Efficient Literature Searches using Python

Blair Bilodeau

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University of Toronto & Vector Institute

VECTOR INSTITUTE

CCÉS CSSC

Société statistique du Canada
Statistical Society of Canada

Workshop Motivation

- Me trying to read all the new papers posted on arXiv

Workshop Goals

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- Discuss the goal of focused literature searches v.s. reading new updates.

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- Practice!

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- Find papers which might help you solve your current problem.
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- Find out if you've been scooped.
- Avoid keeping track of all new papers – many will quickly become irrelevant to you.

Preprint Servers

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Researchers in stats, math, bio, medicine, and other fields use these to post versions of papers before publication (as well as open source access after publication).

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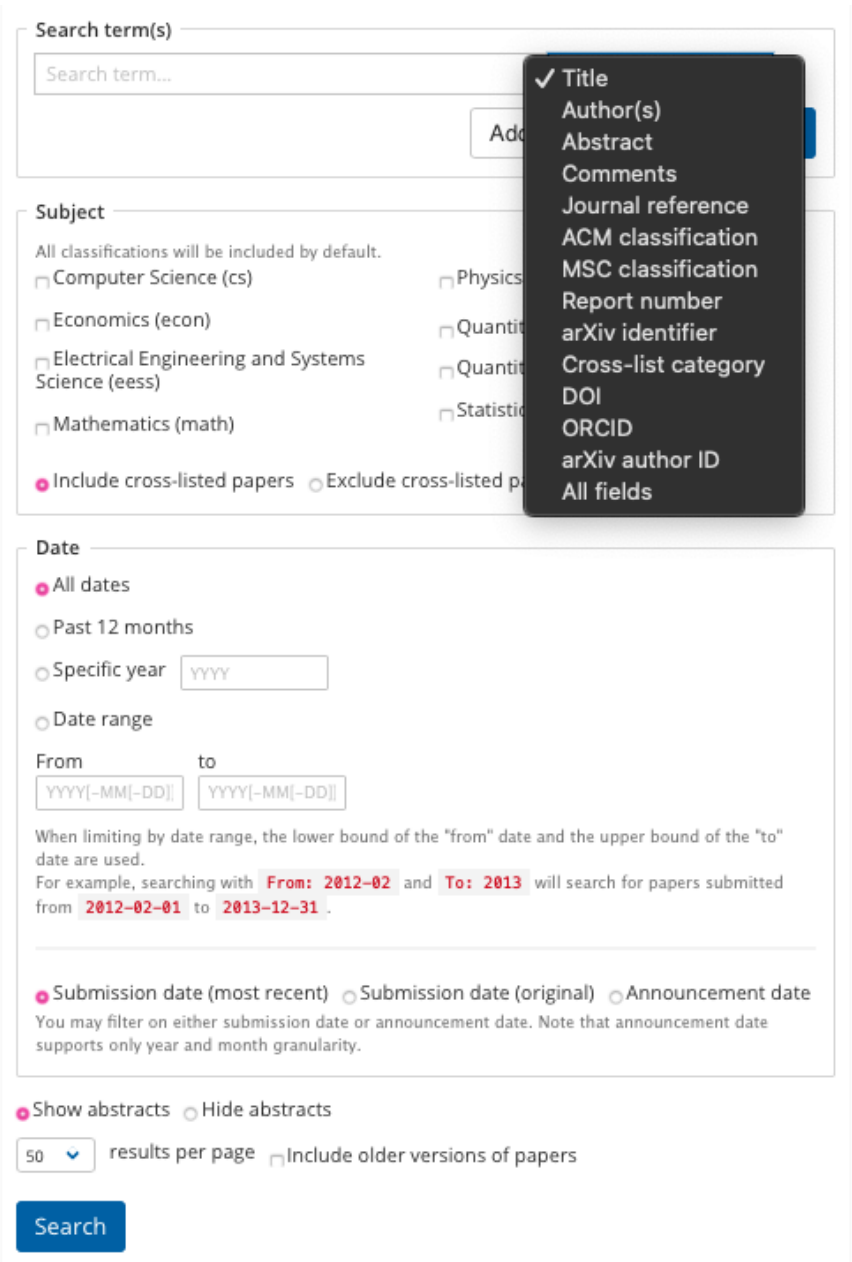
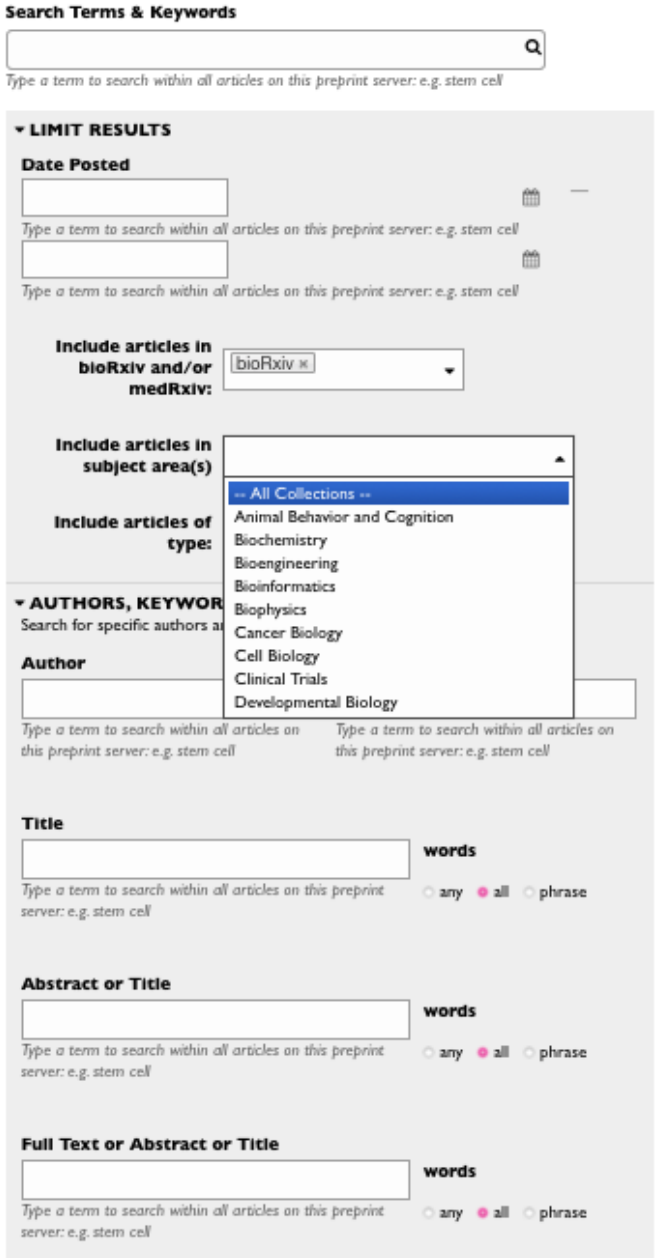
Disadvantages

- No peer-review, so papers may be rougher.
- Easy to get lost in a sea of papers.

Preprint Server Search Options





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Biorxiv Options

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Biorxiv Options

- No known options to me, besides this project with a broken link.
  (`https://github.com/gokceneraslan/biorxiv-sanity-preserver`)

Customized Python Script

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Goals

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- Easy to run and parse output everyday.
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Access the Scripts

`https://github.com/blairbilodeau/arxiv-biorxiv-search`

Downloading Python

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If you don't see the following, you have to install.

```
blairbilodeau@Blairs-MacBook-Pro ~ % python3
Python 3.7.5 (v3.7.5:5c02a39a0b, Oct 14 2019, 18:49:57)
[Clang 6.0 (clang-600.0.57)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>>
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If you do see that, great! You're now in a python environment. Either spend some time in there (try typing `print('hello world!')`) or type `exit()` to leave. Take a break for the next slide.

Downloading Python

Option 1: Directly Download Python

Go to `https://www.python.org/downloads/` and download Python 3.
(The actual version doesn't matter as long as it's Python 3.x.x)

Option 2: Use Anaconda

Download from `https://www.anaconda.com/products/individual`.
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Common Troubleshooting Tips

- Make sure the default python path is python3 if you have both installed
- On Windows, add python to your path environment
    - Computer: Properties: Advanced System Settings: Environment Variables: Path: add ";C:\Python36" (or whichever version) to the end

Python Packages

In order to do anything interesting in Python, you need to install "packages". These are scripts people have written so you don't have to reinvent the wheel.

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Installing Packages

We will use `pip`, which is automatically included with installations.

To install a package named `name`:
open up terminal or command prompt and type `pip install name`.
On windows, you may need to type something like
`C:\Python36\Scripts\pip install name` or
`C:\Python36\Scripts\pip.exe install name`

Python Packages

For example, to install the package `pandas`,

```
[blairbilodeau@Blairs-MacBook-Pro ~ % pip install pandas
Collecting pandas
  Downloading pandas-1.0.3-cp37-cp37m-macosx_10_9_x86_64.whl (10.0 MB)
     |████████████████████████████████| 10.0 MB 8.5 MB/s
Requirement already satisfied: python-dateutil>=2.6.1 in /Library/Frameworks/Pyt
hon.framework/Versions/3.7/lib/python3.7/site-packages (from pandas) (2.8.0)
Requirement already satisfied: numpy>=1.13.3 in /Library/Frameworks/Python.frame
work/Versions/3.7/lib/python3.7/site-packages (from pandas) (1.17.2)
Requirement already satisfied: pytz>=2017.2 in /Library/Frameworks/Python.framew
ork/Versions/3.7/lib/python3.7/site-packages (from pandas) (2019.3)
Requirement already satisfied: six>=1.5 in /Library/Frameworks/Python.framework/
Versions/3.7/lib/python3.7/site-packages (from python-dateutil>=2.6.1->pandas) (
1.12.0)
Installing collected packages: pandas
Successfully installed pandas-1.0.3
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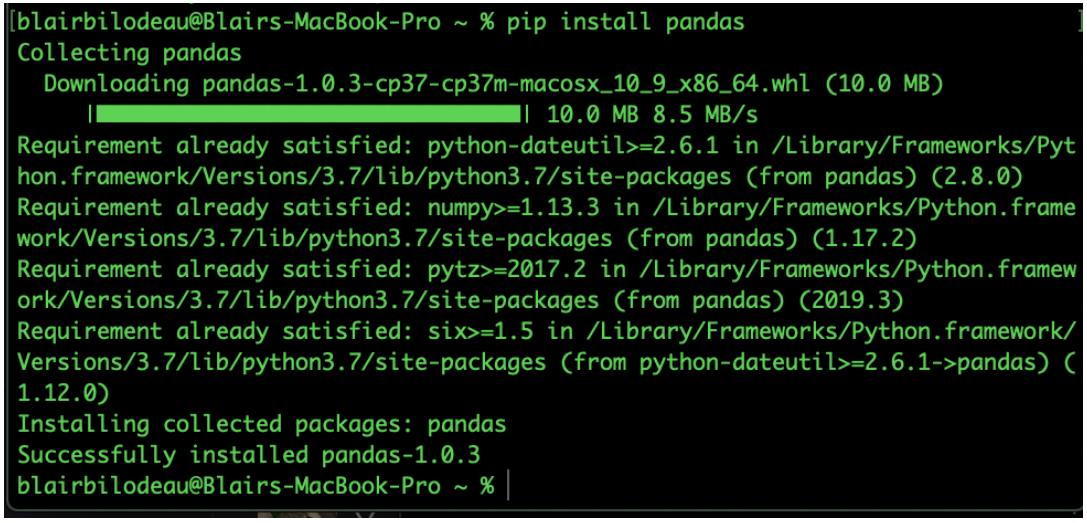

Extra packages needed for this script...

- `pandas` (data structure tools)
- `requests` (handling opening websites)
- `beautifulsoup4` (parsing HTML)

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- Check each of these abstract/title combinations against a custom set of keyword matching requirements;
- Repeat this for each subject;
- Display the titles and abstracts selected (with other info if desired), with optional exporting of information to `csv` file and downloading of full `pdfs`.

`arxiv_search_function.py` Parameters

```
#######
## Main function
## Parameters:
# sdate        - datetime object        - starting date of search period
# fdate        - datetime object        - end date of search period
# kwd_req      - list of str            - keywords that are required to be in the title or abstract
# kwd_exc      - list of str            - keywords that must not be in the title or abstract
# kwd_one      - list of lists of str   - keywords of which at least one must be included
# athr_req     - list of str            - authors which are required
# athr_exc     - list of str            - authors to exclude
# athr_one     - list of lists of str   - authors of which one must be included
# subjects     - list of str            - subject options are:
#                                           astro-ph, cond-mat, gr-qc, hep-ex, hep-lat, hep-ph, hep-th, math-ph, nlin, nucl-ex, nucl-th,
#                                           physics, quant-ph, math, cs, q-bio, q-fin, stat
# max_records  - int                    - maximum number of results to return
# max_time     - float                  - maximum amount of seconds to be spent searching
# cols         - list                   - arxiv fields to extract
#                                           column options are:
#                                           id, url, title, authors, date, abstract, categories
# export       - str                    - folder location to dump results list in csv
# exportfile   - str                    - by default the file name will be today's date, but you can override this with exportfile
# download     - str                    - folder location to dump returned pdfs into
#                                           (files named using year_lastname format)
```

- `kwd_req, kwd_exc, kwd_one` are the main parameters that allow for custom searching of papers
- All of these are optional – if you don't pass any arguments you will get the first 50 papers from `cs` for the month

`arxiv_search_function.py` **Demonstration**

I will now show an example of running through the code in a Jupyter notebook.

`biorxiv_search_function.py` Parameters

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# kwd_type     - 'all' or 'any'         - whether all keywords are required or just one of them
# athr         - list of max 2 str      - authors which are required
# subjects     - list of str            - subject options are:
#                                         (Note capitalization and spacing are important for subject)
#                                           Animal Behaviour and Cognition, Biochemistry, Bioengineering, Bioinformatics,
#                                           Biophysics, Cancer Biology, Cell Biology, Clinical Trials, Developmental Biology,
#                                           Ecology, Epidemiology, Evolutionary Biology, Genetics, Genomics, Immunology,
#                                           Microbiology, Molecular Biology, Neuroscience, Paleontology, Pathology,
#                                           Pharmacology and Toxicology, Physiology, Plant Biology, Scientific Communication and Education,
#                                           Synthetic Biology, Systems Biology, Zoology
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# abstract     - bool                   - whether to extract the abstract of every paper returned by search
#                                           (potentially very time consuming)
# export       - str                    - folder location to dump results list in csv
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Timesaving Workflow

Running the Script

- Create a separate python file to call the functions with parameters you desire, and run that from command line every day.
- See the file `search_examples.py` in my Github.

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Automating the Script

- Mac: used `launchd`
  - Create a shell script to run the python file you want (`search_examples.sh`)
  - Place the file `file.name.plist` in /Library/LaunchDaemons with names changed (currently runs once every 24 hours, can be changed).
  - In command line, type `cd Library/LaunchDaemons` and then `sudo launchctl load file.name.plist`.
- Windows: use Task Scheduler
  - Create a batch file to run the python file you want.
  - Follow the instructions in Task Scheduler after clicking `Create Basic Task`.