypost.com/tech/
   ID: 40b8760d-53b6-4edb-a9b7-f60c3c13258d.html
   Description: Get the latest news on technology companies, products, reviews and more in the tech industry on the New York Post.

3. **Title: [Columnists | New York Post](https://nypost.com/columnists/)**
   Url: https://nypost.com/columnists/
   ID: fc17eac6-ad31-4c0c-b079-3bebbc17fcb9.html
   Description: Visit the post for more.

4. **Title: [News | New York Post](https://nypost.com/news/)**
   Url: https://nypost.com/news/
   ID: 2f65e692-a9f9-4f32-9591-198ecc3a0d9b.html
   Description: Read the latest news and breaking news for local, U.S. and world events on the New York Post.

5. **Title: [Daily Horoscope | New York Post](https://nypost.com/horoscopes/)**
   Url: https://nypost.com/horoscopes/
   ID: e8940ca0-ff7c-4925-aaab-47e9f260d0c1.html
   Description: N/A

6. **Title:** Living | New York Post
   Url: https://nypost.com/living/
   ID: 08328725-0507-4b37-a111-b1eda05fd1fc.html
   Description: Find the latest lifestyle news on health, sex, dating, food, home and more on the New York Post.

7. **Title:** Entertainment | New York Post
   Url: https://nypost.com/entertainment/
   ID: 3e6224e7-52b2-49bb-b35e-36e453227413.html
   Description: Get the latest entertainment news and breaking news on your favorite celebrities, movies, TV shows and more on the New York Post.

8. **Title:** Media | New York Post
   Url: https://nypost.com/media/
   ID: bbc54461-2472-49bf-8c43-4e1a383347f4.html
   Description: Get the latest news on media companies across the world on the New York Post.

9. **Title:** Opinion | New York Post
   Url: https://nypost.com/opinion/
   ID: 1f12f8e0-2b05-4fdc-98f0-2473818a378c.html
   Description: Read the New York Post's opinion and commentary section featuring newspaper articles on the latest breaking news.

10. **Title:** New York Post
    Url: https://nypost.com/
    ID: dc52408d-235a-4535-a9bd-4b08b1c777b0.html
    Description: Your source for breaking news, news about New York, sports, business, entertainment, opinion, real estate, culture, fashion, and more.

➢ An Example of the Actual Webpage

MAUREEN **CALLAHAN**

MARK **CANNIZZARO**

BRIAN **COSTELLO**

JOHN **CRUDELE**

MARK **CUNNINGHAM**

STEVE **CUOZZO**

BRETT **CYRGALIS**

KEN **DAVIDOFF**

MACKENZIE **DAWSON**

SERENA **FRENCH**

NICOLE **GELINAS**

JONAH **GOLDBERG**

MICHAEL **GOODWIN**

JENNIFER **GOULD KEIL**

MICHAEL **GRAY**

CARLOS **GREER**

Killer vet's chilling final Facebook post before California bar massacre

BARBARA **HOFFMAN**

RICHARD **JOHNSON**

KEITH **J. KELLY**

FRED **KERBER**

KEVIN **KERNAN**

GEORGE **A. KING III**

HOWIE **KUSSOY**

BRIAN **LEWIS**

SETH **LIPSKY**

DREW **LOFTIS**

RICH **LOWRY**

MICHELLE **MALKIN**

ANDREW **MARCHAND**

KAROL **MARKOWICZ**

DAN **MARTIN**

BETSY **MCCAUGHEY**

California wildfire

SEE ALL ▶

BOB **MCMANUS**

PHIL **MUSHNICK**

JOHNNY **OLEKSINSKI**

RALPH **PETERS**

ANDREA **PEYSER**

JOHN **PODHORETZ**

MIKE **PUMA**

MICHAEL **RIEDEL**

NAOMI **SCHAEFER RILEY**

ROBERT **RORKE**

PAUL **SCHWARTZ**

STEVE **SERBY**

JOEL **SHERMAN**

PAUL **SPERRY**

MICHAEL **STARR**

SARA **STEWART**

JACOB **SULLUM**

JONATHON **TRUGMAN**

MIKE **VACCARO**

LOIS **WEISS**

GEORGE **F. WILL**

GEORGE **WILLIS**

SALENA **ZITO**

NEW YORK POST

SECTIONS & FEATURES

NEWS	REAL ESTATE
PAGE SIX	TECH
SPORTS	MEDIA
METRO	PHOTOS
ENTERTAINMENT	VIDEO
BUSINESS	ALEXA
OPINION	COVERS
FASHION	HOROSCOPES
LIVING	CLASSIFIEDS

NEWSLETTERS & MORE

EMAIL NEWSLETTERS
RSS FEEDS
NYPOST STORE
POST HEADLINERS

HOME DELIVERY

SUBSCRIBE
MANAGE SUBSCRIPTION
PREFERENCES

HELP/SUPPORT

CUSTOMER SERVICE
APP FAQ & HELP

CONTACT US

TIPS
NEWSROOM
LETTERS TO THE EDITOR
REPRINTS
CAREERS

APPS

IPHONE APP
IPAD APP
ANDROID PHONE
ANDROID TABLET

ADVERTISE

MEDIA KIT
CONTACT

POST DIGITAL NETWORK

Page Six

DECIDER

Powered by WordPress.com VIP

❖ URL Tables

➢ Donald Trump

Solr Lucene	Page Rank
https://nypost.com/2018/10/15/donald-and-melania-trump-begin-tour-of-towns-destroyed-by-hurricane-michael/	https://nypost.com/fashion/
https://nypost.com/2018/10/15/donald-and-melania-trump-begin-tour-of-towns-destroyed-by-hurricane-michael/	https://nypost.com/tech/
https://nypost.com/2016/02/15/donald-trump-has-invented-a-new-way-to-win/	https://nypost.com/columnists/
https://nypost.com/2016/11/09/	https://nypost.com/news/
https://nypost.com/2017/11/06/how-donald-trump-manipulated-bon-jovi-out-of-bills-purchase/	https://nypost.com/horoscopes/
https://nypost.com/2018/10/01/donald-trump-pays-tribute-to-friend-david-wright/	https://nypost.com/living/
https://nypost.com/2016/05/03/donald-trump-is-the-nominee-cruz-and-kasich-should-drop-out/	https://nypost.com/entertainment/
https://nypost.com/2016/11/10/	https://nypost.com/media/
https://nypost.com/2017/01/20/	https://nypost.com/opinion/
https://nypost.com/2016/11/11/	https://nypost.com/

➢ LA Lakers

Solr Lucene	Page Rank
https://nypost.com/2018/09/25/lebron-james-knows-it-wont-come-easy-with-lakers/	https://nypost.com/sports/
https://nypost.com/2018/09/07/warriors-star-emerges-as-lakers-flashy-plan-b-in-free-agency/	https://nypost.com/2018/10/15/tom-bradys-postgame-words-to-gronk-are-an-nfl-nightmare/
https://nypost.com/2018/10/10/klay-thompson-gushes-over-lebron-as-lakers-pursuit-looms/	https://nypost.com/2018/10/15/nfl-flameout-admits-to-having-sex-with-12-year-old-girl-police/
https://nypost.com/tag/nba/	https://nypost.com/2018/10/15/eli-manning-trade-could-save-him-and-the-giants-espn-qb/
https://nypost.com/tag/los-angeles-lakers/	https://nypost.com/2018/10/14/aaron-hernandez-had-sexual-relationship-with-hs-quarterback/
https://nypost.com/2001/02/14/	https://nypost.com/2018/10/15/mlb-youngsters-bring-the-trash-talk-and-much-needed-fun/

https://nypost.com/2014/05/02/	https://nypost.com/2018/10/15/empty-vows-alderson-back-stab-inside-mets-gm-search-mess/
https://nypost.com/2012/11/12/	https://nypost.com/2018/10/15/angry-about-the-subways-send-cuomo-a-message/
https://nypost.com/2015/06/26/	https://nypost.com/2018/10/15/a-giants-trade-for-ex-patriots-quarterback-would-make-sense/
https://nypost.com/2017/02/21/	https://nypost.com/2018/10/15/how-one-veterans-vietnam-horrors-inspired-this-is-us/

> **Star Wars**

Solr Lucene	Page Rank
https://nypost.com/2015/12/18/	https://nypost.com/photos/
https://nypost.com/2015/12/15/	https://nypost.com/sports/
https://nypost.com/2015/12/17/	https://nypost.com/fashion/
https://nypost.com/2015/12/16/	https://nypost.com/tech/
https://nypost.com/2015/12/22/	https://nypost.com/columnists/
https://nypost.com/2015/12/14/	https://nypost.com/news/
https://nypost.com/2015/11/24/	https://nypost.com/real-estate/
https://nypost.com/2015/04/20/	https://nypost.com/metro/
https://nypost.com/2015/10/20/	https://nypost.com/horoscopes/
https://nypost.com/2015/04/16/	https://nypost.com/living/

> **Lebron James**

Solr Lucene	Page Rank
https://nypost.com/2018/09/25/lebron-james-knows-it-wont-come-easy-with-lakers/	https://nypost.com/sports/
https://nypost.com/2018/04/04/lebron-saban-feud-over-shop-talk-show-in-copyright-dispute/	https://nypost.com/metro/

https://nypost.com/tag/los-angeles-lakers/	https://nypost.com/2018/10/13/100m-cybersecurity-center-slated-to-open-in-soho-next-year/
https://nypost.com/2010/07/09/	https://nypost.com/2018/10/15/judge-tosses-stormy-daniels-defamation-suit-against-trump/
https://nypost.com/2018/07/02/	https://nypost.com/2018/10/15/beach-house-still-standing-after-hurricane-michael-devastates-nearby-homes/
https://nypost.com/2018/10/10/klay-thompson-gushes-over-lebron-as-lakers-pursuit-looms/	https://nypost.com/2018/10/15/ex-nightlife-king-plans-to-open-a-private-club-in-noho/
https://nypost.com/2010/07/08/	https://nypost.com/2018/10/15/nyc-goes-entire-weekend-without-a-shooting-for-first-time-in-14-years/
https://nypost.com/2014/07/11/	https://nypost.com/2018/10/15/new-york-city-restaurant-scene-teeming-with-new-entries/
https://nypost.com/2010/07/01/	https://nypost.com/2018/10/15/knicks-season-preview-what-theyre-really-playing-for/
https://nypost.com/2010/07/07/	https://nypost.com/2018/10/12/little-kids-are-wearing-grown-up-makeup-is-it-ok/

> **2018 World Cup**

Solr Lucene	Page Rank
https://nypost.com/2018/07/12/theres-a-knicks-battle-and-bet-over-the-world-cup-final/	https://nypost.com/photos/
https://nypost.com/video/this-psychic-pig-just-predicted-the-world-cup/	https://nypost.com/sports/
https://nypost.com/2018/06/05/nycfc-cant-wait-to-get-monkey-off-their-back-in-u-s-open-cup/	https://nypost.com/tips/
https://nypost.com/2018/10/04/stricken-ryder-cup-fan-i-thought-id-be-trampled-by-tiger-woods-fans/	https://nypost.com/fashion/
https://nypost.com/2018/07/13/son-of-stanley-cup-winning-devil-chasing-nhl-dream/	https://nypost.com/tech/
https://nypost.com/2014/06/12/	https://nypost.com/mobile-apps/
https://nypost.com/2014/06/11/	https://nypost.com/columnists/
https://nypost.com/2018/10/04/capitals-stanley-cup-tribute-was-a-little-bit-petty/	https://nypost.com/news/

https://nypost.com/2018/10/02/nhl-preview-these-stanley-cup-contenders-are-racing-the-clock/	https://nypost.com/real-estate/
https://nypost.com/tag/tiger-woods/	https://nypost.com/privacy/

> **North Korea**

Solr Lucene	Page Rank
https://nypost.com/2018/08/30/a-glimpse-at-life-inside-north-korea/slide-1/	https://nypost.com/sports/
https://nypost.com/2018/08/24/state-department-reportedly-blindsided-by-trump-canceling-north-korea-trip/	https://nypost.com/real-estate/
https://nypost.com/2018/06/07/former-pow-calls-on-trump-to-reclaim-us-ship-captured-by-north-korea/	https://nypost.com/2018/10/15/tom-bradys-postgame-words-to-gronk-are-an-nfl-nightmare/
https://nypost.com/2018/10/07/pompeo-progress-made-with-kim-jong-un-on-north-korea-trip/	https://nypost.com/2018/10/15/nfl-flameout-admits-to-having-sex-with-12-year-old-girl-police/
https://nypost.com/2018/09/10/north-korea-marks-the-hermit-kingdoms-70th-anniversary/slide-1/	https://nypost.com/2018/10/15/eli-manning-trade-could-save-him-and-the-giants-espn-qb/
https://nypost.com/2017/09/09/how-democrats-left-america-naked-before-north-koreas-nukes/	https://nypost.com/2018/10/14/aaron-hernandez-had-sexual-relationship-with-hs-quarterback/
https://nypost.com/2017/09/03/	https://nypost.com/2018/10/15/mlb-youngsters-bring-the-trash-talk-and-much-needed-fun/
https://nypost.com/2018/10/02/trumps-love-for-kim-is-undercutting-his-own-teams-necessary-toughness/	https://nypost.com/2018/10/15/empty-vows-alderson-back-stab-inside-mets-gm-search-mess/
https://nypost.com/2017/09/04/	https://nypost.com/2018/10/15/how-eddie-lampert-led-sears-into-bankruptcy-disaster/
https://nypost.com/2018/10/04/north-korean-hackers-linked-to-global-banking-heist/	https://nypost.com/2018/10/15/the-south-bronx-is-in-the-midst-of-a-development-boom/

> **Hurricane Florence**

Solr Lucene	Page Rank
https://nypost.com/2018/09/14/hurricane-florence-storms-north-carolina/slide-1/	https://nypost.com/photos/
https://nypost.com/2018/09/11/the-carolinas-brace-for-hurricane-florence/slide-1/	https://nypost.com/news/
https://nypost.com/2018/09/13/hurricane-florence-closes-in-on-carolina-coast/	https://nypost.com/real-estate/

https://nypost.com/2018/09/10/hurricane-florence-looks-wild-from-the-international-space-station/	https://nypost.com/2018/10/15/surveillance-video-shows-moment-before-model-shot-in-neck-crashes-car/
https://nypost.com/2018/09/20/unc-football-players-lend-hand-to-hurricane-florence-victims/	https://nypost.com/2018/10/15/beach-house-still-standing-after-hurricane-michael-devastates-nearby-homes/
https://nypost.com/2018/09/14/astronaut-snaps-picture-of-hurricane-florence-as-it-makes-landfall/	https://nypost.com/2018/10/15/ex-nightlife-king-plans-to-open-a-private-club-in-noho/
https://nypost.com/2018/09/15/kitten-named-survivor-rescued-with-owner-from-hurricane-florence/	https://nypost.com/2018/10/15/sears-death-of-an-american-icon/slide-1/
https://nypost.com/2018/09/24/hurricane-florence-isnt-done-with-the-carolinas-just-yet/	https://nypost.com/2018/10/15/heres-what-elizabeth-warrens-dna-test-shows/
https://nypost.com/2018/09/19/north-carolina-hog-lagoons-are-exploding-poo-after-hurricane-florence/	https://nypost.com/2018/10/11/michael-leaves-florida-panhandle-in-shambles/slide-1/
https://nypost.com/tag/hurricanes/page/2/	https://nypost.com/2018/10/10/hurricane-michael-starts-pounding-the-florida-panhandle/slide-1/

➢ **Paul Allen**

Solr Lucene	Page Rank
https://nypost.com/2018/10/15/microsoft-co-founder-paul-allen-dead-at-65/	https://nypost.com/sports/
https://nypost.com/2018/10/15/microsoft-co-founder-paul-allen-dead-at-65/	https://nypost.com/tech/
https://nypost.com/2018/10/15/microsoft-co-founder-paul-allen-dead-at-65/	https://nypost.com/columnists/
https://nypost.com/tag/paul-allen/	https://nypost.com/news/
https://nypost.com/2018/03/06/microsoft-co-founder-finds-long-lost-wwii-aircraft-carrier/	https://nypost.com/
https://nypost.com/author/carleton-english/	https://nypost.com/2018/10/15/microsoft-co-founder-paul-allen-dead-at-65/
https://nypost.com/tech/page/2/	https://nypost.com/2018/10/15/worlds-youngest-male-billionaire-is-25-year-old-model/
https://nypost.com/tech/page/3/	https://nypost.com/2018/10/15/sears-death-of-an-american-icon/slide-1/
https://nypost.com/tech/	https://nypost.com/2018/10/15/state-department-sends-out-email-featuring-cookie-monster-cat/

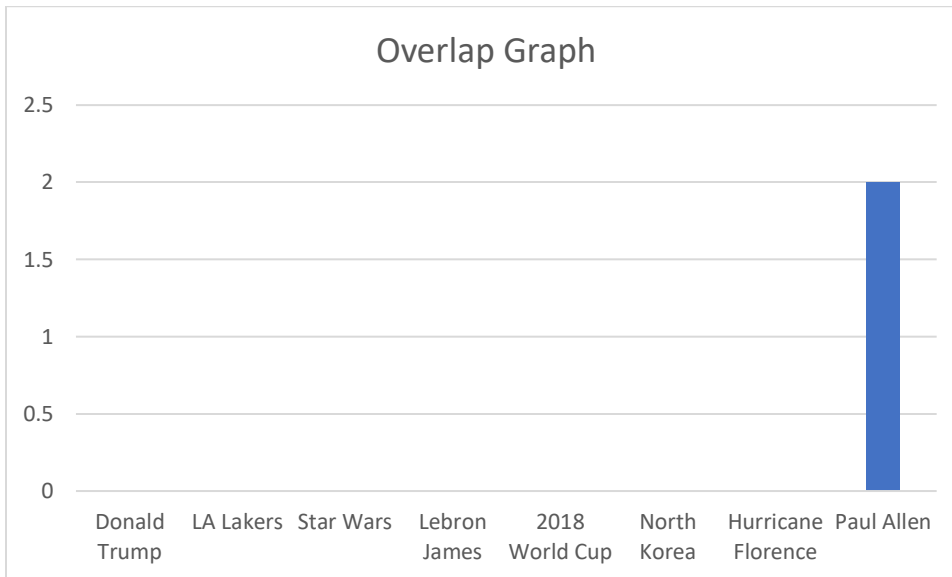| https://nypost.com/2018/03/06/microsoft-co-founder-finds-long-lost-wwii-aircraft-carrier/	https://nypost.com/2018/10/15/de-blasios-nycha-strategy-was-deceptive-from-the-start/

❖ Overlap Graph

> Overlap table

Queries	Overlap
Donald Trump	0
LA Lakers	0
Star Wars	0
Lebron James	0
2018 World Cup	0
North Korea	0
Hurricane Florence	0
Paul Allen	2

> Overlap graph

Overlap Graph

(x-axis means 8 queries, y-axis means overlap values)