

What's in a Web Archive Collection? Summarization and Discovery of Archived Webpages

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Old Dominion University

Slides: <https://bit.ly/weigle-nlm-2022>

Featuring work done in collaboration with

Web Science and Digital Libraries (WS-DL) Research Group at ODU



PhD Students and Alumni



Dr. Michael L. Nelson



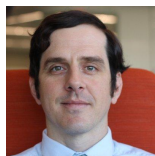
Shawn Jones
(PhD 2021)



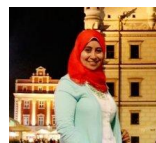
Alexander Nwala
(PhD 2020)



Sawood Alam
(PhD 2020)



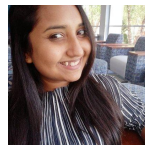
Mat Kelly
(PhD 2019)



Yasmin AlNoamany
(PhD 2016)

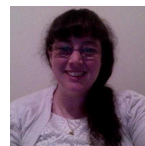


Kritika Garg



Himarsha Jayanetti

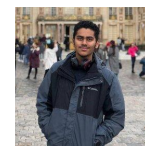
MS Students and Alumni



Lesley Frew



Abigail Mabe
(MS 2021)



Dhruv Patel
(MS 2021)



Maheedhar Gunnam
(MS 2018)



Surbhi Shankar
(MS 2017)

Funders



The Web holds our stories

ESPN.com

March 13, 2020

TOP EVENTS ▾

NCAAM

Canceled
NJ 7 SJU
OH 7 CREI

Canceled
OH 4 CLEM
OH 4 FSU

Canceled
MN 25 MINN
WI 25 IOWA

Canceled
WI 24 BUT
IL 4 PROV

Canceled
IN 1 OKST
IN 1 KU

ESPN

NCAA tournaments canceled over coronavirus

The NCAA has called off its men's and women's basketball tournaments as part of a complete cancellation of all remaining spring and winter championships.

5h • ESPN News Services

What we know and don't know after NCAA tournament cancellations

CNN.com

March 14, 2020

CNN

Trump declares national emergency

LIVE UPDATES

The declaration comes as there is only one US state left without coronavirus cases

Get info: Send your stories | Podcast | Newsletter | Alerts

Trump says he takes no responsibility for early testing failures

Analysis: Trump's appalling, blame-shifting briefing

See exec's response to Trump's attempt to shake hands

But webpages can change or disappear

ESPN.com

November 1, 2022

TOP EVENTS ▾ MLB 8:03 PM ET FOX HOU 1-1 UCL Gamecast 53' 4:00 PM ET B04 0 MUN PHI 1-1 Statistics BRU 0 INT

ESPN

HUBSPACE ONE EASY APP FOR YOUR SMART DEVICES Shop Now How does it work? get more done

BREAKING NEWS

Nets part with Nash; Udoka on deck, sources say

The Nets and coach Steve Nash have agreed to part ways, the two sides announced Tuesday. Suspended Celtics coach Ime Udoka has emerged as the likely next Brooklyn coach, sources told ESPN's Adrian Wojnarowski.

2h

How the Nets devolved into chaos in a matter of

CNN.com

November 1, 2022

Audio Live TV Log In

LIVE UPDATES: Ukraine | Election news | Parkland shooter sentencing | TRENDING: Taylor Swift tour | Seoul vic

North Carolina race may offer early indicators for 2024 election

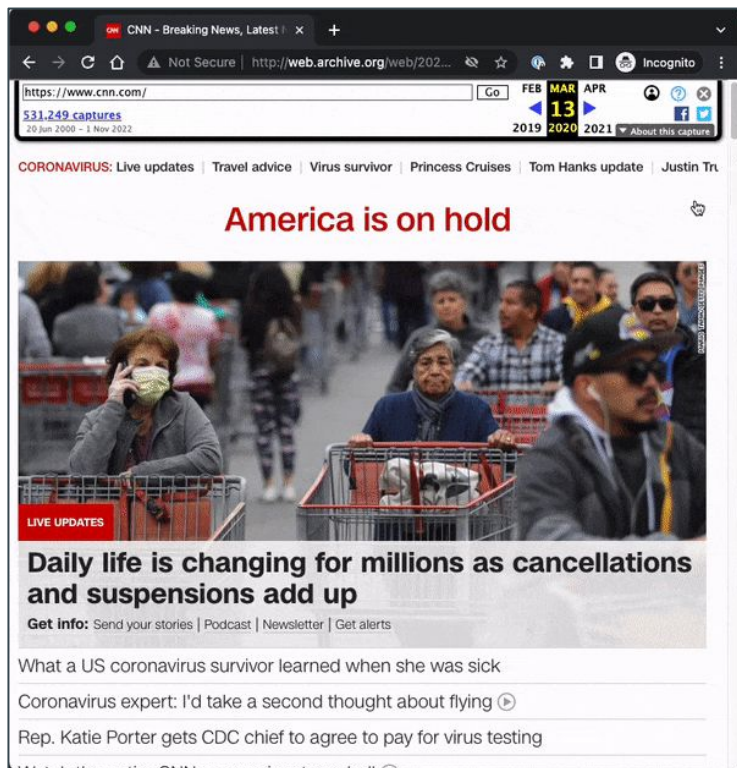
For the GOP, the midterm Senate race could reveal the extent to which Trumpism has taken hold in the state

Report election disinformation | Full midterm coverage

Analysis: Five scenarios that could play out on election night

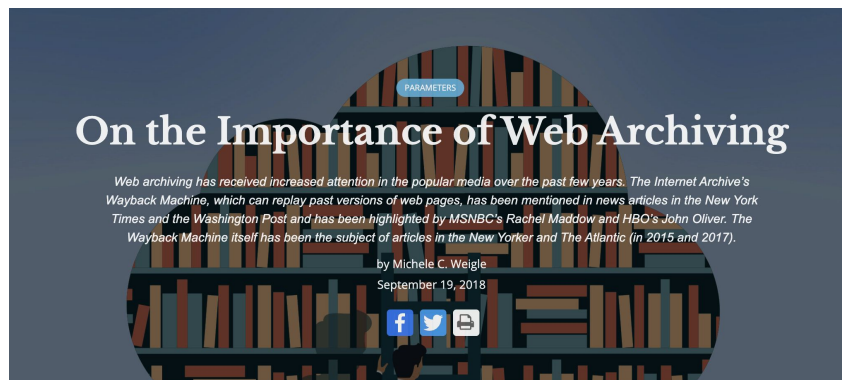
A seismic political shift is underway in Florida

Maybe it's archived?



[CNN.com](https://www.cnn.com/) archived on March 13, 2020

More than just saving a screenshot, web archives strive to capture and allow replay of the *entire contents of a web page*, including its source HTML and embedded images, stylesheets, and JavaScript source code.



Michele C. Weigle, "On the Importance of Web Archiving", *SSRC Parameters*, Sep 2018, <https://items.ssrc.org/parameters/on-the-importance-of-web-archiving/>

Web archives are essential for studying recent history and culture



Ian Milligan (University of Waterloo), <https://twitter.com/NetPreserve/status/1141321443373920256>

There are several public web archives



and others...

https://en.wikipedia.org/wiki/List_of_Web_archiving_initiatives

How do webpages get archived?

Anatomy of a Web Page

Browser: About Me - Michele C. Weigle | x +
Address Bar: https://weiglemc.github.io
Incognito

Michele C. Weigle @ ODU | Publications | Teaching | Students | Talks | Schedule

About Me

I am a Professor of Computer Science at Old Dominion University, where I've been on the faculty since 2006. For an overview of my research direction for the past few years, see [On the importance of web archiving](#), an article I wrote for [SSRC Parameters](#) in 2018. I'm currently featured on the [ODU Faculty Women in STEM page](#), where you can read a bit about my background and experiences as a woman in computer science. (For more information, see my [bio](#).)

Research Interests: web science, social media, web archiving, digital preservation, information visualization (see some student infovis projects in my [infovis gallery](#).)

Dr. Michele C. Weigle
Professor of Computer Science

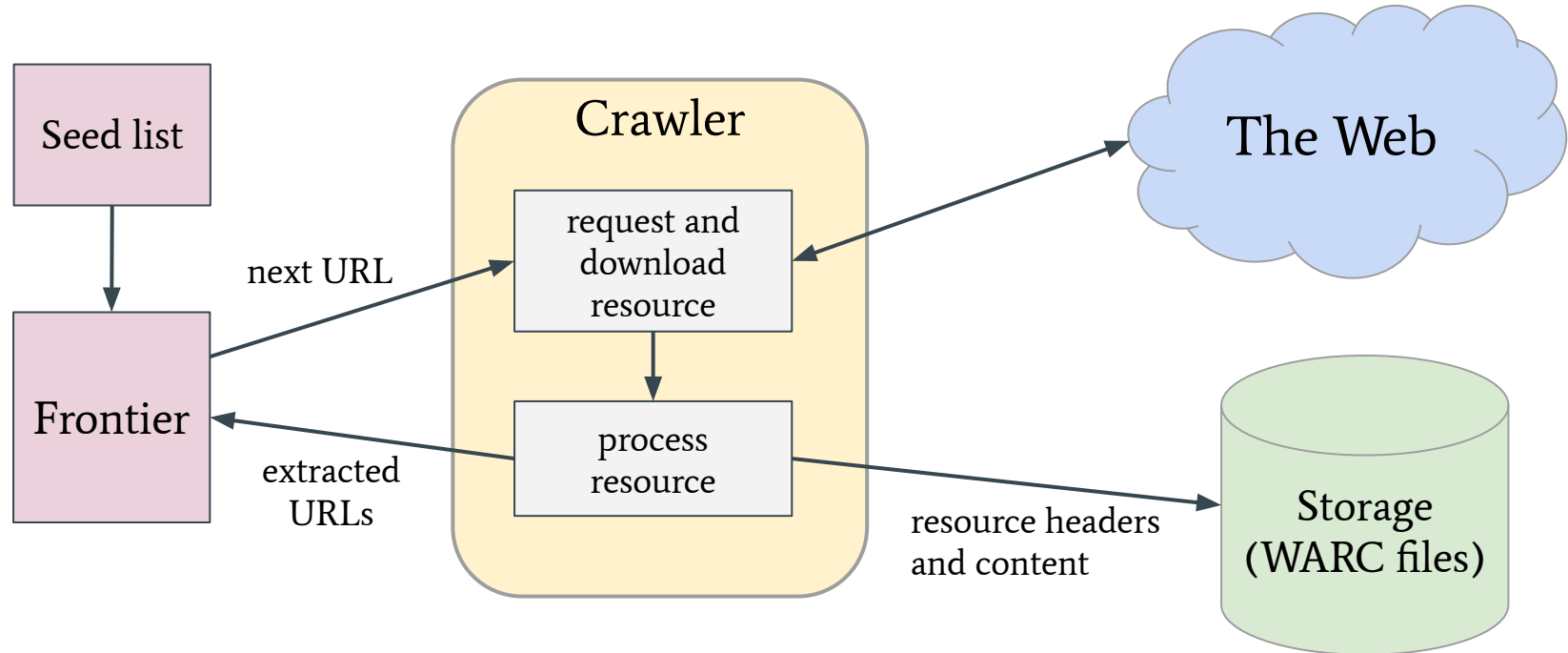
Norfolk, VA
Old Dominion University
Website

CSS
JavaScript

<https://www.cs.odu.edu/~mweigle/>

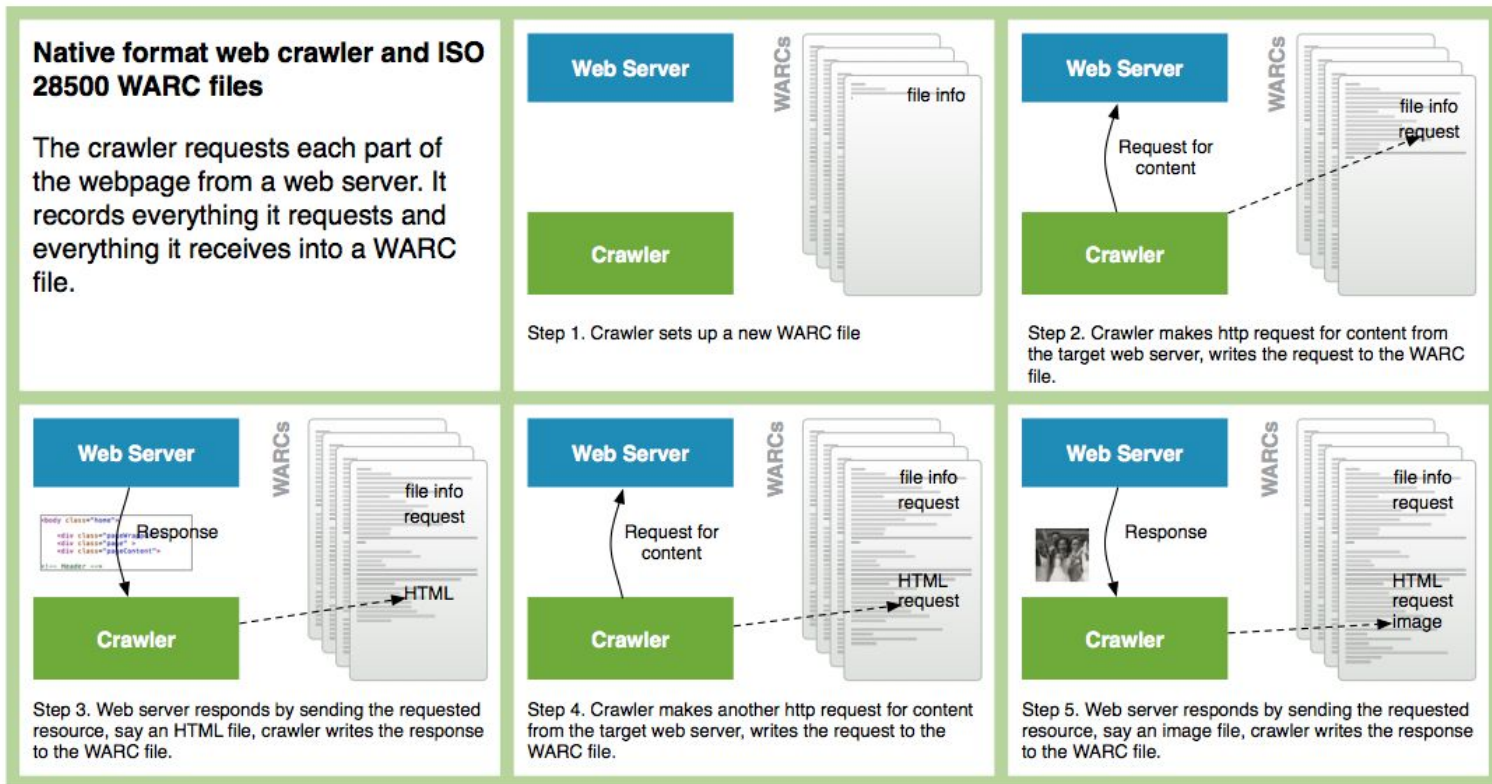
How do webpages get archived?

Web Crawling Process



How do webpages get archived?

WARC: Web ARChive file format



<https://www.hanzo.co/blog/iso-28500-warc>

On-Demand Web Archiving



Add Seeds

Enter one seed URL per line below to add them to this collection.

https://craftycocktails.com/pages/mixology-101/

Access:

Frequency:

Seed Type:

www.archive-it.org

<https://web.archive.org>

Save Page Now

https://



<https://archive.today>

My url is alive and I want to archive its content



New Capture

URL to capture

Add to collection:

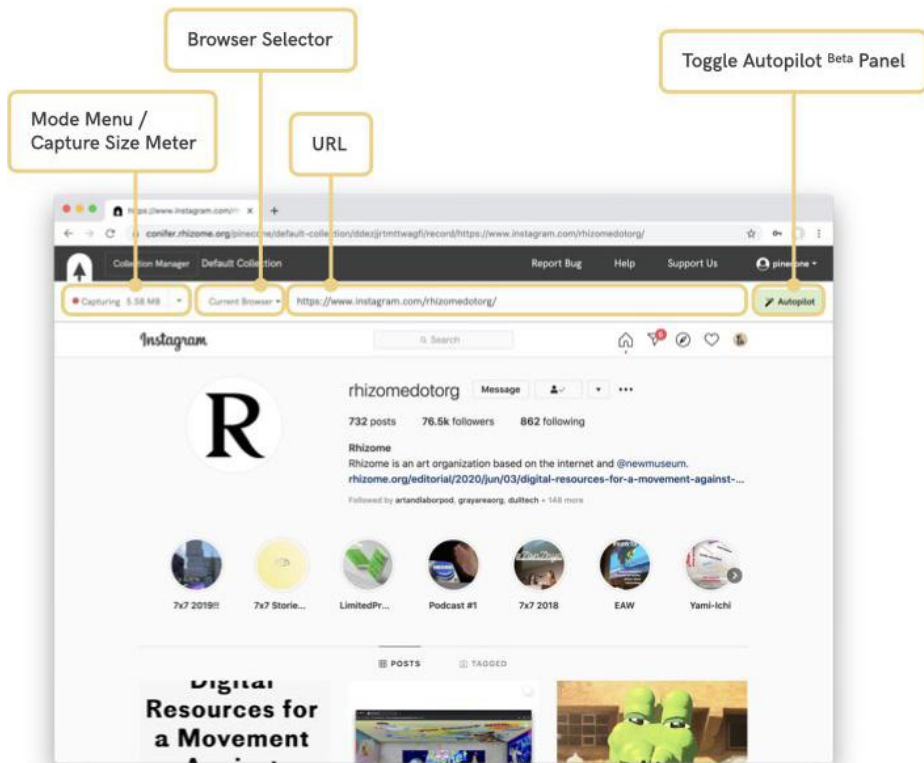
Select browser:

Session settings

browser	version	release	OS	capabilities
Chrome	v76	2019-08-05	linux	flash, autopilot
Firefox	v68	2019-07-09	linux	flash, autopilot

<https://conifer.rhizome.org>

Webrecorder and Conifer



<https://guide.conifer.rhizome.org/>



<https://twitter.com/IlyaKreymer/status/1288193177279541248>

Mat Kelly and Michele C. Weigle, “WARCcreate - Create Wayback-Consumable WARC Files from Any Webpage,” In JCDL 2012, <https://www.cs.odu.edu/~mweigle/papers/kelly-jcdl12.pdf>

Query web archives for <https://www.nlm.nih.gov/hmd/>

<https://web.archive.org/>

The screenshot shows the Wayback Machine homepage. At the top, there is a navigation bar with links for ABOUT, BLOG, PROJECTS, HELP, DONATE, CONTACT, JOBS, VOLUNTEER, and PEOPLE. Below this is a search bar with the text "INTERNET ARCHIVE" and "SIGN UP | LOG IN". The main content area features the "WayBack Machine" logo and a search bar containing the URL "https://www.nlm.nih.gov/hmd/", which is circled in red. Below the search bar are several thumbnail images of archived web pages. At the bottom, there are sections for "Tools", "Subscription Service", and "Save Page Now".

<https://archive.today/>

The screenshot shows the archive.today homepage. At the top, there is a navigation bar with links for ABOUT, BLOG, PROJECTS, HELP, DONATE, CONTACT, JOBS, VOLUNTEER, and PEOPLE. Below this is a search bar with the text "INTERNET ARCHIVE" and "SIGN UP | LOG IN". The main content area features the "archive.today" logo and a search bar containing the URL "https://www.nlm.nih.gov/hmd/", which is circled in red. Below the search bar are several thumbnail images of archived web pages. At the bottom, there are sections for "Tools", "Subscription Service", and "Save Page Now".

Mementos for <https://www.nlm.nih.gov/hmd/>

https://web.archive.org/web/19990000000000*/https://www.nlm.nih.gov/hmd/

Wayback Machine

INTERNET ARCHIVE

Explore more than 747 billion web pages saved over time

Calendar · Collections · Changes · Summary · Site Map · URLs

Saved 1,461 times between December 5, 1998 and October 14, 2022.

1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

JAN FEB MAR

<https://archive.ph/https://www.nlm.nih.gov/hmd/>

archive.today

webpage capture

search examples:

- www.nlm.nih.gov for all snapshots from the host
- *.nlm.nih.gov for list of subdomains
- <https://www.nlm.nih.gov/hmd/> for exact url
- <https://www.nlm.nih.gov/hmd/> for url prefix

Oldest Newest List of URLs, ordered from newer to older

[History of Medicine Home Page](#)

<http://www.nlm.nih.gov/hmd/>
redirected from
• <http://nlm.nih.gov/hmd>

12 Dec 2012 13:29 2 Jan 2014 03:52

Navigating the Wayback Machine

The screenshot shows the Wayback Machine homepage. At the top, there's a search bar with the URL `https://www.nlm.nih.gov/hmd/` entered. Below the search bar, a calendar navigation shows the date `Tue, 02 Mar 1999 10:07:23 GMT`. A bar chart displays the frequency of captures over time, with a peak in 1999. A calendar view for March 1999 is shown below, with a pop-up window for **MARCH 2, 1999** listing five snapshots. The time `10:07:23` is circled in red in the original image.

This screenshot shows the History of Medicine Division website as it appeared in 1999. The page features the National Library of Medicine logo and a banner for the History of Medicine Division. Navigation buttons for `Search MEDLINE`, `Search NLM Site`, `MEDLINE plus`, `Contact NLM`, and `Site Map` are visible. The page content includes a **General Description** section with links to `Collections`, `Services`, `Finding Guides`, and `Reprints and Translations`. There is also a **HISTLINE** section with a link to `Search HISTLINE free` and a **History of Medicine Online Exhibitions** section with a link to `We Were Here First: The History of the NLM Site`.

<https://web.archive.org/web/19990302100723/https://www.nlm.nih.gov/hmd/>

Querying Multiple Web Archives Using Memento Time Travel



<https://timetravel.mementoweb.org/>

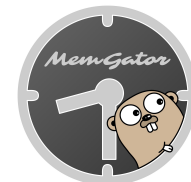
Arquivo.pt Memento, 3 hours after

Internet Archive Memento, 1 day after

The National Archives and Records Administration Memento, 1 year 148 days before

Herbert Van de Sompel, Michael L. Nelson, and Robert D. Sanderson, "HTTP Framework for Time-Based Access to Resource States -- Memento", RFC 7089, <https://www.rfc-editor.org/rfc/rfc7089.html>

Querying Multiple Web Archives Using MemGator



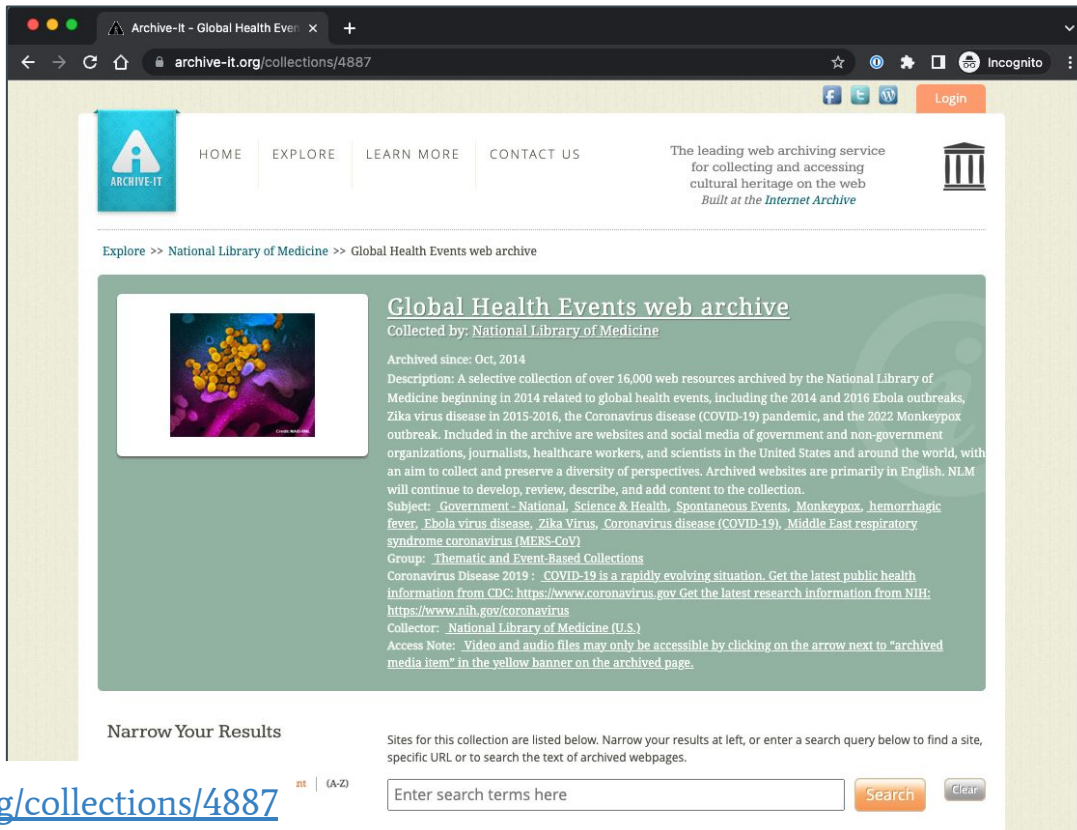
```
curl https://memgator.cs.odu.edu/timemap/link/https://www.nlm.nih.gov/hmd/
```

<https://memgator.cs.odu.edu/>

```
mweigle-laptop: [~]% curl https://memgator.cs.odu.edu/timemap/link/https://www.nlm.nih.gov/hmd/  
<https://www.nlm.nih.gov/hmd/>; rel="original",  
<https://memgator.cs.odu.edu/timemap/link/https://www.nlm.nih.gov/hmd/>; rel="self"; type="application  
/link-format",  
<https://webarchive.loc.gov/all/19981205095201/http://www.nlm.nih.gov/hmd/>; rel="first memento"; date  
time="Sat, 05 Dec 1998 09:52:01 GMT",  
<https://web.archive.org/web/19981205095201/http://www.nlm.nih.gov:80/hmd/>; rel="memento"; datetime="1  
<https://web.archive.org/web/19990127152411/http://www.nlm.nih.gov:80/hmd/>;  
rel="memento"; datetime="Wed, 27 Jan 1999 15:24:11 GMT",  
<https://webarchive.loc.gov/all/19990209110725/http://www.nlm.nih.gov/hmd/>  
; rel="memento"; datetime="Tue, 09 Feb 1999 11:07:25 GMT",  
<https://webarchive.loc.gov/all/19990302020841/http://www.nlm.nih.gov/hmd/>; rel="memento"; datetime="  
Tue, 02 Mar 1999 02:08:41 GMT",  
<https://web.archive.org/web/19990302020841/http://www.nlm.nih.gov:80/hmd/>; rel="memento"; datetime="  
Tue, 02 Mar 1999 02:08:41 GMT",  
<https://webarchive.loc.gov/all/19990302034201/http://www.nlm.nih.gov/hmd/>; rel="memento"; datetime="  
Tue, 02 Mar 1999 03:42:01 GMT",
```

Sawood Alam, Michael Nelson. MemGator - A Portable Concurrent Memento Aggregator: Cross-Platform CLI and Server Binaries in Go. In JCDL 2016.

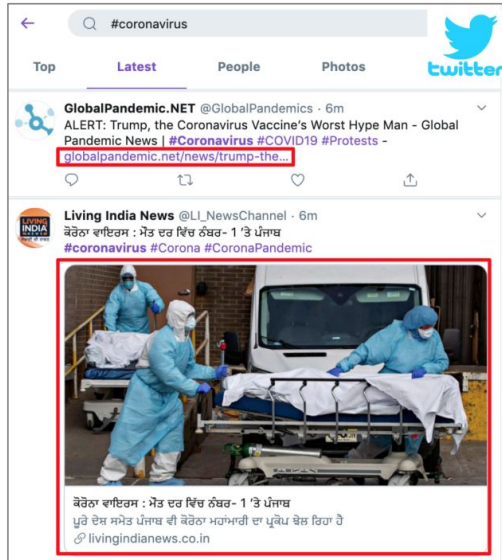
Web archivists can create curated collections



The screenshot shows a web browser window displaying the Archive-It website. The browser's address bar shows the URL archive-it.org/collections/4887. The website header includes the Archive-It logo, navigation links (HOME, EXPLORE, LEARN MORE, CONTACT US), and a tagline: "The leading web archiving service for collecting and accessing cultural heritage on the web. Built at the Internet Archive." Below the header, the breadcrumb trail reads "Explore >> National Library of Medicine >> Global Health Events web archive". The main content area features a green banner with a thumbnail image of a virus and the title "Global Health Events web archive". The text below the banner provides details about the collection, including its date (Oct, 2014), a description of its contents (over 16,000 web resources related to global health events), and subject terms. At the bottom of the page, there is a search bar with the placeholder text "Enter search terms here" and a "Search" button. The URL <https://archive-it.org/collections/4887> is also displayed in the bottom left corner of the screenshot.

<https://archive-it.org/collections/4887>

Bootstrapping Collections from Social Media



- Alexander Nwala**, Michele Weigle, and Michael Nelson, “Bootstrapping Web Archive Collections from Social Media,” In ACM Hypertext (HT) 2018, <https://www.cs.odu.edu/~mln/pubs/ht-2018/hypertext-2018-nwala-bootstrapping.pdf>
- Alexander Nwala**, Michele Weigle, and Michael Nelson, “Using Micro-collections in Social Media to Generate Seeds for Web Archive Collections,” In JCDL 2019, <https://arxiv.org/abs/1905.12220>.
- Alexander Nwala**, Michele Weigle, and Michael Nelson, “Garbage, Glitter, or Gold: Assigning Multi-dimensional Quality Scores to Social Media Seeds for Web Archive Collections,” In JCDL 2021, <https://arxiv.org/abs/2107.02680>.

Archive-It is a popular platform for developing and accessing collections

Archive-It - Global Health Ever x +

https://archive-it.org/collections/4887

Narrow Your Results

Group Sort By: Count | (A-Z)

- Coronavirus disease (COVID-19) outbreak (17193)
- Ebola Outbreak 2014 (154)
- Ebola virus disease outbreak in the Democratic Republic of the Congo (10)
- Global Health Organizations (38)
- Measles Outbreak 2015 (6)

More ▾

Creator Sort By: Count | (A-Z)

- Fauci, Anthony S., 1940- (773)
- National Public Radio (U.S.) (694)
- Cable News Network (611)
- NBC News (355)
- Washington Post (344)

More ▾

Date Sort By: Count | (A-Z)

- News article (1)

Type Sort By: Count | (A-Z)

- News article (8707)

Sites Search Page Text

Page 1 of 197 (19,698 Total Results) Next Page ▶

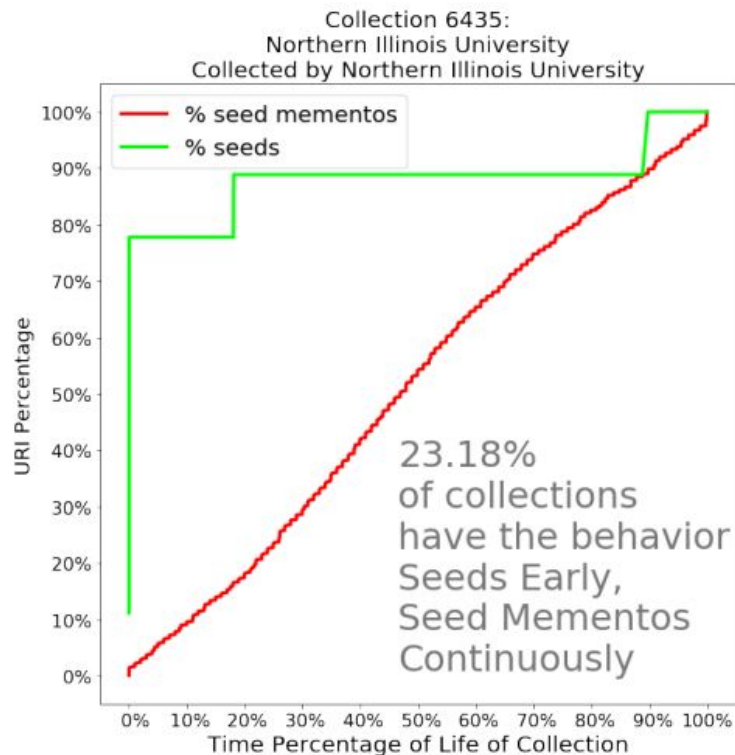
Sort By: Title (A-Z) | Title (Z-A) | URL (A-Z) | URL (Z-A)

Title: 91-DIVOC : Flip the script on COVID-19 | 91-DIVOC
URL: <http://91-divoc.com/>
Captured once on March 10, 2021
Group: Coronavirus disease (COVID-19) outbreak
Creator: 91-DIVOC
Language: English
Type: Website
Collector: National Library of Medicine (U.S.)
Keyword: Tracking the Disease

Title: Arkansas Department of Education Commissioner's Memo - Guidance for Schools Regarding COVID-19
URL: <http://adecm.arkansas.gov/ViewApprovedMemo.aspx?id=4328>
Captured once on October 28, 2020
Group: Coronavirus disease (COVID-19) outbreak
Creator: Arkansas. Department of Education
Language: English
Type: Government directive
Geographic Location: Arkansas
Collector: National Library of Medicine (U.S.)
Keyword: Social Dimensions, Education, Prevention and Control/Risk Management

<https://archive-it.org/collections/4887>

Each seed can have multiple captures, or mementos



Shawn M. Jones, Alexander Nwala, Michele C. Weigle, and Michael L. Nelson, “The Many Shapes of Archive-It,” In iPres 2018, <https://arxiv.org/abs/1806.06878>.

Full-text search can be tricky

If term appears in multiple mementos for a seed, which one should be returned?

Sites for this collection are listed below. Narrow your results at left, or enter a search query below to find a site, specific URL or to search the text of archived webpages.

The following results were found for the term(s): "masks required"

- 757 Sites were found.
- 3278 result(s) for "masks required" within the page text.

Sites

Search Page Text

Page 1 of 164 (3,278 Total Results)

Next Page ▶

Sort By: Best Match

Novel Coronavirus (COVID-19) | Department of Health

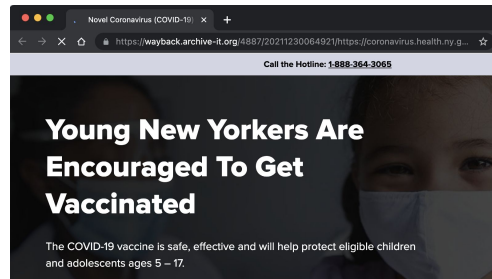
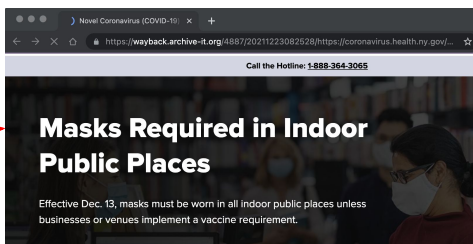
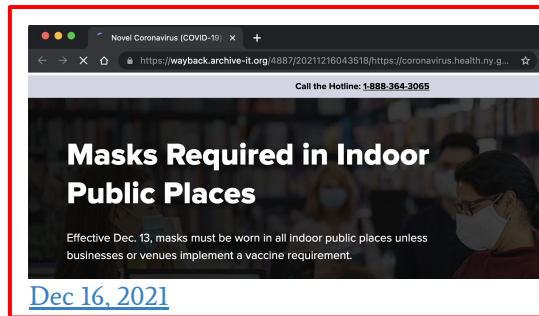
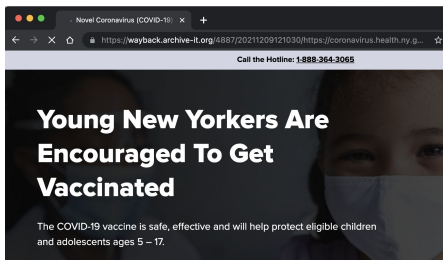
URL: <https://coronavirus.health.ny.gov/home>

This text was captured on **Dec 23, 2021** [Show All Captures](#)

Required in Indoor Public Places Effective Dec. 13, masks must be worn in all indoor public places unless businesses or venues implement a vaccine requirement.

Content: text/html Size: 47 KB

[More Results from coronavirus.health.ny.gov](#)



Search for added phrases

added term/phrase	▼	"non cloth"
domain	▼	any
		Search

Search results for added phrase: non cloth

NumFound: 2

title	Novel Coronavirus (COVID-19) Department of Health
url	https://coronavirus.health.ny.gov/node/1
addition	2022-03-09 13:12:20

title	Novel Coronavirus (COVID-19) Department of Health
url	https://coronavirus.health.ny.gov/home
addition	2022-02-11 21:20:50

- All travelers, and , should continue to follow all CDC travel requirements requirements.
- New Yorkers who don't feel well should stay home.
- Wear **masks in public indoor space** and wash hands regularly.

Last memento before the addition: <https://wayback.archive-it.org/4887/20220203045021/https://coronavirus.health.ny.gov/home>

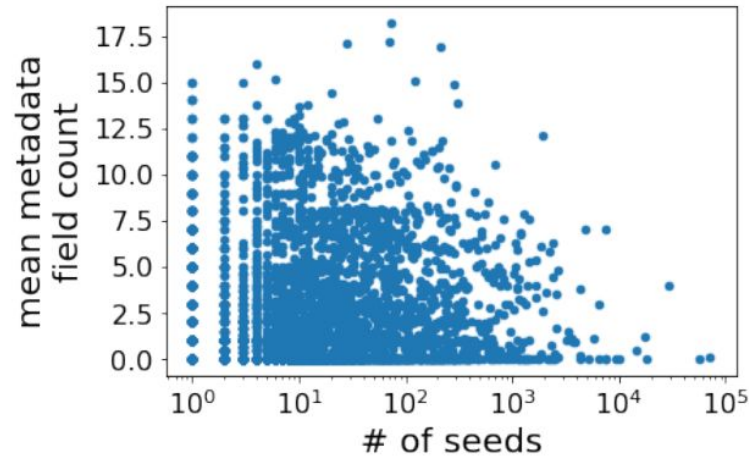
First memento after the addition: <https://wayback.archive-it.org/4887/20220211212050/https://coronavirus.health.ny.gov/home>

And, facets are only useful when curators add metadata

The screenshot shows the Archive-It interface for the '2013 BART Strike' collection. The main content area displays the collection title and a description. Below this, there are several facets for narrowing results, including 'Creator', 'Publisher', 'Date', and 'Format'. A search bar is also present. Red boxes highlight specific elements: the collection title, the collecting organization, the collection metadata, a search result entry, and the facets.

- Collection Name
- Collecting Organization
- Collection Metadata
- Seed URI
- Seed Metadata
- Facets

more seeds -> less metadata



Shawn M. Jones, Alexander Nwala, Michele C. Weigle, and Michael L. Nelson, "The Many Shapes of Archive-It," In iPres 2018, <https://arxiv.org/abs/1806.06878>.

Shawn M. Jones, "Improving Collection Understanding for Web Archives with Storytelling: Shining Light Into Dark and Stormy Archives", PhD Dissertation, ODU, 2021, https://digitalcommons.odu.edu/computerscience_etds/131/

NLM's COVID-19 Collection is an excellent resource

And has been carefully curated, so several facets are available for filtering

Group : Coronavirus disease (COVID-19) outbreak ✕ Type : News article ✕
Language : English ✕ Keyword : Vulnerable Populations ✕

The screenshot shows a web browser window displaying search results for the NLM COVID-19 Collection. The browser address bar shows the URL: archive-it.org/collections/4887?fc=websiteGroup%3ACoronavirus+disease+%28COVID-19%29+ou.... The page features a sidebar with various facets for filtering, including Collector, Keyword, and Geographic Location. A red box highlights the filter facets: Group: Coronavirus disease (COVID-19) outbreak, Type: News article, Language: English, and Keyword: Vulnerable Populations. A red arrow points from this box to the filter facets in the sidebar. The main content area shows search results, including the title "HPP's COVID-19 Preparedness Plan – Homeless Prenatal Program" and "Biden to sign immigration executive orders, including one aimed at reuniting migrant families separated at the border".

Group : Coronavirus disease (COVID-19) outbreak ✕ Type : News article ✕
Language : English ✕ Keyword : Vulnerable Populations ✕

Page 1 of 11 (1,092 Total Results) Next Page ▶

Sort By: Title (A-Z) | Title (Z-A) | URL (A-Z) | URL (Z-A)

Title: HPP's COVID-19 Preparedness Plan – Homeless Prenatal Program
URL: <http://homelessprenatal.org/featured/hpps-covid-19-preparedness-plan>
Captured 2 times between December 21, 2021 and December 21, 2021
Group: Coronavirus disease (COVID-19) outbreak
Creator: Homeless Prenatal Program
Language: English, Spanish
Type: News article
Collector: National Library of Medicine (U.S.)
Keyword: Vulnerable Populations, Pregnant Women, People Experiencing Homelessness

Title: Biden to sign immigration executive orders, including one aimed at reuniting migrant families separated at the border
URL: <https://19thnews.org/2021/02/biden-immigration-executive-order/>
Captured 3 times between August 19, 2021 and April 09, 2022
Group: Coronavirus disease (COVID-19) outbreak
Creator: The 19th News
Language: English
Type: News article
Collector: National Library of Medicine (U.S.)
Keyword: Vulnerable Populations, Migrants, Unaccompanied Migrant Children, Social Dimensions, Legislation and Jurisprudence

The National Library of Medicine Global Health Events web archive, coronavirus disease (COVID-19) pandemic collecting

Susan L. Speaker, PhD, Christie Moffatt, MSLS

doi: <http://dx.doi.org/10.5195/jmla.2020.1090>

Volume 108, Number 4: 656-662

Received 07 2020; Accepted 07 2020

ABSTRACT

Since January 30, 2020, when the World Health Organization declared the SARS CoV-2 disease (COVID-19) to be an emergency of international concern, the National Library of Medicine's (NLM's) Web Collecting and Archiving Working Group has been collecting a broad range of web-based content about the emerging pandemic for preservation in an Internet Archive. This article describes the scope of the COVID-19 project; some of the content collected includes websites, blogs, and social media; collecting criteria and methods; and related COVID-19 collecting efforts by other organizations—2,500 items as of June 30, 2020—chronicles the many facets of the pandemic: epidemiology; disease control measures and resistance to them; effects of the pandemic on health care institutions and commerce, and many aspects of social life; effects for especially vulnerable groups; role of health disparities in mortality; and recognition of racism as a public health emergency.

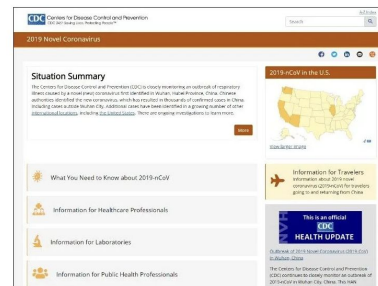
Susan Speaker and Christie Moffatt, "The National Library of Medicine Global Health Events web archive, coronavirus disease (COVID-19) pandemic collecting", *Journal of the Medical Library Association*, Vol 108, No. 4 (2020), Oct 2020, <https://jmla.mlanet.org/ojs/jmla/article/view/1090>

Christie Moffatt, "COVID-19 Web Collecting: Reflections at One Year", Jan 2021, <https://circulatingnow.nlm.nih.gov/2021/01/28/covid-19-web-collecting-reflections-at-one-year/>

COVID-19 WEB COLLECTING: REFLECTIONS AT ONE YEAR

January 28, 2021 About Us, Archives & Manuscripts, Collections, News 8 comments

By Christie Moffatt ~



U.S. Centers for Disease Control and Prevention captured January 30, 2020. Archived pages available at: <https://wayback.archive-it.org/4887/https://www.cdc.gov/coronavirus/2019-nCoV/>

One year ago, on January 30, 2020, the World Health Organization declared the current coronavirus disease (COVID-19) pandemic a [Public Health Emergency of International Concern](#). The disease was yet to be officially named and there were [5 positive cases in the United States](#). With this designation, following National Library of Medicine [Collection Development Guidelines](#), the NLM Web Collecting and Archiving Working Group began collecting web and social media to document the emerging global pandemic. While we had no idea for how long the pandemic would last, nor the extent of its impact, we began this effort with a belief that web content would be a significant part of the primary

historical record for future research and understanding of this historic time. As the nature of web content is ephemeral, future access to the web and social media documenting the pandemic—its impact, our reactions,

New Mexico Department of Health

https://wayback.archive-it.org/4887*/http://cv.nmhealth.org/

10
Positive Cases of COVID-19 in New Mexico

COVID-19 Test Results in NM	
Presumptive Positive *	10
Confirmed Positive	0
Negative	237

[March 14, 2020](#)

27,512
Positive Cases of COVID-19 in New Mexico

[September 21, 2020](#)

246,229
Positive Cases of COVID-19 in New Mexico

[September 21, 2021](#)

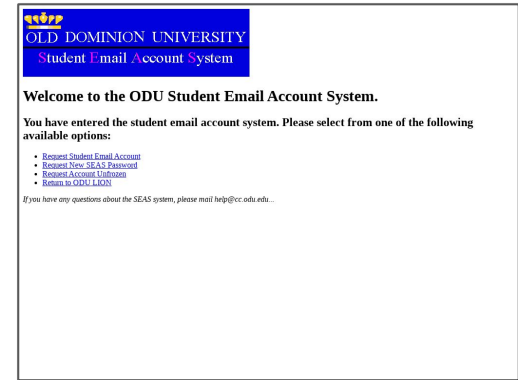
507,323
Positive Cases of COVID-19 in New Mexico

[March 15, 2022](#)

November 2022
([live](#))

507,323
Positive Cases of COVID-19 in New Mexico

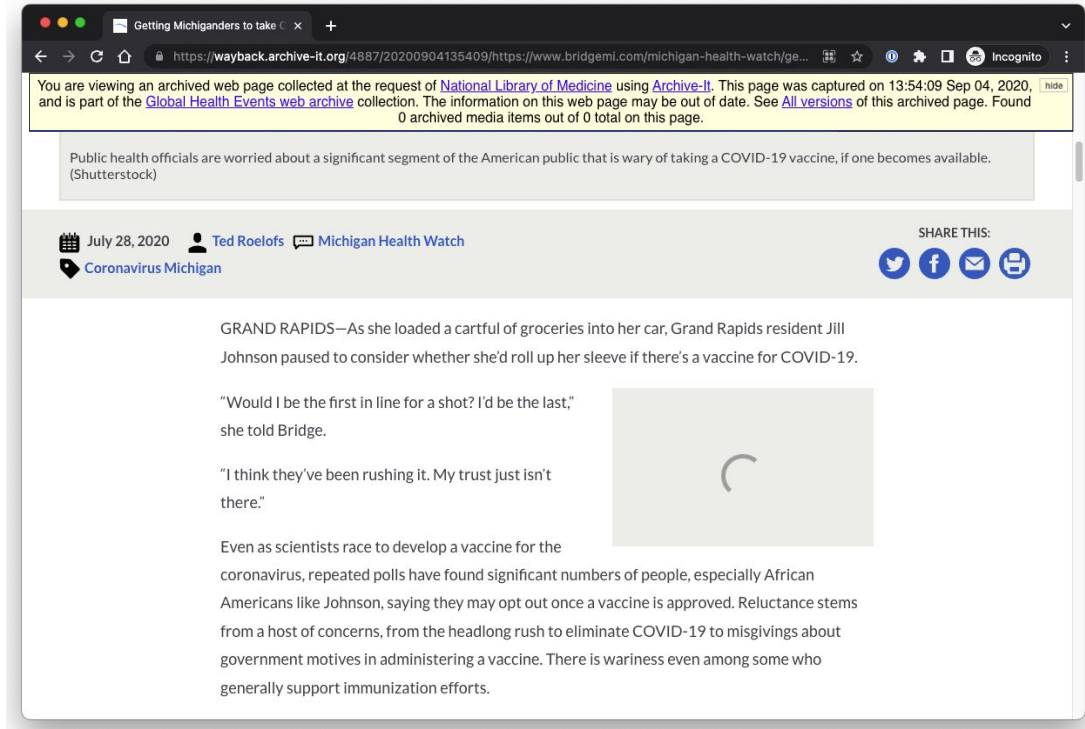
How has a single webpage changed over time?



Abigail Mabe, Dhruv Patel, Maheedhar Gunnam, Surbhi Shankar, Mat Kelly, Sawood Alam, Michael L. Nelson, Michele C. Weigle, "Visualizing Webpage Changes Over Time", <https://arxiv.org/abs/2006.02487>, <https://ws-dl.blogspot.com/2020/05/2020-05-21-visualizing-webpage-changes.html>

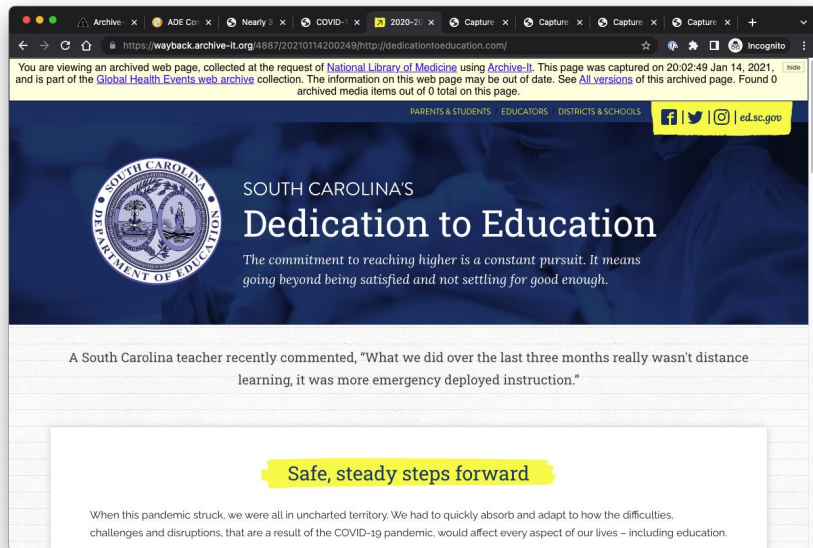
Getting Michiganders to take COVID-19 vaccine: 'My trust just isn't there'

Published Jul 28, 2020
First archived Sep 4, 2020

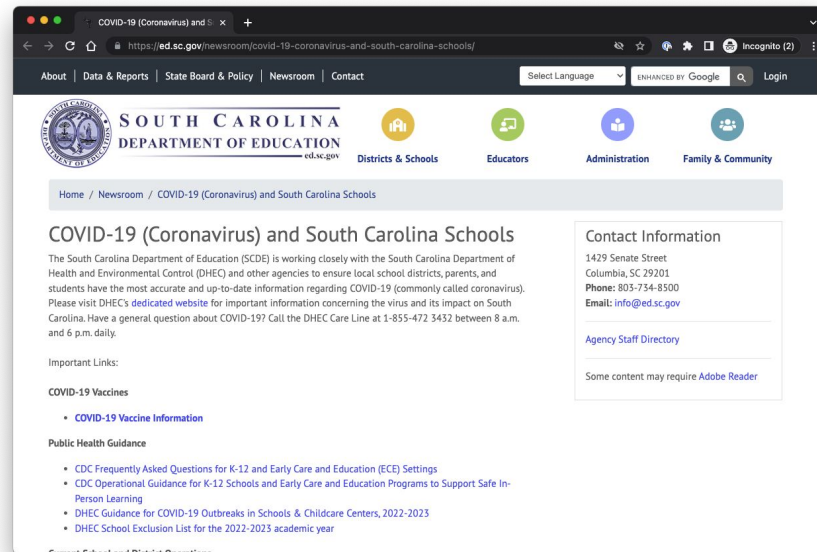


<https://wayback.archive-it.org/4887/20200904135409/https://www.bridgemi.com/michigan-health-watch/getting-michiganders-to-take-covid-19-vaccine-my-trust-just-isnt-there>

South Carolina Dept of Education, Dedication to Education Page



[January 14, 2021](https://wayback.archive-it.org/4887/*/http://dedicationtoeducation.com/)



today
redirects to SC DOE's COVID Newsroom,
<https://ed.sc.gov/newsroom/covid-19-coronavirus-and-south-carolina-schools/>

https://wayback.archive-it.org/4887/*/http://dedicationtoeducation.com/

Twitter Hashtags in Collection

#2019nCoV

#SleeveUp

#flattenthecurve

#COVID19

#SongsOfComfort

#healthworkers

#DontBeASpreader

#StayAtHome

#millionmaskchallenge

#IStayHomeFor

#TheMoment

#SolidarityNotStigma

#MyCOVIDVaccine

#VaccinEquity

#coronavirus

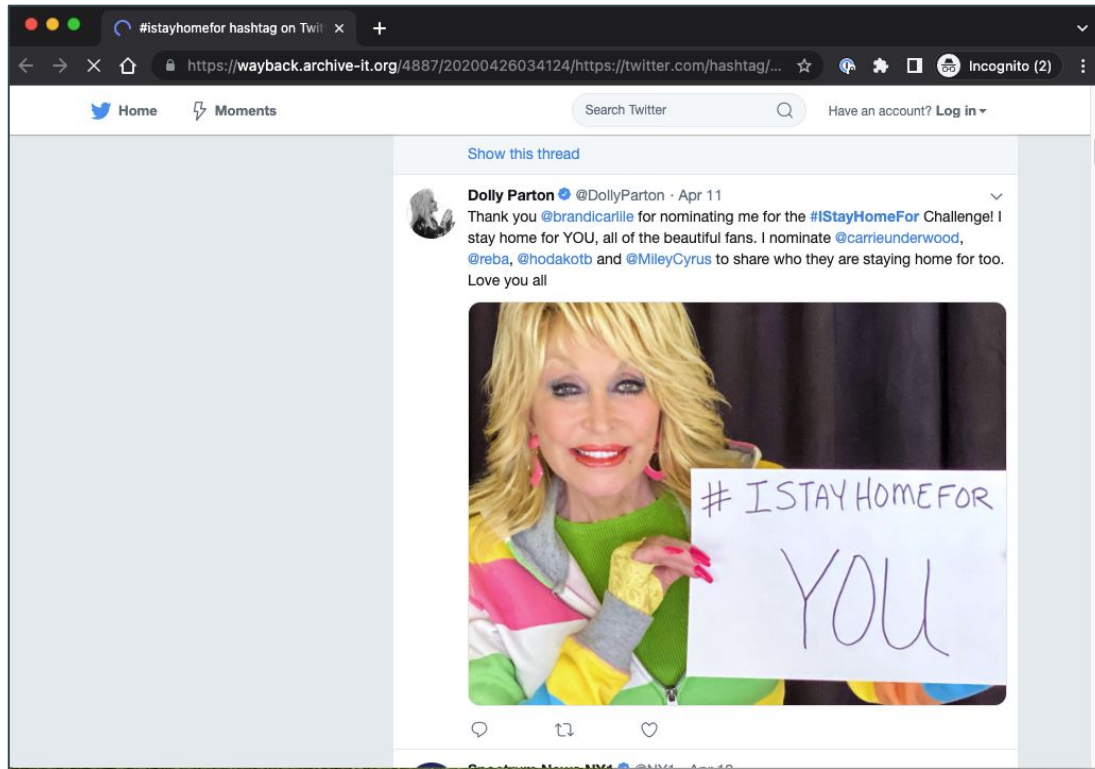
#SafeHands

#WearAMask

#coronacomic

https://archive-it.org/collections/4887?q=hashtag&sort=f_sort_title.asc&fc=websiteGroup%3ACoronavirus+disease+%28COVID-19%29+outbreak&fc=meta_Type%3ASocial+media

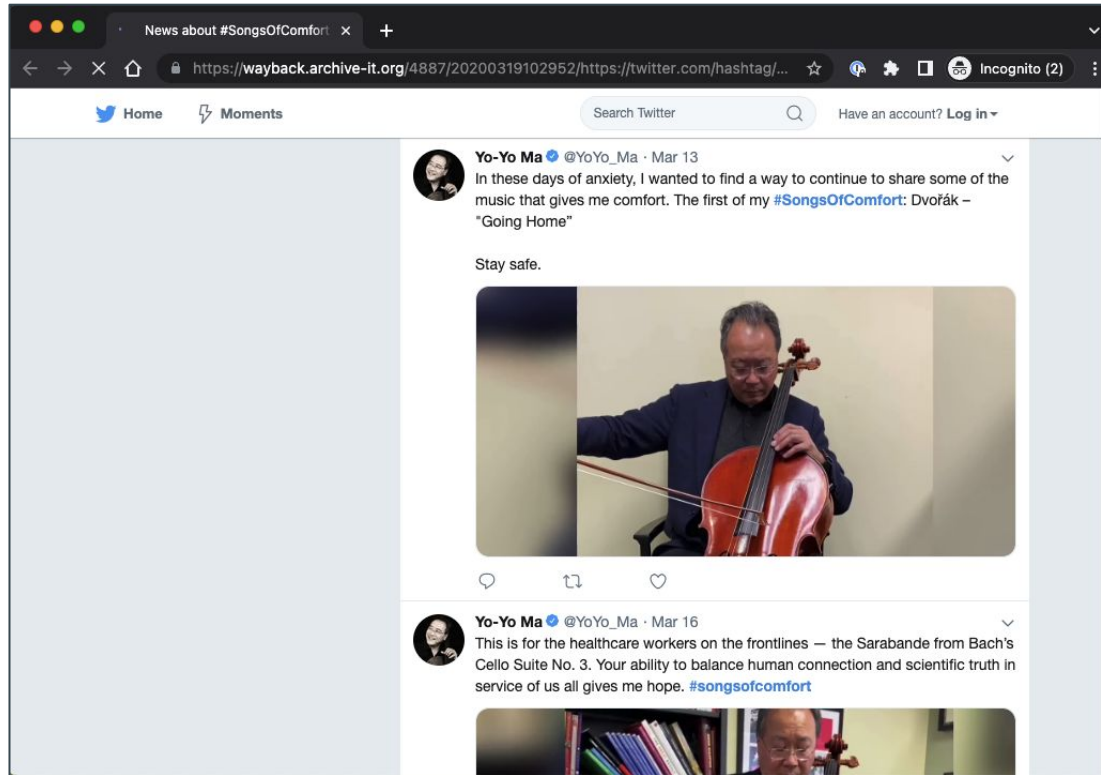
#IStayHomeFor on Twitter (April 2020)



April 26, 2020

<https://wayback.archive-it.org/4887/20200426034124/https://twitter.com/hashtag/IStayHomeFor/>

#SongsOfComfort on Twitter (March 2020)



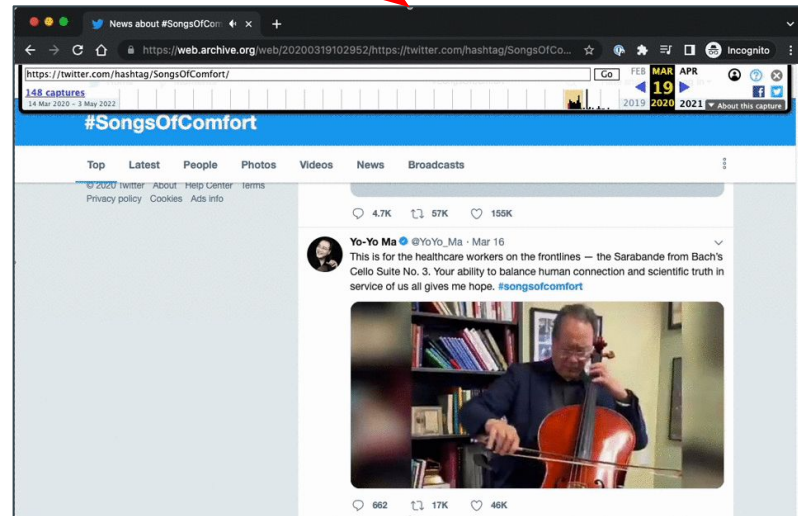
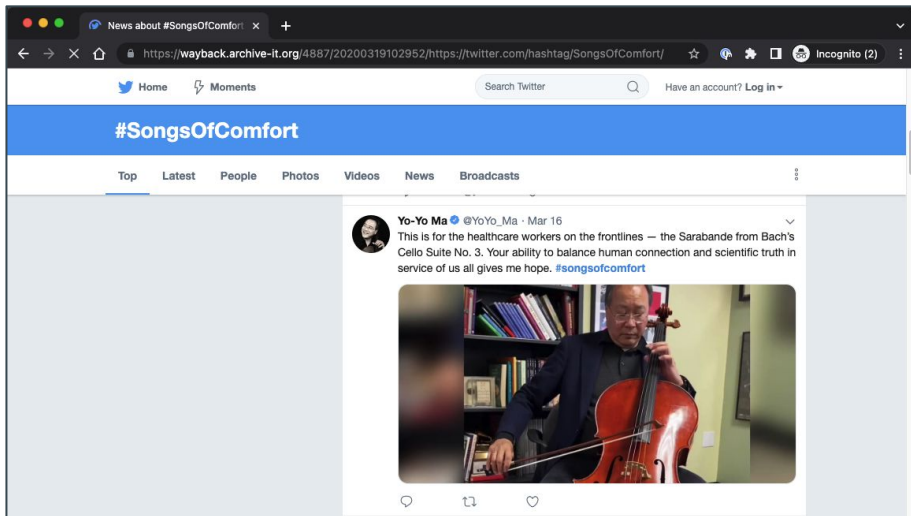
March 19, 2020

<https://wayback.archive-it.org/4887/20200319102952/https://twitter.com/hashtag/SongsOfComfort/>

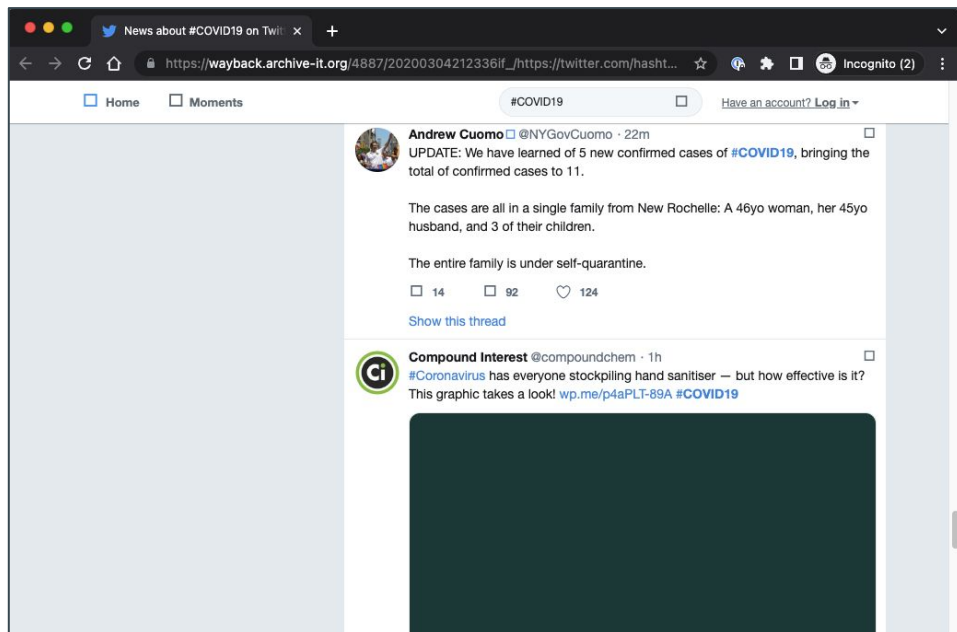
Pro-Tip: Archive-It mementos are also available via IA Wayback

<https://wayback.archive-it.org/4887/20200319102952/https://twitter.com/hashtag/SongsOfComfort/>

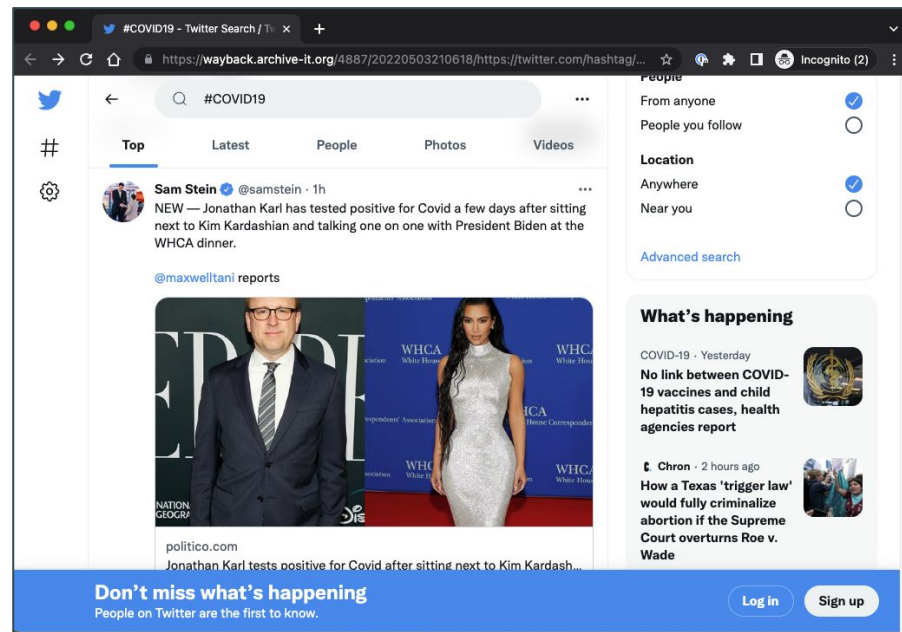
<https://web.archive.org/web/20200319102952/https://twitter.com/hashtag/SongsOfComfort/>



#COVID19 on Twitter (Mar 2020 - May 2022)



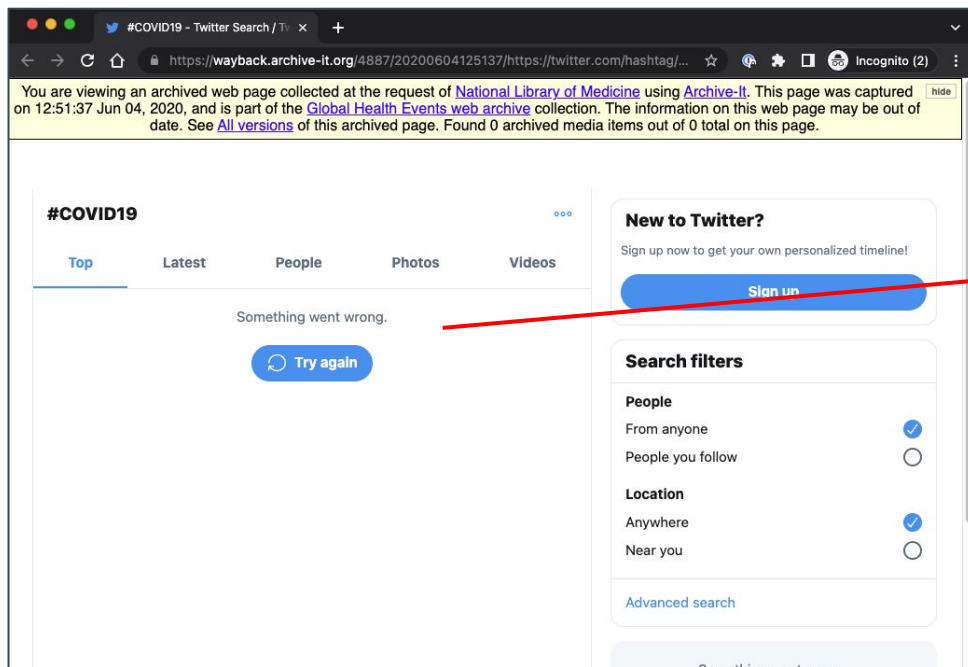
[March 4, 2020](#)



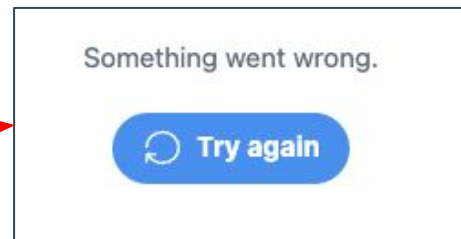
[May 3, 2022](#)

https://wayback.archive-it.org/4887*/https://twitter.com/hashtag/COVID19?src=hashtag/

Issues with Archiving Twitter



June 4, 2020



Kritika Garg and **Himarsha Jayanetti**, "Twitter Was Already Difficult To Archive, Now It's Worse!", July 2020, <https://ws-dl.blogspot.com/2020/07/2020-07-15-twitter-was-already.html>

Kritika Garg, **Himarsha R. Jayanetti**, **Sawood Alam**, Michele C. Weigle, and Michael L. Nelson, "Replaying Archived Twitter: When your bird is broken, will it bring you down?," In JCDL 2021, pp. 160-169, <https://arxiv.org/abs/2108.12092>

COVID-19 Web Archive at Archive-It (154 collections)

Home x +
https://covid19.archive-it.org ☆ ⓘ ⚙ □ 🛡 Incognito

COVID 19 Web Archive About Collections

COVID-19 Web Archive

Explore the pandemic through hundreds of web archive collections

🔍 Search across 100s of COVID-19 Web Collections **Search**

Explore Collections by Location

About the COVID-19 Web Archive

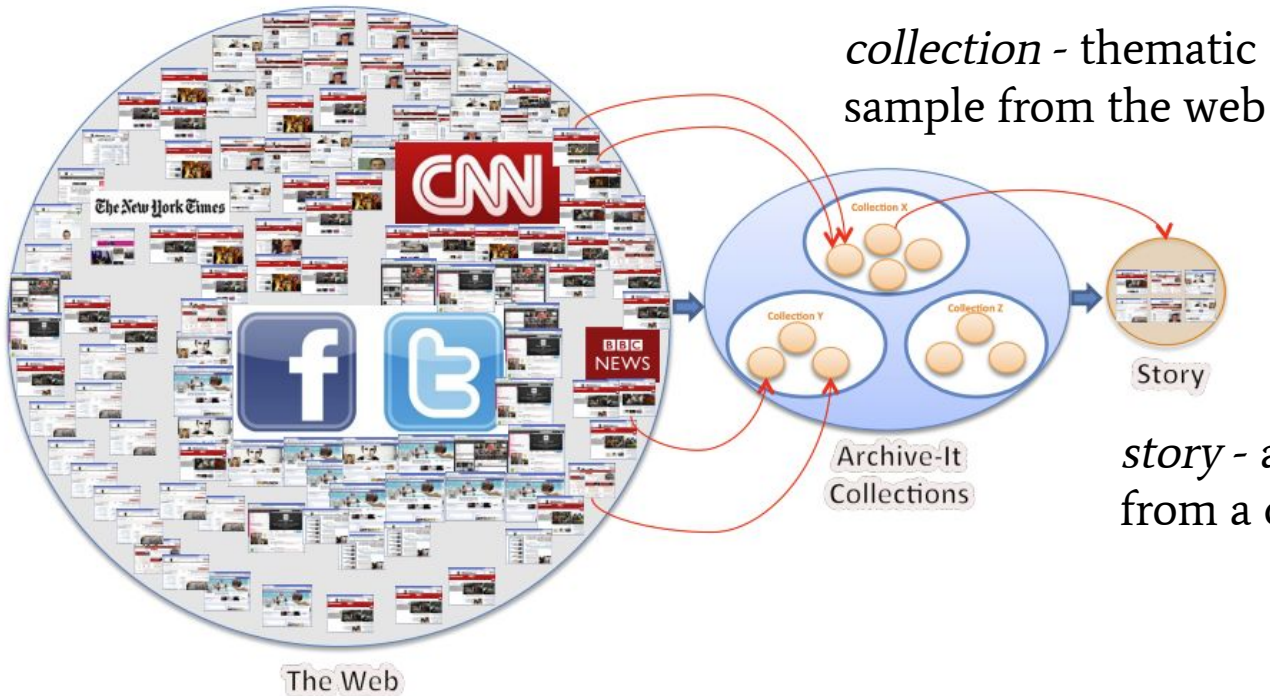
The COVID-19 Web Archive includes 154 collections from 122 collecting organizations. These collections contain more than 80,000 websites documenting the impacts of the COVID-19 pandemic on communities, businesses, healthcare, and other aspects of everyday life. Search the full-text of the archived webpages, as well as images, videos, pdfs, and more.

[More about this project](#)

Featured Collections

<https://covid19.archive-it.org/>

From the Web to Collection to Story



Yasmin AlNoamany, Michele C. Weigle, and Michael L. Nelson, "Generating Stories From Archived Collections", In ACM WebSci, 2017, <https://doi.org/10.1145/3091478.3091508>

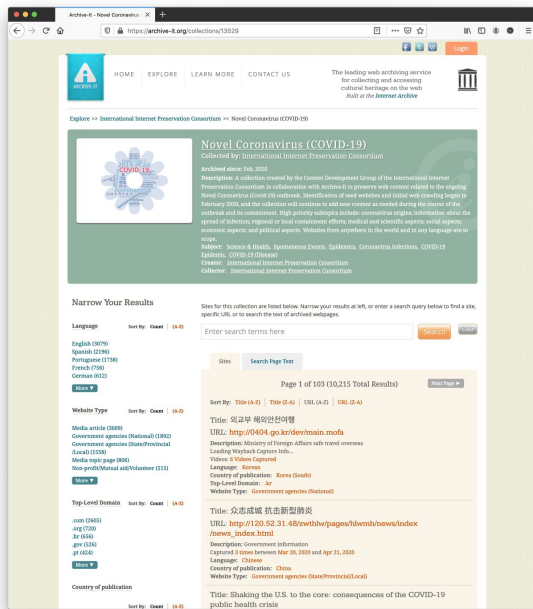
Storify Example

The screenshot shows a web browser displaying a Storify page. The browser's address bar shows the URL: https://web.archive.org/web/20171214003620/https://storify.com/ait_stories/2823spst0s. The Storify page has a blue header with a 'Browse' button and a 'Log In' button. Below the header, the title 'Russia Plane Crash' is prominently displayed. Underneath the title, it says 'by ait_stories 2 years ago 14 Views'. The main content area features four news snippets, each with a small image, a headline, a short text summary, and a source attribution with a date. The snippets are: 1. 'Dozens killed as Russian plane carrying hockey team crashes' from CNN, dated 08 SEP 2011. 2. 'Russian plane crash kills Lokomotiv Yaroslavl ice hockey team' from The Guardian, dated 08 SEP 2011. 3. 'Video: 44 killed in Russian plane crash' from The Global Band Mail, dated 08 SEP 2011. 4. 'Dozens dead in Russian hockey team plane crash' from Reuters, dated 08 SEP 2011. At the bottom of the page, there is a text box containing the URL: http://web.archive.org/web/20171214031158/https://storify.com/ait_stories/2823spst0s/.

Yasmin AlNoamany, Michele C. Weigle, and Michael L. Nelson, "Characteristics of social media stories", *IJDL*, September 2016, <https://doi.org/10.1007/s00799-016-0185-3>

We've developed a suite of tools for collection storytelling

From 23,376 mementos



Dark and Stormy Archives
(DSA) Toolkit

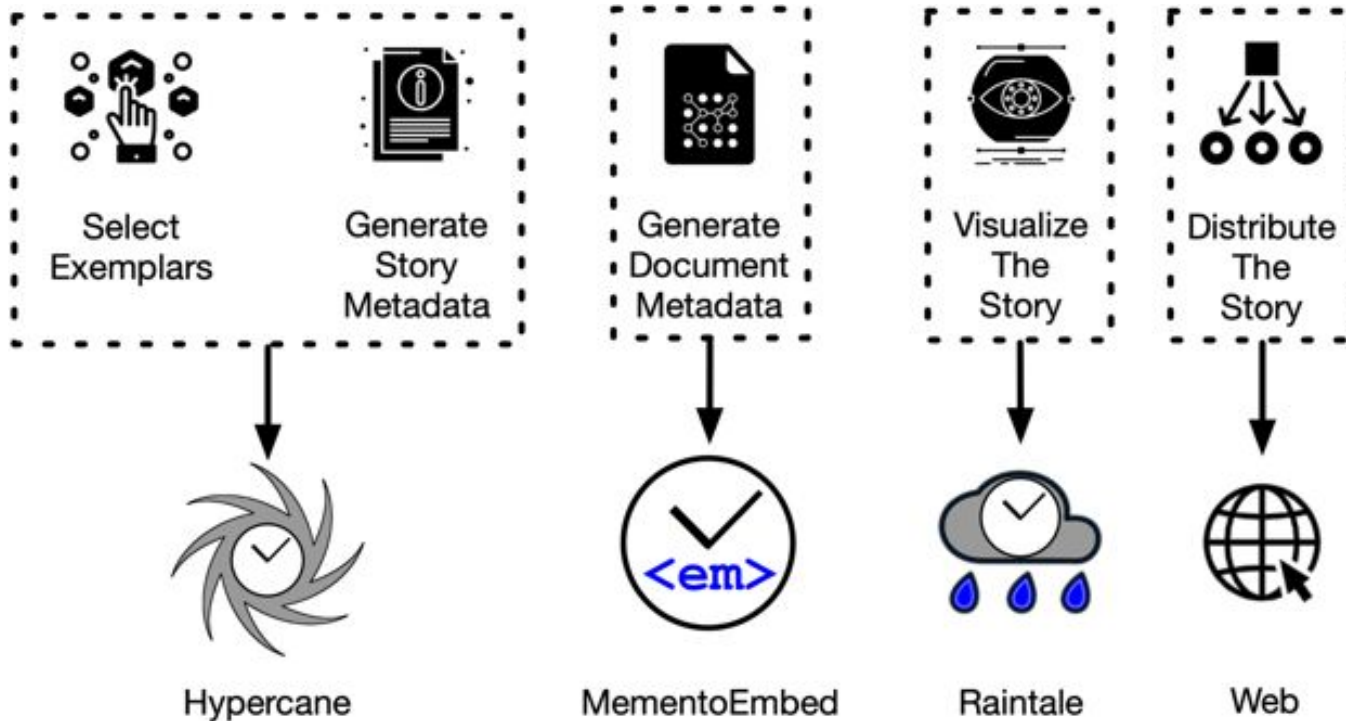


To a sample of 36 mementos, visualized as social cards, phrases, and images



Shawn M. Jones, Himarsha R. Jayanetti, Alex Osborne, Paul Koerbin, Martin Klein, Michele C. Weigle, Michael L. Nelson, “The DSA Toolkit Shines Light Into Dark and Stormy Archives”, *The Code4Lib Journal*, Issue 53, 2022, <https://journal.code4lib.org/articles/16441>

From Collections to Stories with the DSA Toolkit



Shawn M. Jones, Himarsha R. Jayanetti, Alex Osborne, Paul Koerbin, Martin Klein, Michele C. Weigle, Michael L. Nelson, “The DSA Toolkit Shines Light Into Dark and Stormy Archives”, *The Code4Lib Journal*, Issue 53, 2022, <https://journal.code4lib.org/articles/16441>

Story based on IIPC's COVID Collection (generated April 2020)

Archive-It Collection 13529: Novel Coronavirus (COVID-19)
A collection curated by International Internet Preservation Consortium

A short summary story of 36 documents automatically selected by AI Noamany's Algorithm

« Previous Story View the collection behind this story Next Story »

Most frequent entities china, wuhan, cdc, japan, chinese

Most frequent sumgrams covid 19, public health, covid 19, the centers for disease control and prevention, the world health organization

Virus Outbreak: COVID-19 likely synthetic: Researchers say - Taipei Times

Virus Outbreak: COVID-19 likely synthetic: Researchers say ESCAPED? Given China's poor track record with lab safety management, the virus is likely to have escaped from a facility, public health re...

www.taipetimes.com © 2020-03-05T19:48:11Z Preserved by ARCHIVE-IT.ORG

TIMISKAMING Health Unit

COVID-19

On this page: Current situation in Timiskaming Services at THU What THU is doing to respond to COVID-19 What to

striking image

most frequent entities:

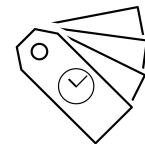
china, wuhan, cdc,
japan, chinese

most frequent sumgrams:

covid 19, public health,
the centers for disease
control and prevention,
the world health
organization

36 social cards, each
representing a
memento

[https://oduwsdl.github.io/dsa-puddles/stories/shari/2020/04/22/archive-it_collection_13529_novel_coronavirus_\(covid-19\)/](https://oduwsdl.github.io/dsa-puddles/stories/shari/2020/04/22/archive-it_collection_13529_novel_coronavirus_(covid-19)/)



Python library

Given an Archive-It collection, obtain collection metadata, seed list, and seed metadata.

```
In [3]: aic.get_collection_name()
Out[3]: 'Social Media'

In [4]: aic.get_collectedby()
Out[4]: 'Willamette University'

In [5]: aic.get_description()
Out[5]: 'Social media content created by Willamette University.'

In [6]: aic.get_collection_uri()
Out[6]: 'https://archive-it.org/collections/5728'

In [7]: aic.get_archived_since()
Out[7]: 'Apr, 2015'

In [8]: aic.is_private()
Out[8]: False

In [9]: len(aic.list_seed_uris())
Out[9]: 113

In [10]: aic.list_seed_uris()[0]
Out[10]: 'http://blog.willamette.edu/mba/'

In [11]: seed_url = aic.list_seed_uris()[0]

In [12]: aic.get_seed_metadata(seed_url)
Out[12]:
{'collection_web_pages': [{'title': 'Willamette MBA Blog',
'description': ['Blog for the Willamette University Atkinson Graduate School of Management']}]}
```

Shawn M. Jones, Alexander Nwala, Michele C. Weigle, and Michael L. Nelson, “The Many Shapes of Archive-It,” In iPres 2018, <https://arxiv.org/abs/1806.06878>.

Hypercane provides composable operators

<https://oduwsdl.github.io/hypercane/>



sample

Produce a list of exemplars with an existing algorithm.



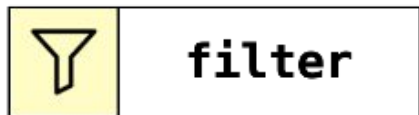
cluster

Divide a collection into meaningful sub-collections.



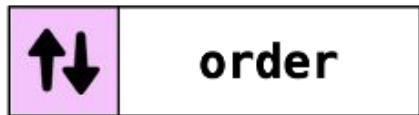
score

Rank mementos in a cluster according to certain criteria.



filter

Remove mementos from consideration.



order

Sort mementos based on the preceding score operation.

S. M. Jones, M. C. Weigle, and M. L. Nelson. "Hypercane: Toolkit for Summarizing Large Collections of Archived Webpages", ACM SIGWEB Newsletter, 2021, DOI 10.1145/3473044.3473047, <https://www.cs.odu.edu/~mweigle/papers/jones-sigweb21.pdf>

MementoEmbed generates a social card from a memento



<http://mementoembed.ws-dl.cs.ou.edu/>

The screenshot shows a social card with the following elements:

- Thumbnail:** A small image showing a news broadcast with the text "VACCINATION UPDATE Doses Administered 107,597".
- Title:** "Delaware concerned over low numbers of minority populations getting vaccine" in blue text.
- Source:** "Preserved by ARCHIVE-IT.ORG" with the Archive-IT logo.
- Archive Info:** "Member of the Collection Global Health Events web archive".
- Text:** "So far just 5% of the people who have received the vaccine in Delaware are Black, and just 2% are Hispanic."
- Metadata:** "6ABC.COM @ 2021-06-23T17:55:45Z" with a 6abc logo.
- Links:** "Other Versions || Current version".

information from the memento content

information about the archive

information about the memento

other mementos for this page

current (live) version of this page

<https://wayback.archive-it.org/4887/20210623175545/https://6abc.com/delaware-covid-19-vaccine-underserved-communities-black-americans-hispanic/10273580/>

Shawn Jones, A Preview of MementoEmbed: Embeddable Surrogates for Archived Web Pages, <https://ws-dl.blogspot.com/2018/08/2018-08-01-preview-of-mementoembed.html>,

Raintale can produce stories in several formats



<https://oduwsdl.github.io/raintale/>

Australian Zoos, Wildlife Sanctuaries & Aquariums

Story By: Himarsha
5 snapshots

This is a list of webpage snapshots we have saved from a point in time about Australian Zoos, Wildlife Sanctuaries & Aquariums

2004 SEP 15

Three Great Zoos - Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo



Sleep overnight with the animals at Victoria's open Range Zoo NEW! Tuesday, February 5: Victoria's Open Range Zoo Experience Safari Slumber at Victoria's Open Range Zoo at Werribee and sleep under...

<http://www.zoo.org.au/index.html>

2004 SEP 16

Three Great Zoos - Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo



Murrundindi - Discover the Aboriginal Sanctuary Perspective NEW! Every Saturday, 12.00pm until 2.30pm. Murrundindi, an elder of the Wurundjeri people presents an Aboriginal cultural pe...

<http://www.zoo.org.au/index.html>

HTML

Australian Zoos, Wildlife Sanctuaries & Aquariums
Story By: Himarsha
Collection URL: <http://pandora.nla.gov.au/col/17208>

Three Great Zoos - Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo
Preserved by [NLA.GOV.AU](#)
Sleep overnight with the animals at Victoria's open Range Zoo NEW! Tuesday, February 5: Victoria's Open Range Zoo Experience Safari Slumber at Victoria's Open Range Zoo at Werribee and sleep under...
www.zoo.org.au @ 2004-09-15 14:45:11
Other Versions | Current Version

Three Great Zoos - Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo
Preserved by [NLA.GOV.AU](#)
Murrundindi - Discover the Aboriginal Sanctuary Perspective NEW! Every Saturday, 12.00pm until 2.30pm. Murrundindi, an elder of the Wurundjeri people presents an Aboriginal cultural pe...
www.zoo.org.au @ 2004-09-16 10:48:59
Other Versions | Current Version

Three Great Zoos - Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo

Markdown

Web Archive Stories on Twitter

Thread

Web Archive Stories @archive_stories · 5m
Australian Zoos, Wildlife Sanctuaries & Aquariums
Story By: Himarsha @Himarsha

Web Archive Stories @archive_stories · 5m
Three Great Zoos - Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo

2004-09-15 14:45:11
webarchive.nla.gov.au/awa/2002021013...

Web Archive Stories @archive_stories · 5m
Three Great Zoos - Melbourne Zoo, Healesville Sanctuary and Werribee Open Range Zoo

2004-09-16 10:48:59
webarchive.nla.gov.au/awa/2003081014...


Twitter Thread

S. M. Jones, M. Klein, M. C. Weigle, and M. L. Nelson. "MementoEmbed and Raintale for Web Archive Storytelling", 2020, <https://arxiv.org/abs/2008.00137>

DSA Puddles -- Visualizations x +


https://oduwsdl.github.io/dsa-puddles/ Incognito (2)

DSA Puddles Visualizations of the Dark and Stormy Archives Project




2022, NOV 08

StoryGraph Biggest Story 2022-11-08 -- election day (14), the 2020 election (11), secretary state (9), two years (7), key races (7)



2022, NOV 07

StoryGraph Biggest Story 2022-11-07 -- new york (15), president joe biden (13), election day (12), gov ron (11), a campaign event (11)



2022, NOV 06

StoryGraph Biggest Story 2022-11-06 -- president joe biden (11), mehmet oz (11), new york (8), two years ago (7), election day (7)

Browse By Post Category

| All | | Story Generated by an expert archivist | | storygraph | | Early Experiments with Raintale | | CIKM 2019 study examples |
 | Stories Generated By Algorithms | | Wikipedia References |

2022 midterm elections (12), mehmet oz (9), president joe biden's (8), election day (8), john fetterman (7)

web archive

2020 election (17), president joe biden (16), election day (10), two years (9), speaker nancy pelosi


<https://oduwsdl.github.io/dsa-puddles/>

dsa-puddles x +

https://oduwsdl.github.io/dsa-puddles/categories/Stories_Generated_By_Algorithms/ Incognito


DSA Puddles Visualizations of the Dark and Stormy Archives Project

Category: Stories Generated By Algorithms




2022, OCT 21

Archive-It Collection 9280: Opioid Epidemic web archive




2021, FEB 17

Archive-It Collection 1784: Earthquake in Haiti



2020, DEC 02

Archive-It Collection 649: Tragedy at Virginia



2020, NOV 18

https://oduwsdl.github.io/dsa-puddles/categories/Stories_Generated_By_Algorithms/

NLM Collections as a Stories

Archive-It Collection 9280: Opioid Epidemic web archive
A collection curated by National Library of Medicine

A short summary story of 20 documents automatically selected by AI/Noamny's Algorithm

« Previous Story View the collection behind this story Next Story »

Most frequent entities americans, u.s., america, trump, oycocynin

Most frequent summaries the opioid epidemic, the opioid crisis, overdose deaths, in the united states, public health.

When The National Opioid Crisis Hits Home – And How The UN Is Helping | unfoundation.org
For me, the opioid crisis is more than a national headline. I come from a small town in Monroe, Michigan that has been devastated by this epidemic. My neighbors and family friends have lost their...

Opioid overdose
The term "opioids" includes compounds that are extracted from the poppy seed as well as semisynthetic and synthetic compounds with similar properties that can interact with opioid receptors in the brain.

Drug Policy Alliance
The war on drugs is harming millions of us. Let's work together to end it. It's time for a new approach grounded in science, compassion, health and human rights. About Us.

The disturbing reason behind the spike in organ donations
The study says people who have received organs from drug users do not generally have worse outcomes than people who do not.

When a Company Is Making Money From the Opioid Crisis
Some shareholders of a major drug distributor are arguing that the company's goals should be more in line with

https://oduwsdl.github.io/dsa-puddles/stories/archive-it_collections/2022/11/02/archive-it_collection_9280/

Archive-It Collection 9626: Bernadine Healy Papers
A collection curated by National Library of Medicine

A short summary story of 8 documents automatically selected by AI/Noamny's Algorithm

« Previous Story View the collection behind this story Next Story »

Most frequent entities healy, nih, bernadine healy, the american red cross, the national institutes of health

Most frequent summaries bernadine healy, the national institutes of health, the american red cross, the ohio state university college of

Bernadine Healy, NIH and Red Cross leader, dies at 67
Bernadine Healy, the first woman to lead the National Institutes of Health and past president of the American Heart Association and American Red Cross, died Aug. 6 at her home in Ohio. She was 67.

Dr. Bernadine R. Healy, Influential Health Administrator, Dies at 67
Dr. Healy, the first woman to run the National Institutes of Health, helped overturn assumptions that heart disease was mainly just a male problem.

Dr. Bernadine R. Healy | 1944-2011: Physician left trail throughout health field
Dr. Bernadine R. Healy, a leading health crusader, died Saturday of complications from cancer.

National Institutes of Health Director Bernadine Healy said Friday...
National Institutes of Health Director Bernadine Healy said Friday she is stepping down at the end of June as President Clinton can choose his own person to...

Testing to Foil Sudden Cardiac Death

https://oduwsdl.github.io/dsa-puddles/stories/archive-it_collections/2022/11/02/archive-it_collection_9626/

Archive-It Collection 7219: Environmental Health web archive
A collection curated by National Library of Medicine

A short summary story of 7 documents automatically selected by AI/Noamny's Algorithm

« Previous Story View the collection behind this story Next Story »

Most frequent entities flint, michigan, ods, hhs, nicole lurie

Most frequent summaries lead exposure, the water crisis, effects lead, would include blood lead level monitoring behavioral health services, tested lead

Partners are Helping Shape Brighter Futures for Flint's Children
The Flint community, together with partners, has really come together to help children and families overcome the potential health effects of this crisis.

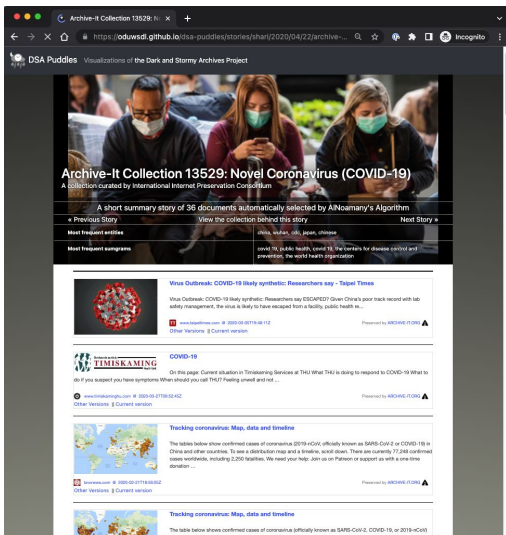
Science heroes of Flint's lead water crisis | PLOS Blogs Network
"LEAD MAKES THE MIND GIVE WAY" Old news, from a doc in Rome in the second century BC, quoted by William Feringan in the New Yorker. Feringan's is a fine angry summary of thousands of years of accumulated medical knowledge about the evils of lead, epitomized currently by the lead-filled water crisis in Flint, Michigan--and a sorry number of other places. Lead exposure in children, the points out, "can cause stunted growth, permanent mental retardation, speech impairment, hearing loss, reproductive problems, and kidney damage." Mike the Mad Biologist says its lead crisis means Flint is facing "an educational catastrophe." He argues that the effects of lead poisoning are close to the test-score differences between poor children and those better off and between black and white children. Incidental Economist Aaron Carroll cites data suggesting that "high blood lead levels were associated with increased oppositional, hyperactive and bullying behaviors in children. Teenagers who had high lead.

Mayor Weaver Thanks President Obama for Newly Appointed Staff Member

HHS awards \$500,000 in funding to Flint health centers
FLINT, Mich. – U.S. Department of Health and Human Services Secretary Sylvia M. Burwell today announced \$500,000 in funding to help two area health centers increase and expand activities in response to the lead contamination of Flint's water.

https://oduwsdl.github.io/dsa-puddles/stories/archive-it_collections/2022/11/03/archive-it_collection_7219/

Challenge: How do users discover appropriate collections?



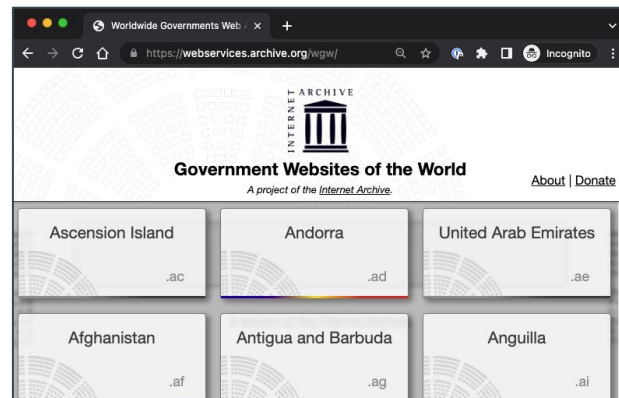
[https://oduwsdl.github.io/dsa-puddles/stories/shari/2020/04/22/archive-it-collection-13529-novel-coronavirus-\(covid-19\)/](https://oduwsdl.github.io/dsa-puddles/stories/shari/2020/04/22/archive-it-collection-13529-novel-coronavirus-(covid-19)/)

Featured Collections

<p>Community/Local Impact Collections about local resources and the community level impact of COVID-19, including local journalism, community groups, K-12 schools, and religious organizations.</p>	<p>COVID-19 in the U.S. Collections about the impact of COVID-19 in the United States.</p>
<p>Responses from Universities and Colleges Collections measuring the impact of COVID-19 on academic institutions, including student experiences and institutional responses from colleges and universities.</p>	<p>Government Response Local, state/regional, and national government responses and initiatives to combat the spread of COVID-19 and provide educational resources for the public.</p>

<https://covid19.archive-it.org/>

<https://web.archive.org>



<https://webservices.archive.org/wgw>

Collection Search

Enter any keyword

End Of Term (US Gov) ▾

SEARCH

This service is based on indexes of specific data from selected Collections.

✓ End Of Term (US Gov) 2016

End Of Term (US Gov) 2020

- .gov web pages
- .gov PDFs
- hk.appledaily.com
- Media Cloud
- PDFs
- poetry.com
- Presentations
- Russian Independent Media
- South China Morning Post (scmp.com)
- thestandnews.com

Challenge: How can users work with collections as research data?



<https://archivesunleashed.org/>

ARCH (Archives Research Compute Hub)

<https://webservices.archive.org/pages/arch>

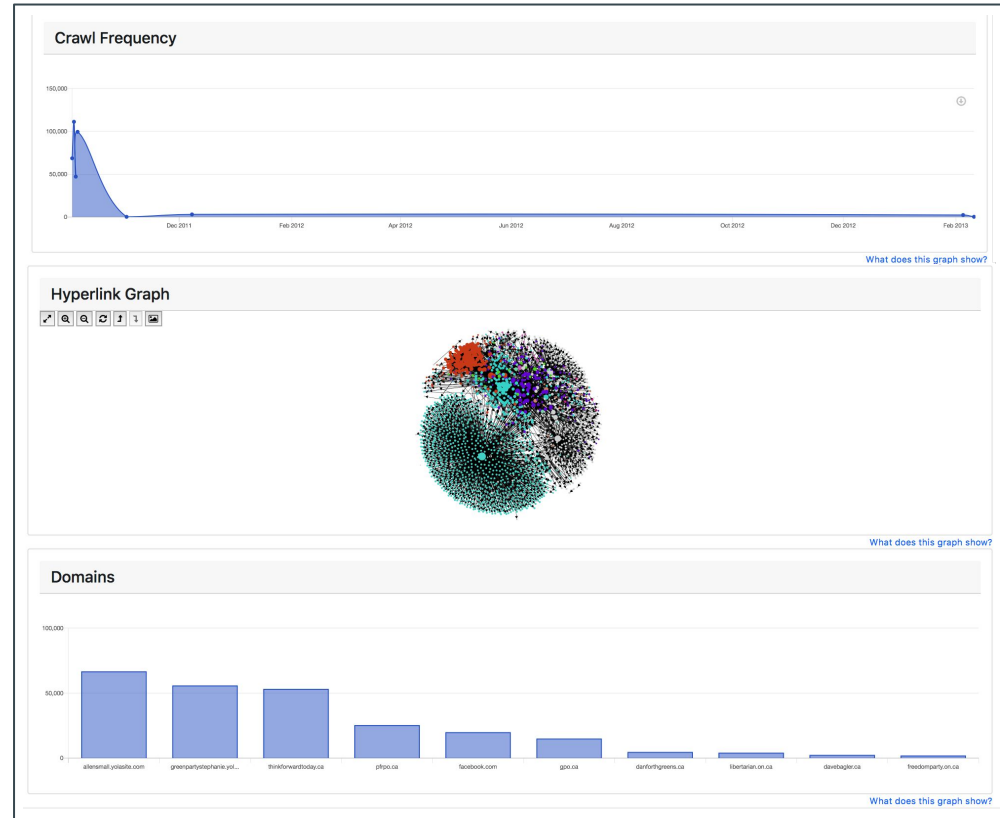
Gephi
3.11 MB

Raw Network
1.45 MB

Domains
8.21 KB

Web Page Text
1.37 GB

Text by Domains
21.6 KB



Challenge: How can users work with collections as research data?

Archives 
Unleashed

<https://archivesunleashed.org/>

ARCH (Archives Research Compute Hub)

<https://webservice.archive.org/pages/arch>

Applications of Web Archive Research with the Archives
Unleashed Cohort Program,

<http://blog.archive.org/2022/03/21/library-as-laboratory-recap-applications-of-web-archive-research-with-the-archive-unleashed-cohort-program/>



Supporting Computational Use of Web Collections,
<http://blog.archive.org/2022/03/07/library-as-laboratory-recap-supporting-computational-use-of-web-collections/>

Challenge: How do users discover specific mementos?

View unavailable page

- Deletion - page
- Site unavailable on live web

View change over time

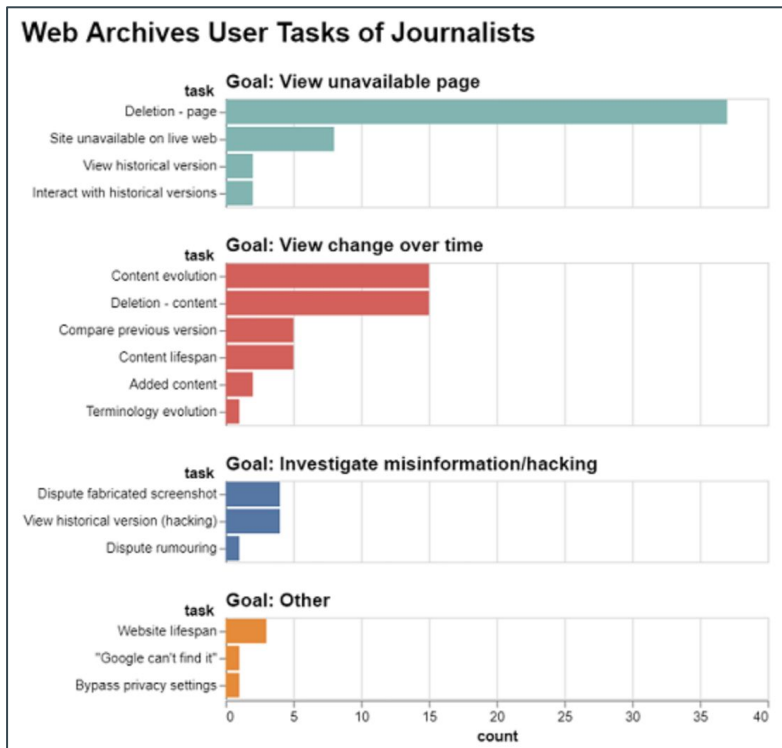
- Content evolution
- Deletion - content

Investigate misinformation/hacking

- Dispute fabricated screenshot
- View historical version

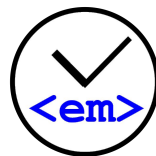
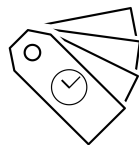
Other

- Website lifespan



Conclusion

- Web archives contain traces of our history and culture.
- Web archive collections are thematic groups of archived web pages that can help with discovery.
- The DSA Toolkit can produce overviews of web archive collections, especially useful for large collections.
- Challenges related to discovery in web archives remain.



Slides: <https://bit.ly/weigle-nlm-2022>

Tools and Code: <https://github.com/oduwsdl>