## Finding and Evaluating Datasets Data Bootcamp - Summer 2023

## Finding Dataset Guide:

## <u>https://libguides.colorado.edu/</u> <u>findingdatasets/2023</u>





## Data are...

- ...discrete values or units of information
  - numbers, words,
    - characters, images, sound recordings, videos.
- ...anything that can be collected, stored, organized, and analyzed.

Image by Ryan Skjervem on Unsplash



The data-information-knowledge-wisdom (DIKW) hierarchy © Luis Tedeschi, CC BY-NC 4.0

# What is a dataset?



- Grouped information collected, assembled, and organized
- Used for analysis of an issue, phenomenon, or subject
- Can be textual, numeric, images, sounds, video, code, geospatial
- Many formats
  - CSV, XML, TIFF, PDF, etc,

## "Traditional" vs. "Big" Data

- structured format
- stored in relational databases (uses tables, each row has a unique identity or 'key')
- Uses "traditional" storage methods and tools
- Majority of datasets you'll find to work with

- Large volume data (too big for relational databases)
- Variety of formats/types of data
- Receives data at high velocity (is constantly being created and stored)
- Stored in data warehouses

   (w/software framework such as Hadoop) or in the cloud



## Good Data vs. Bad Data





## Good Data has...



### 1. Documentation:

- a. Method of data collection/ generation/manipulation
- b. Clear variables/column headers
- c. COIs/funding
- 2. License:
  - a. Does it have one? Is it permissive enough for your use case?

### 3. Usable Format:

- a. Is it \*.stata that you can only use with STATA, or is it a \*.csv that you can use with anything?
- b. Do you need \*streaming\* data, or is \*static\* data ok?

## Also...



## 1. Complete data:

- a. No gaps
- 2. Good Metadata:
  - a. Accurate labels
- 3. Minimal Cleaning
  - a. You can use the dataset with relatively little manual correction or improvements or adjustment

Image by Setyaki Irham on Unsplash

## "bad" data



- Hinders/delays analysis
- Can lead to: inaccurate/harmful conclusions

- 1. Incomplete
- 2. Unknown sources
- 3. Poorly documented methodology
- 4. Irregular entries
  - a. Happens easily with multiple contributors or sources of data
- 5. Contains errors
- 6. Inaccurate/sloppy metadata/labels
  - a. Date format (and timestamp)
  - b. Fractions, measurements
- 7. Old, expired, not relevant

## Examples: "Dirty" or "Unclean" Data

Misspellings or alternate spellings

Non-standard dates, names, etc

Missing field values

Duplicate records

Different data formats

Outdated data



## Metadata

- Provides information about contents, format, and accessibility:
  - Creator/author(s), purpose, time, location, type of data, origin, purpose, time, geographic location, creator, access, and terms of use
- Used for retrieval, indexing and citation

Examples of metadata standards:

- <u>Astronomy Visualization Metadata</u>
- Darwin Core
- <u>Data Documentation Initiative (DDI)</u> to document numeric data files
- <u>Dublin Core</u>, a general purpose metadata standard
- ISO 19115 or FGDC's <u>Content Standard for Digital Geospatial Metadata</u> for geospatial data
- Ecological Metadata Language

Title

Name of the project or collection of datasets Creator

Names and institutions of the people who created the data

Date

Key dates associated with the data, such as dates covered by the data or date of creation

Description

Description of the resource

Keywords or Subjects

Keywords or subjects describing the content of the data

Identifier

Unique number or alphanumeric string used to identify the data like a DOI. Many repositories provide DOIs for deposited datasets.

Coverage (if applicable)

Geographic coverage

Language Language of the resource Publisher Entity responsible for making the dataset available Funding Agencies Organization or agency who funded the research Access restrictions Where and how your data can be accessed by other researchers License E.g., CC0, CC By 4.0, MIT, etc. See the ReDATA license matrix for help selecting a license. Format

#### Title

Name of the dataset or research project that produced it

#### Creator

Names and addresses of the organization or people who created the data

#### Identifier

Number used to identify the data, even if it is just an internal project reference number

#### Dates

Key dates associated with the data, including project start and end date, data modification data release date, and time period covered by the data

#### Subject

Keywords or phrases describing the subject or content of the data

#### Funders

Organizations or agencies who funded the research

#### Rights

Any known intellectual property rights held for the data

#### Language

Language(s) of the intellectual content of the resource, when applicable

#### Location

Where the data relates to a physical location, record information about its spatial coverage

#### Methodology

How the data was generated, including equipment or software used, experimental protocol, other things you might include in a lab notebook

## Finding Datasets



## Managing Expectations...



- 1. The dataset you want may not exist
- 2. You may have to "clean" your data
  - a. Format
  - b. Errors or other issues
- 3. Not all datasets are free



#### **Global Data Creation is About to Explode**

Actual and forecast amount of data created worldwide 2010-2035 (in zettabytes)





## In 2022:

- 5 billion internet users (<u>DOMO</u>)
- 397 minutes

   (6 hrs 37 min)
   average internet
   time per day
   (OBERLO)



## Open vs. Proprietary Data

- Open data: available to all
  - a. Data sets are often required by grant issuing agencies
    - i. Publicly-funded research is already required to be available in an open-access repository (see <u>OSTP memo</u>)
    - ii. New changes will eliminate the embargo period (during which it is not available so only those with paid access can read at first)
- Proprietary data: privately owned and funded; protected by copyright, patents, contracts, privacy protected
  - i. May be related to computer software, business/financial information, or unpublished research (insurance data, health data, financial data, data protected by court order, recipes, designs, patterns)
  - ii. The University Libraries gives you access to some proprietary data
- If you can't get a specific data set, what else is available? You may need to be creative!

### If you can't find or access a dataset:

- Your advisor, instructor, research team, and <u>subject librarian</u> can give you advice and assistance
- You can ask the researchers of a project for their data
  - (But they might not be willing to share)
    - In a recent article, researchers gave reasons for not sharing data:
      - lack of time to search for data (29.2%)
      - loss of data (27.7%)
      - privacy or legal concerns (23.1%)

## Steps for Finding Data

- 1. Define your question or the problem you are investigating
- 2. Search background information
- 3. Identify possible sources/repositories
- 4. Search for data set
- 5. Evaluate data set



#### Photo by Suket Dedhia on Pexels

## **Find Background Information**

- 1. General background information provides you with:
  - a. Context
  - b. Knowledge of terms used by experts in the field you are investigating
  - c. Can help you **identify places to search**
- 2. You can see what research has already been done on your topic
  - a. See the methods used to collect and analyze data
  - b. See what issues investigated (so you don't repeat what has been done)
- 3. Sometimes you can find data sets in **articles** or in databases
  - i. Web of Science allows you to search for articles with data included
  - ii. ACM (calls data "artifacts")

\*\*\*To search background information, use **popular sources** (internet/social media search) and **scholarly sources** (check out <u>library guides</u> about where to look in various subject areas)

## **Identify Possible Sources**

- Data sets must be created: collected, organized, stored, made accessible
- This takes time, money and effort
  - Who has the resources, responsibility/mandate, interest, in collecting this data?
    - Person? (Researcher? Scientist?)
    - Research organizations/labs?
    - Government <u>departments and agencies</u>? (EPA, Census Bureau?)
    - International organizations? (World Bank, World Health Organization)
    - Companies? (Facebook, Amazon, Pfizer)
    - Other???

## **Searching for Data: Internet Search**

### 1. Internet search

- 1. Find and search the sources you identified as places to start
- 2. Do a general search; try lots of different search terms (synonyms, terms you collected during background research)
  - i. Try specific words such as "data set," "survey," "statistics," "poll"
  - ii. Use quotation marks to keep words together: "environmental impact," "college student"
  - iii. Use boolean operators to search your terms "environmental impact" AND "cryptocurrency mining"
  - iv. Use a site search: "environmental impact" site:reddit.com
  - v. Search for a data repository for your topic: "open data repository for ornithology"

### 4. Library Resources

### 1. Use Library Guides by discipline to find data:

- 1. <u>Government Information (has TONS of links to local and federal government websites)</u>
  - i. <u>https://libguides.colorado.edu/strategies/government</u>
- 2. <u>Business Information</u> (has TONS of guides about how to find various kinds of data at the bottom of the page)
  - i. <u>https://libguides.colorado.edu/portal/business</u>
- 3. Geospatial Data: <u>https://libguides.colorado.edu/geospatialdata</u>

### 2. Use Specific Library Databases to Find Data:

- 1. <u>Statista</u>
- 2. <u>Statistical Insight</u>
- 3. Proquest Statistical Abstracts of the World
- 4. <u>Statistical Abstract of the United States</u>
- 5. Data Planet Statistical Datasets
- 6. <u>Passport</u>
- 7. <u>Web of Science</u>
  - i. use filter on the left side of the screen to limit to "associated data"

### Searching for Data: Use a Data Search Engine

- Use a data repository database to search for data sets
  - a. <u>Google Data Search</u>: Dataset Search is a search engine for datasets. Using a simple keyword search, users can discover datasets hosted in thousands of repositories across the Web.
  - b. <u>Re3data.org</u>: global registry of research data repositories that covers research data repositories from different academic disciplines.
  - c. <u>Open Access Directory's List of Open Repositories</u>
  - d. Open Access Directory's List of Repositorties by Discipline
  - e. <u>Nature's List of Scientific Data Repositories</u>

## Some Databases to Check Out...

- Data.gov
- Kaggle
- <u>Microsoft Research Open Data</u>
- Reddit Datasets
- ICPSR (Inter-university Consortium for Political and Social Research)
- World Bank Open Data World Health Organization Data
- Amazon Web Services (AWS) Data Exchange
- <u>Data.europa.eu</u>
- Figshare
- <u>Zenodo</u>

## **Evaluate Your Data Set**

- 1. Return to the questions, is the data:
  - a. Usable: readable, well-documented, and available
  - b. Appropriate to your task/question
  - c. Functional format for your software/analysis
  - d. Complete, has good metadata
  - e. Minimal "cleaning" or "wrangling" needed
- 2. Consider who (people and organizations) that have made the data
  - a. Currency
  - b. Relevance
  - c. Authority
  - d. Accuracy
  - e. Purpose
- 3. How was the data set created? What kinds of flaws (sample size, bias) might it have?

## How to evaluate data sets?

Consider:

- Currency (is it still relevant? Newer, better data?)
- Relevance (is this the right data for your question?)
- Authority (who put together the data? Are they qualified?)
- Accuracy (How detailed is the data? How precise? Are there inconsistencies?)
- Purpose (Why was it collected?)

Also consider:

- Funding source?
- Sample size?
- Bias? (look at methodology behind collection)
- Is it available? Accessible to you?



## Need Help Using Data?

- CRDDS Learning Materials and Classes/Consultations
- <u>Coursera</u>
- LinkedIn Learning
- YouTube
- ICPSR training guide on Youtube
- SAGE Research Methods Online

## Traits of a "good" data set

- 1. Usable: readable, well-documented, and available
- 2. Appropriate to your task/question
- 3. Functional format for your software/analysis
- 4. Complete, has good metadata
- 5. Minimal "cleaning" or "wrangling" needed

- Provides information about your topic
- Helps prove/disprove theories

#### **Some Data Formats**

#### From Axiom Data Science:

- Containers: TAR, GZIP, ZIP
- Databases: CSV, XML
- Tabular data: CSV
- Geospatial vector data: SHP, GeoJSON, KML, DBF, NetCDF
- Geospatial raster data: GeoTIFF/TIFF, NetCDF, HDF-EOS
- Moving images: MOV, MPEG, AVI, MXF
- Sounds: WAVE, AIFF, MP3, MXF
- Statistics: ASCII, DTA, POR, SAS, SAV
- Still images: TIFF, JPEG 2000, PDF, PNG, GIF, BMP
- Text: XML, PDF/A, HTML, ASCII, UTF-8
- Web archive: WARC

## 1. Define your question

- 1. What is your topic?
- 2. How can you think about this topic empirically?
- 3. What kind of data do you want to find?
  - a. You can always search around to see what data is available...

### Keep in mind:

- Your research question or focus may change as you investigate, be flexible
- Not all data is available, you might have to come up with alternative kinds of data to complete your research

## What is a data set?

- It is information that is:
  - collected, assembled, and organized (by someone)
  - for analysis of an issue, phenomenon, or subject.
  - Data can be: textual, numeric, images, sound, video, code, geospatial
  - Some formats (CSV, XML, TIFF, PDF, etc.)





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<pre>2 EUEWEDD:D:20200213;000000;1,0074700;1,0019000;1,1013000;1,0040000;111237 EUEWEDD:D:20200214;000000;1,0041300;1,0061200;1,0025900;1,0030100;116105 EUEWEDD:D:20200216;00000;1,0024000;1,0041000;1,0019000;1,0040300;63446 EUEWEDD:D:20200217;00000;1,0041300;1,0051000;1,0027000;1,0035000;844744</pre>	1	EURUSD: D: 20200212;000000;1.0910900;1.0925600;1.0063000;1.0074700;1320244
EURUSD: p:20200214;000000;1.0841300:1.0061200;1.085900;2.0030100:116105 EURUSD: p:20200216;000000;1.0024000;1.0044000;1.001900;1.0040300;63406 EURUSD: p:20200217;000000;1.0641300:1.0851000;1.0027000;2.0035000;847446	2	EURUSD: D: 20200213:000000;1.0874700;1.0889000;1.0833000;1.0840300;1312373
<pre>6 EURUSD;D;20200216;000000;1.0624000;1.0644000;1.0618900;1.0640300;63466 5 EURUSD;D;20200217;000000;1.0641300;1.0651000;1.0627000;1.0635000;844744</pre>	2	EURUSD; D; 20200214; 000000; 1.0841300; 1.0861200; 1.0825900; 1.0830100; 1161853
5 EURUSD; D: 20200217;000000:1.0841300;1.0851000;1.0827000;1.0835000;844744	9	EURUSD; D; 20200216; 000000; 1.0824000; 1.0844000; 1.0818900; 1.0840300; 63496
		EURUSD; D: 20200217;000000; 1,0841300; 1,0851000; 1,0827000; 1,0835000; 844744

