

Steps

1. Downloaded solr and spinned up the solr service at localhost:8983.
2. Downloaded Foxnews web page from Google drive and indexed Foxnews web pages into solr.
3. Created a php web server running at localhost:8000, which receives queries from frontend and send them to solr service.
4. Handled the result JSON from solr service and display the information in a brief and clear UI.
5. Created a webpages graph using networkx with these parameters (alpha=0.85, personalization=None, max_iter=30, tol=1e-06, nstart=None, weight='weight', dangling=None). It means we initialize the alpha to be 0.85 and iteration number to be 30.
6. Built web pages into a directed graph using java. The edges is from web page A to web page B, if there is an outgoing link pointing from A to B.
7. Computed a page rank file using the directed graph. This is done by utilizing networkx library in python.
8. Modified solr configuration to enable PageRank algorithm using the page rank file.
9. Created a radio in the UI indicating whether using PageRank instead of Lucene and it will send additional parameter to the backend service.
10. Compared results of default algorithm(Lucene) and PageRank

Why page rank differs

Some page has higher page rank than others, for example:

<https://www.foxnews.com/us> is higher than

<https://www.foxnews.com/category/us/personal-freedoms> because the former one is more high-level than the latter and it has more links going out to its sub-level pages.

Flow of query

First, we entered the web page, typed in query and submitted.

← → ↻ 🏠 | 🛡️ ⓘ localhost:8000/index.php?

Search: PageRank: ☐

And It returned search result with default Lucene ranking algorithm.

← → ↻ 🏠 | 🛡️ ⓘ localhost:8000/index.php?q=Democrats ... 🛡️ ☆

Search: PageRank: ☐

Results 1 - 10 of 1762:

1.

title	RNC Chair McDaniel: Democrats' impeachment vote is baseless political vendetta - Trump di News
url	https://www.foxnews.com/opinion/rnc-chair-mcdaniel-democrats-impeachment-vote-is-baseles trump-did-nothing-wrong
id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/54806d10bde1-6c8aee9779e7.html
description	Democrats have rigged the impeachment process in favor of their highly partisan effort to ove election.
2.

title	Democrats aren't actually impeaching the President - yet, but they are digging deep Fox Ne
url	https://www.foxnews.com/politics/democrats-arent-actually-impeaching-the-president-yet-but-
id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/c0858e78a7cc-81f1b80573cc.html
description	Those are some of the words one could use to describe what House Democrats are doing whe impeachment.
3.

title	David Bossie: Baseless Trump impeachment inquiry by desperate Democrats makes dramatic
url	https://www.foxnews.com/opinion/david-bossie-baseless-trump-impeachment-inquiry-by-despe dramatic-flip-flop
id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/d91f4b72-a0b68006972b.html
description	House Democrats are staging the kind of illegitimate and anti-democratic coup attempt you e World country or the old Soviet Union - not the United States of America.
4.

title	Federal judge sides with House Democrats over subpoena for Trump's financial records Fox
url	https://www.foxnews.com/politics/federal-judge-house-democrats-mazars-subpoena-trump-fin
id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/7f9b9a77-a3a8-4968-8589-5d6a7b9a2a24.html
description	A Washington, D.C.-based federal judge has sided with House Oversight Committee Democrat subpoena of Trump accounting firm Mazars USA, in a major ruling that breathes new life into efforts to probe the president's financial dealings.
5.

title	Rep. Andy Biggs: Democrats seek Trump's impeachment to grab power - He didn't engage in Fox News
url	https://www.foxnews.com/opinion/rep-andy-biggs-lipstick-impeachment
id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/2d80467dc8f6141789fc.html

After selected the radio, It returned search results using PageRank.

localhost:8000/index.php?q=Democrats&sort=pageRankFile+desc

Search: Submit Query PageRank: ☐

Results 1 - 10 of 1762:

1.	title	Opinion Fox News
	url	https://www.foxnews.com/opinion
	id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/061c4f94-022cf394e73be.html
	description	NA
2.	title	U.S. Fox News
	url	https://www.foxnews.com/us
	id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/6ddff7f2-8b78-4743-8090-569afae9f4d.html
	description	Fox news features local news and national news articles and videos.
3.	title	Fox News - Breaking News Updates Latest News Headlines Photos & News Videos
	url	https://www.foxnews.com/
	id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/56d916a8-9687-43e5-88d1-045a4aee8e51.html
	description	Breaking News, Latest News and Current News from FOXNews.com. Breaking news and video U.S., World, Entertainment, Health, Business, Technology, Politics, Sports.
4.	title	Politics Fox News
	url	https://www.foxnews.com/politics
	id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/fb457a87-9af2c-90293d7532aa.html
	description	Presidential politics and political news from foxnews.com. News about political parties, political international politics, politics news headlines plus in-depth features and video clips.
5.	title	PERSONAL FREEDOMS Fox News
	url	https://www.foxnews.com/category/us/personal-freedoms
	id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/46e56bb5-lada486e06505.html
	description	PERSONAL FREEDOMS
6.	title	HOUSE OF REPRESENTATIVES Fox News
	url	https://www.foxnews.com/category/politics/house-of-representatives
	id	/home/zihuiliu/Downloads/FOXNEWS-20201112T155138Z-001/FOXNEWS/foxnews/39000d39-4b92980c0c7f.html

Clicked into second result and it showed the corresponding page.


By using this site, you agree to our [Privacy Policy](#) and our [Terms of Use](#).

FOX NEWS 4:43 PM

U.S. Politics Opinion Business Entertainment Sports Lifestyle TV Fox Nation Listen More :

Hot Topics LIVE UPDATES: Trump projected to win NC

U.S.



Fox MORNIN

Get all the s
the most po
first thing ev

Arrives Week

U.S. Clips

PRESIDENT SENATE HOUSE MY RACES

NEED 270 TO WIN

BIDEN	TRUMP
290	232

Alaska 96% in

D	BIDEN	42.6%
R	TRUMP	53.6%

al return' to normalcy by 'second

Table(left : Lucene, right : PageRank)

Cannes

https://www.foxnews.com/category/entertainment/events/cannes-film-festival	https://www.foxnews.com/entertainment/french-woman-roman-polanski-rape-1975
https://www.foxnews.com/entertainment/selena-gomez-bill-murray-whispered-cannes-film-festival-reveal	https://www.foxnews.com/entertainment/ryan-gosling-eva-mendes-is-definitely-not-anti-sweatpants
https://www.foxnews.com/entertainment/selena-gomez-cannes-film-festival-red-carpet	https://www.foxnews.com/entertainment/julie-andrews-therapy-saved-my-life
https://www.foxnews.com/entertainment/ryan-	https://www.foxnews.com/entertainment/whitney-

gosling-eva-mendes-is-definitely-not-anti-sweatpants	houston-was-sexually-abused-during-childhood-new-documentary-claims
https://www.foxnews.com/entertainment/quentin-tarantino-once-upon-a-time-in-hollywood-trailer-release	https://www.foxnews.com/entertainment/selena-gomez-mom-sister-concert
https://www.foxnews.com/entertainment/woody-allen-retire-family-politics	https://www.foxnews.com/entertainment/sharon-stone-rocks-bikini-see-her-many-ageless-looks
https://www.foxnews.com/entertainment/whitney-houston-was-sexually-abused-during-childhood-new-documentary-claims	https://www.foxnews.com/entertainment/dolph-lundgren-sylvester-stallone-rocky-iv-hospital
https://www.foxnews.com/entertainment/elton-john-rocketman-biopic-drugs-addiction-eating-disorder	https://www.foxnews.com/entertainment/michael-moore-endorses-bernie-sanders
https://www.foxnews.com/opinion/a-joan-rivers-thanksgiving	https://www.foxnews.com/entertainment/elton-john-rocketman-biopic-drugs-addiction-eating-disorder
https://www.foxnews.com/entertainment/selena-gomez-new-dog-instagram	https://www.foxnews.com/category/entertainment/events/cannes-film-festival

Congress

https://www.foxnews.com/us/navy-vet-donates-gold-star-families-stories-to-library-of-congress	https://www.foxnews.com/opinion
https://www.foxnews.com/opinion/judge-andrew-apolitano-congress-constitutional-power-declare-war	https://www.foxnews.com/tech
https://www.foxnews.com/politics/jon-stewart-blasts-congress-over-9-11-fund-hearing-drove-me-nuts-there-were-empty-seats	https://www.foxnews.com/category/politics/foreign-policy
https://www.foxnews.com/opinion/rep-andy-biggs-congress-debt-ceiling-budget-deal	https://www.foxnews.com/category/world/conflicts
https://www.foxnews.com/opinion/gutfeld-congress-attacking-zuckerberg	https://www.foxnews.com/official-polls
https://www.foxnews.com/opinion/andy-biggs-congress-judges-immigration-laws	https://www.foxnews.com/category/politics/executive
https://www.foxnews.com/faith-values/bible-school-drew-brees-day-congress	https://www.foxnews.com/category/tech/topics/security
https://www.foxnews.com/category/us/congress	https://www.foxnews.com/opinion/mike-huckabee-lets-fight-for-fabricated-structural-steel-manufacturing-jobs
https://www.foxnews.com/opinion/bradley-blakeman-trade-pact-with-canada-and-mexico-offers-incredible-benefits-congress-should-	https://www.foxnews.com/trending/

approve-it	
https://www.foxnews.com/politics/trump-tells-congress-to-immediately-approve-mexico-canada-trade-deal-says-us-moving-past-stupid-years-of-trade-policy	https://www.foxnews.com/media/elijah-cummings-seat-kimberly-klacik-baltimore-election-republican

Democrats

https://www.foxnews.com/opinion/rnc-chair-mcdaniel-democrats-impeachment-vote-is-baseless-political-vendetta-trump-did-nothing-wrong	https://www.foxnews.com/opinion
https://www.foxnews.com/politics/democrats-arent-actually-impeaching-the-president-yet-but-they-are-digging-deep	https://www.foxnews.com/us
https://www.foxnews.com/opinion/david-bossie-baseless-trump-impeachment-inquiry-by-desperate-democrats-makes-dramatic-flip-flop	https://www.foxnews.com/
https://www.foxnews.com/politics/federal-judge-house-democrats-mazars-subpoena-trump-financial-record	https://www.foxnews.com/politics
https://www.foxnews.com/opinion/rep-andy-biggs-lipstick-impeachment	https://www.foxnews.com/category/us/personal-freedoms
https://www.foxnews.com/media/democrats-disdain-working-class-trump-jr-fox-friends	https://www.foxnews.com/category/politics/house-of-representatives
https://www.foxnews.com/opinion/liz-harrington-democrats-holding-soviet-style-show-trial-to-overthrow-trump-not-an-impeachment-inquiry	https://www.foxnews.com/category/politics/senate
https://www.foxnews.com/opinion/donald-trump-jr-democrats-immigration-radical-ideology	https://www.foxnews.com/category/entertainment/music
https://www.foxnews.com/opinion/hans-von-spakovsky-in-trump-impeachment-probe-democrats-refuse-to-follow-nixon-and-clinton-precedents	https://www.foxnews.com/category/politics/foreign-policy
https://www.foxnews.com/opinion/david-bossie-trump-impeachment-vote-is-democratic-declaration-of-war-republicans-must-declare-war-on-dems	https://www.foxnews.com/category/world/conflicts

Patriot Movement

https://www.foxnews.com/politics/trump-antifa-terrorist-portland-protests	https://www.foxnews.com/science
https://www.foxnews.com/world/iranian-cruise-missiles-drones-saudi-oil	https://www.foxnews.com/
https://www.foxnews.com/media/fox-nation-	https://www.foxnews.com/tech

patriot-awards-american-heroes-st-petersburg	
https://www.foxnews.com/media/fox-nation-patriot-awards	https://www.foxnews.com/category/science/planet-earth
https://www.foxnews.com/media/marine-vet-most-valuable-patriot-awards-congress	https://www.foxnews.com/category/entertainment/movies
https://www.foxnews.com/faith-values/veterans-serve-disaster-relief	https://www.foxnews.com/entertainment/gwyneth-paltrow-relationship-harvey-weinstein
https://www.foxnews.com/media/tomi-lahren-patriot-awards-fox-nation	https://www.foxnews.com/politics/aoc-bloomberg-purchase-election
https://www.foxnews.com/entertainment/netflix-pulls-patriot-act-with-hasan-minhaj-episode-after-getting-valid-legal-complaint-from-saudi-arabia	https://www.foxnews.com/world/ukraine-russia-separatists-pullback
https://www.foxnews.com/media/vice-president-mike-pence-fox-nation-patriot-awards	https://www.foxnews.com/science/earths-mantle-and-crust-are-in-a-fiery-battle-to-the-death-of-supercontinents
https://www.foxnews.com/tech/netflix-defends-pulling-patriot-act-episode-in-saudi-arabia	https://www.foxnews.com/auto/2020-ram-1500-built-to-serve-pickup-salutes-the-u-s-military

Republicans

https://www.foxnews.com/politics/house-republicans-storm-impeachment-inquiry-deposition-what-went-down	https://www.foxnews.com/opinion
https://www.foxnews.com/opinion/tom-del-beccaro-republicans-must-win-the-impeachment-trial-and-they-can-by-following-these-five-steps	https://www.foxnews.com/
https://www.foxnews.com/politics/republicans-hunter-biden-ukraine-whistleblower-impeachment-witness	https://www.foxnews.com/politics
https://www.foxnews.com/politics/house-republicans-plan-to-call-adam-schiff-to-testify-in-impeachment-inquiry-call-him-a-fact-witness	https://www.foxnews.com/category/politics/house-of-representatives
https://www.foxnews.com/politics/trump-settles-score-with-republicans-who-didnt-embrace-him-in-midterms	https://www.foxnews.com/category/politics/senate
https://www.foxnews.com/politics/republicans-impeachment-hearings-lineup	https://www.foxnews.com/category/world/conflicts
https://www.foxnews.com/politics/bill-weld-thrilled-other-republicans-are-challenging-trump-in-primary	https://www.foxnews.com/official-polls
https://www.foxnews.com/entertainment/chelsea-handler-republicans-colorado-school-shooting	https://www.foxnews.com/category/world/scandals
https://www.foxnews.com/opinion/matt-gorman-	https://www.foxnews.com/category/

kavanaugh-republicans	politics/elections
https://www.foxnews.com/opinion/newt-gingrich-house-republicans-2020-retirements	https://www.foxnews.com/politics.html

Senate

https://www.foxnews.com/politics/trump-senate-trial-impeachment-inquiry-reporters-notebook	https://www.foxnews.com/opinion
https://www.foxnews.com/category/politics/2020-senate-races	https://www.foxnews.com/travel
https://www.foxnews.com/media/jeff-sessions-former-embattled-trump-attorney-general-announces-bid-for-old-us-senate-seat	https://www.foxnews.com/us
https://www.foxnews.com/opinion/newt-gingrich-left-viciously-attacks-mcconnell-because-hes-successful-senate-leader-and-trump-ally	https://www.foxnews.com/health
https://www.foxnews.com/faith-values/pastor-andrew-brunson-senate-trump-prayer	https://www.foxnews.com/shows
https://www.foxnews.com/politics/jeff-sessions-alabama-senate-campaign-expected	https://www.foxnews.com/entertainment
https://www.foxnews.com/politics/trump-sessions-against-senate-run-alabama	https://www.foxnews.com/world
https://www.foxnews.com/category/politics/elections/senate	https://www.foxnews.com/science
https://www.foxnews.com/politics/virginia-democrat-accused-of-sex-with-teen-secretary-wins-state-senate-seat	https://www.foxnews.com/
https://www.foxnews.com/media/trump-senate-mike-pence-joe-scarborough	https://www.foxnews.com/politics

Olympics 2020

https://www.foxnews.com/sports/alex-morgan-2020-olympics-child-birth	https://www.foxnews.com/opinion
---	---

https://www.foxnews.com/sports/naomi-osaka-us-citizenship-japan-2020-olympics	https://www.foxnews.com/entertainment
https://www.foxnews.com/category/sports/olympics	https://www.foxnews.com/
https://www.foxnews.com/tech/russian-hackers-attack-possible-olympic-ban	https://www.foxnews.com/politics
https://www.foxnews.com/category/sports/soccer	https://www.foxnews.com/tech
https://www.foxnews.com/person/c/barnini-chakraborty	https://www.foxnews.com/category/health/heart-health
https://www.foxnews.com/category/sports/tennis	https://www.foxnews.com/lifestyle
https://www.foxnews.com/category/person/alex-morgan	https://www.foxnews.com/category/us/personal-freedoms
https://www.foxnews.com/sports/kikkan-randall-new-york-city-marathon-skiing-cancer	https://www.foxnews.com/category/entertainment/style
https://www.foxnews.com/sports	https://www.foxnews.com/category/entertainment/tv

Stock

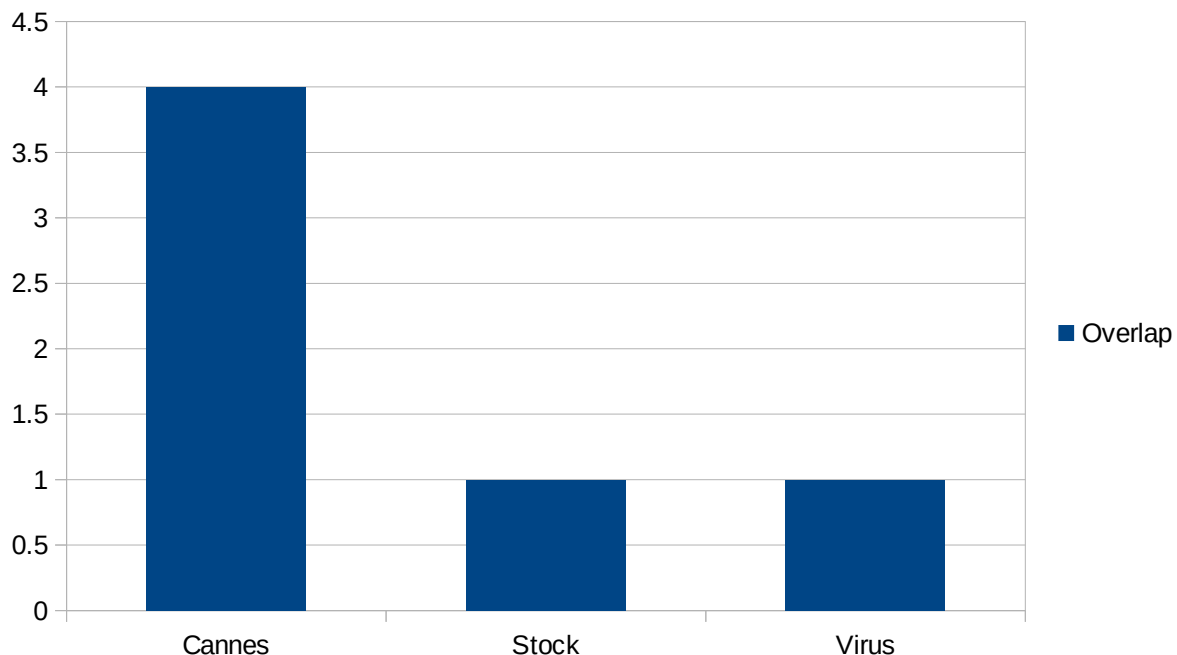
https://www.foxnews.com/tech/jeff-bezos-to-be-no-2-richest-behind-bill-gates-after-amazon-stock-drop	https://www.foxnews.com/
https://www.foxnews.com/transcript/cavuto-looking-back-at-the-stock-market-crash-30-years-ago	https://www.foxnews.com/category/us/economy
https://www.foxnews.com/transcript/cavuto-the-markets-are-easier-to-take-stock-of-than-life	https://www.foxnews.com/science/revolutionary-war-rifle-stolen-50-years-ago-on-display
https://www.foxnews.com/category/shows/your-world/transcript/common-sense	https://www.foxnews.com/entertainment/demi-lovato-first-interview-year
https://www.foxnews.com/category/tech/companies/microsoft	https://www.foxnews.com/media/chris-wallace-elizabeth-warren-medicare-for-all-plan

https://www.foxnews.com/person/c/gordon-chang	https://www.foxnews.com/tech/hp-recalls-more-laptop-lithium-ion-batteries-after-reports-of-overheating-melting-and-charring
https://www.foxnews.com/category/person/sheryl-sandberg	https://www.foxnews.com/tech/heres-how-the-trump-tariffs-hike-may-affect-prices-for-pc-parts
https://www.foxnews.com/category/tech/companies/amazon	https://www.foxnews.com/category/tech/companies/amazon
https://www.foxnews.com/auto/fiat-chrysler-sales-boss-reid-bigland-sues-company-for-violating-whistleblower-protections	https://www.foxnews.com/opinion/max-lucado-fearless-parenting
https://www.foxnews.com/sports/royals-hire-ex-cardinals-skipper-mike-matheny-as-manager	https://www.foxnews.com/auto/electric-ford-mustang-lithium

Virus

https://www.foxnews.com/tech/computer-virus-cripples-tribune-publishing-los-angeles-times	https://www.foxnews.com/science
https://www.foxnews.com/science/deadly-seal-virus-spreading-melting-arctic-ice	https://www.foxnews.com/category/science/planet-earth
https://www.foxnews.com/health/connecticut-third-mosquito-eee-death	https://www.foxnews.com/category/science/wild-nature
https://www.foxnews.com/category/tech/topics/virus	https://www.foxnews.com/category/tech/topics/computers
https://www.foxnews.com/health/eee-eastern-equine-encephalitis-massachusetts-man-killed	https://www.foxnews.com/science/deadly-seal-virus-spreading-melting-arctic-ice
https://www.foxnews.com/health/what-is-norovirus-3-things-to-know-about-the-vomit-inducing-bug	https://www.foxnews.com/science/sandra-orangutan-legal-personhood-new-home-florida
https://www.foxnews.com/health/pregnant-women-who-get-flu-shot-are-less-likely-to-be-hospitalized-from-virus-cdc-says	https://www.foxnews.com/science/ancient-shipwrecks-stone-pyramid-anchors-discovered-greek-island

https://www.foxnews.com/category/health/infectious-disease/zika	https://www.foxnews.com/science/earths-mantle-and-crust-are-in-a-fiery-battle-to-the-death-of-supercontinents
https://www.foxnews.com/health/flu-season-2019-vaccine	https://www.foxnews.com/science/mammoth-traps-prehistoric-mexico
https://www.foxnews.com/health/british-mom-son-flu	https://www.foxnews.com/science/mercury-transit-2019-what-to-know



In most search results of above 9, high level web pages like(www.foxnews.com/us, www.foxnews.com/science etc) will have higher page rank, thus dominate the returned search results. This could lower the possibility to have more overlap with results from Lucene.