HW4: Inverted-index creation, using Lunr and Solr

Summary

In this 4th HW, you're going to use Lunr (a JS library) in three ways, and Solr (a Java library) in one way, to inverted-index documents/data (each piece of data, eg a student's info, is called a 'document' and is expressed as JSON).

Description

We are doing to describe each of the 4 pieces separately below, since they are all independent of each other...

1. Lunr, using xem

Start with https://bytes.usc.edu/~saty/tools/xem/run.html?x=lunr-cs572-hw4. As you can see, we fetch https://bytes.usc.edu/cs572/s23-sear-chhh/hw/HW4/data/yelp_academic_dataset_business.json/yelp_academic_dataset_business-50.json [a portion of the famous Yelp businesses dataset, with only 50 rows], index the 'state' field, then display the 'name' field as the output (in Lunr terminology, this (name) is the 'ref' field).

Also fetch https://bytes.usc.edu/cs572/s23-sear-chhh/hw/HW4/data/yelp_academic_dataset_business.json/yelp_academic_dataset_business-1000.json, and https://bytes.usc.edu/cs572/s23-sear-chhh/hw/HW4/data/yelp_academic_dataset_business.json/yelp_academic_dataset_business.json, do the same state searches. For "PA", how many results do we get, for the three different files?

Next, pick a different column (field) to index https://bytes.usc.edu/cs572/s23-sear-chhh/hw/HW4/data/yelp_academic_dataset_business.json/yelp_academic_dataset_business-50.json, then search for a value in that field.

2. Lunr, using repl.it

Bring up https://replit.com/@satychary/TrivialGrouchyScreenscraper, fork and run it. You'll see a file called fun.jsonl, containing two simple docs that get indexed and searched. REPLACE the data with your own - that also has two fields, eg. (movieName, rating), (course, grade), (foodItemUnitPortion, calories)... and TEN docs. You can also add more schools and rankings if you like (eg from https://www.usnews.com/best-colleges/rankings/national-universities), rather than use alternate fields. Programmatically search for a range of the second field (eg rank, grade, calories, ratings...), and display the result as a simple JS array.

3. Lunr, via TypeScript in StackBlitz

Fork https://stackblitz.com/edit/lunr-getting-started-z5rtjm?file=index.ts, and take a look at index.ts, to find a 'documents' array (these are what get indexed and searched). Put in 10 paragraphs from HW3's data2.zip (the 'smaller' files), to create 10 indexable documents. Search the documents for two different terms, which you know, occur in more than one document.

4. Solr, using Docker

Solr is a powerful search engine with a rich search syntax, easy setup, fast indexing - we specify a search 'schema' (fieldname, fieldtype), for the fields we want to index and search, then we add documents (data) which kicks off the indexing, then we search (via a URL query, or via one of MANY APIs in multiple languages).

Start by installing Docker: https://docs.docker.com/engine/install/ Docker makes it so easy to run Solr inside a lightweight virtual machine 'container' (runtime) - to do this, we'd first download an 'image' (template), then run it to launch a container.

Bring up a conda shell on a PC (https://docs.conda.io/projects/conda/en/latest/user-guide/install/windows.html) or a terminal on Mac/Linux, and type the following, to download the Solr image.

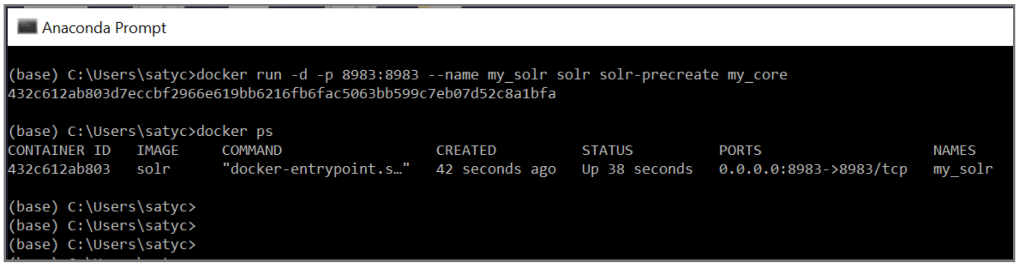
```
docker pull solr
```

Now we can run Solr via [see https://hub.docker.com/_/solr for more]

```
docker run -d -p 8983:8983 --name my_solr solr solr-precreate my_core
```

In the above, 'my_core' is our name for a Solr 'core', which is an area where Solr keeps the docs to index, the index itself, and other files (eg config).

FYI, you can run 'docker ps' to verify that the container is indeed, up and running:



```
(base) C:\Users\satyc>docker run -d -p 8983:8983 --name my_solr solr solr-precreate my_core
432c612ab803d7eccbf2966e619bb6216fb6fac5063bb599c7eb07d52c8a1bfa

(base) C:\Users\satyc>docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED          STATUS          PORTS                    NAMES
432c612ab803   solr      "docker-entrypoint.s…"   42 seconds ago   Up 38 seconds   0.0.0.0:8983->8983/tcp   my_solr

(base) C:\Users\satyc>
(base) C:\Users\satyc>
(base) C:\Users\satyc>
```

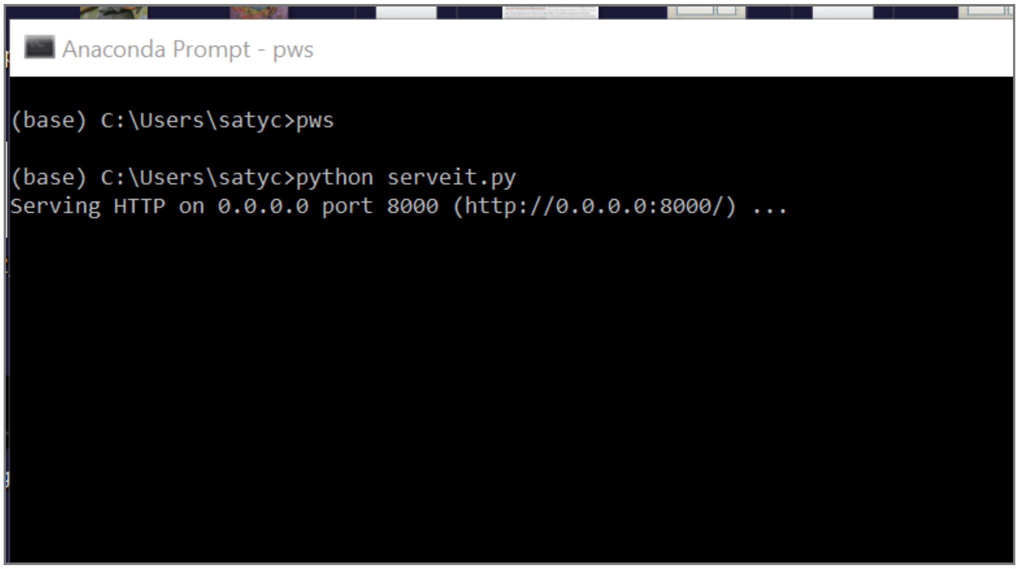
We are almost ready to start using Solr, via the browser (by visiting http://localhost:8983/) -but- we need one more thing first - a webserver. Here is one way: in the conda shell, run

```
python serveit.py
```

Here is serveit.py (you'd create it by copying and pasting my code below):

```
import http.server

class MyHTTPRequestHandler(http.server.SimpleHTTPRequestHandler):
    def end_headers(self):
        self.send_my_headers()
        http.server.SimpleHTTPRequestHandler.end_headers(self)

    def send_my_headers(self):
        self.send_header("Cache-Control", "no-cache, no-store, must-revalidate")
        self.send_header("Pragma", "no-cache")
        self.send_header("Expires", "0")


if __name__ == '__main__':
    http.server.test(HandlerClass=MyHTTPRequestHandler)

# from https://stackoverflow.com/questions/12193803/invoke-python-simplehttpserver-from-command-line-with-no-cache-option
# usage: python serveit.py :) GREAT, because it does NOT cache files!! Serves out of port 8000 by default.
```

I've aliased the Python command above, to 'pws', since I run it a lot:

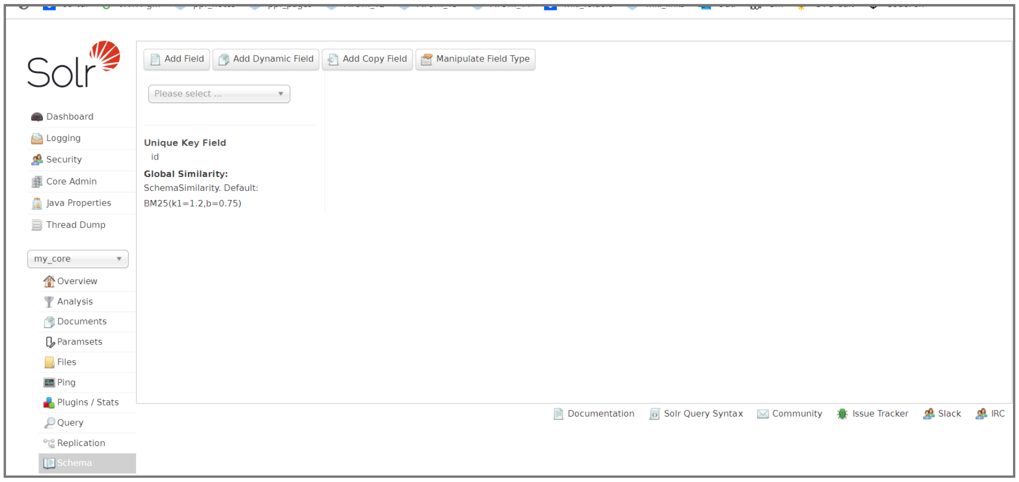


```
(base) C:\Users\satyc>pws

(base) C:\Users\satyc>python serveit.py
Serving HTTP on 0.0.0.0 port 8000 (http://0.0.0.0:8000/) ...
```

Ready to roll! To see the 'Solr panel' [lol!], go to http://localhost:8983 – ta da!!

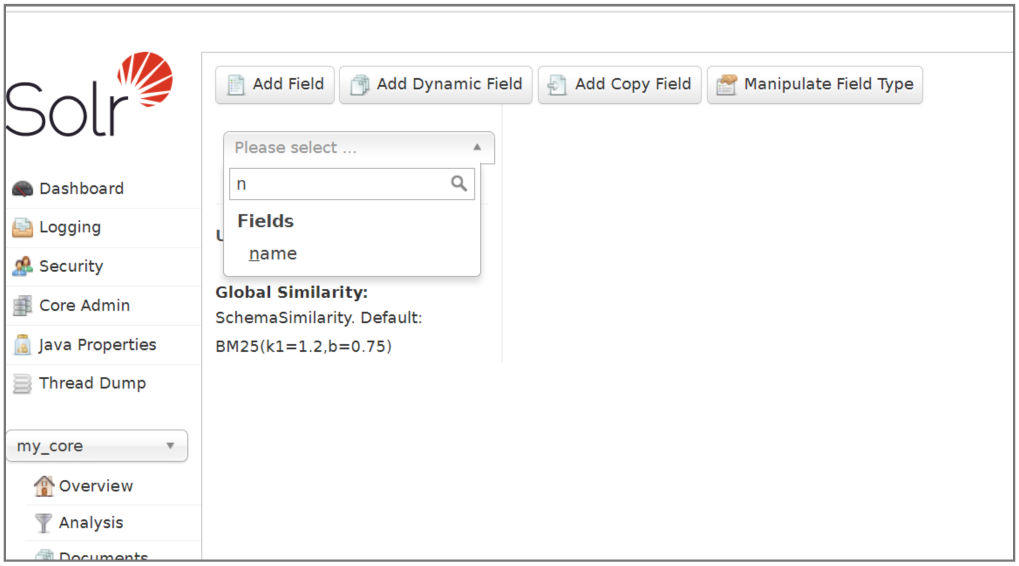
Poke around in the panel, by clicking on the various buttons, to get a feel for the interface – you can see that there is a LOT you can specify, customize, run – please do explore these after the course. But for this exercise, we only need to do three things:

1. Add field names and types, for the docs (data) we will index – in other words, we need to specify a schema (click on 'Add Field', to add fields one by one):

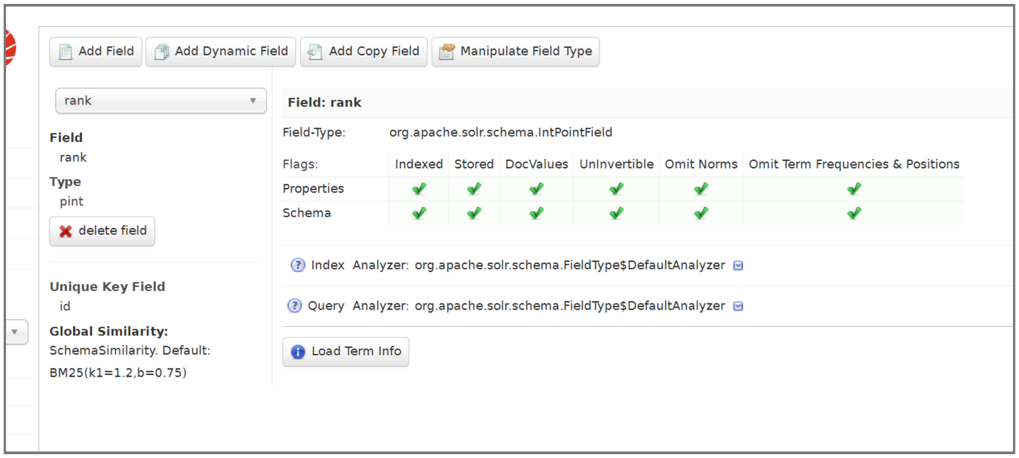


Unique Key Field
id
Global Similarity:
SchemaSimilarity. Default:
BM25(k1=1.2,b=0.75)

After creating our schema, we can verify that it looks right by searching for the fieldnames we put in:



Global Similarity:
SchemaSimilarity. Default:
BM25(k1=1.2,b=0.75)



Field
rank
Type
pint

Unique Key Field
id
Global Similarity:
SchemaSimilarity. Default:
BM25(k1=1.2,b=0.75)

Field: rank

Field-Type: org.apache.solr.schema.IntPointField

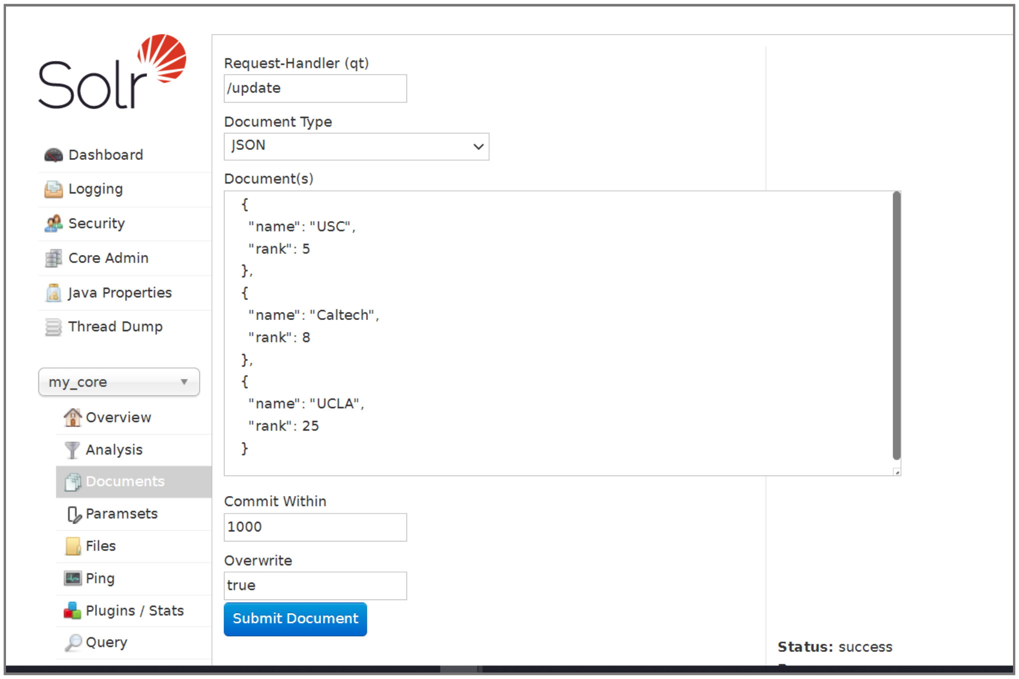
Flags:	Indexed	Stored	DocValues	UnInvertible	Omit Norms	Omit Term Frequencies & Positions
Properties	✓	✓	✓	✓	✓	✓
Schema	✓	✓	✓	✓	✓	✓

Index Analyzer: org.apache.solr.schema.FieldType$DefaultAnalyzer

Query Analyzer: org.apache.solr.schema.FieldType$DefaultAnalyzer

2. Add docs you'd like Solr to index, that correspond to the schema (note the non-standard syntax – we are NOT specifying valid JSON, instead we're adding a list of comma-separated JSONs (one for each doc), a lot like for Lunr (which called for a .jsonl, ie. a list of JSONs without

commas)):



Request-Handler (qt): /update

Document Type: JSON

Document(s):

```
{
  "name": "USC",
  "rank": 5
},
{
  "name": "Caltech",
  "rank": 8
},
{
  "name": "UCLA",
  "rank": 25
}
```

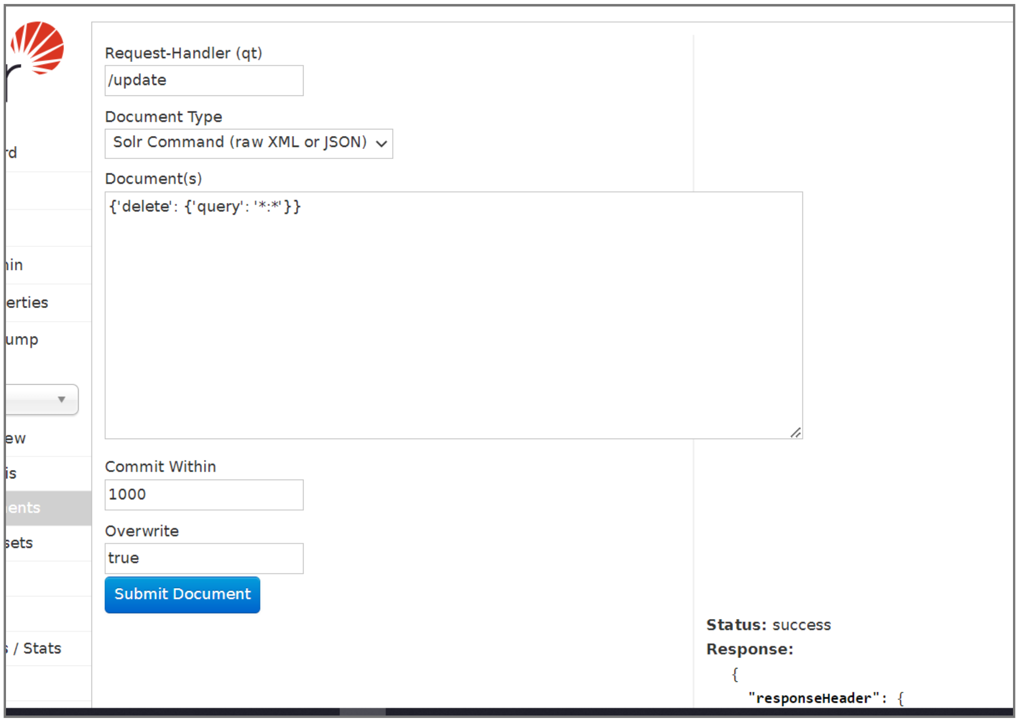
Commit Within: 1000

Overwrite: true

Status: success

Doing the above (pressing 'Submit Document') leads to our data getting indexed!

FYI if you ever want to clean out all the docs and start over [more here: https://stackoverflow.com/questions/23228727/deleting-solr-documents-from-solr-admin] - click on 'Submit Document' after typing the 'delete' command:



Request-Handler (qt): /update

Document Type: Solr Command (raw XML or JSON)

Document(s):

```
{'delete': {'query': '*:*'}}
```

Commit Within: 1000

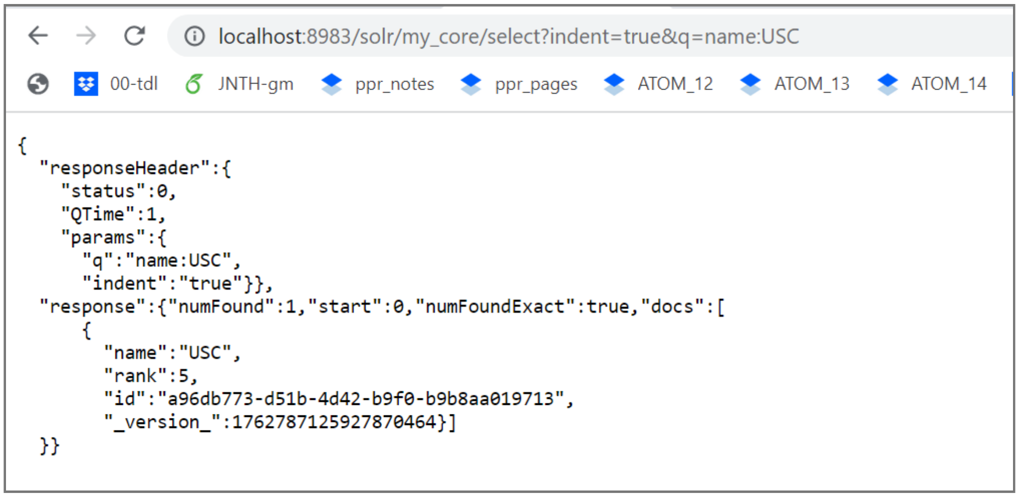
Overwrite: true

Status: success

Response:

```
{
  "responseHeader": {
```

3. **Now we can search** - via URL query syntax, among many other ways [more here: https://solr.apache.org/guide/solr/latest/query-guide/standard-query-parser.html]



```
{
  "responseHeader":{
    "status":0,
    "QTime":1,
    "params":{
      "q":"name:USC",
      "indent":"true"}},
  "response":{"numFound":1,"start":0,"numFoundExact":true,"docs":[
      {
        "name":"USC",
        "rank":5,
        "id":"a96db773-d51b-4d42-b9f0-b9b8aa019713",
        "_version_":1762787125927870464}]
  }}
```

Cool! And that's all there is to it, for Solr basics. If you exit your shell, that will stop Docker and also the webserver.

Rubrics

Your (max 10) points will come from your submitting these:

- 2 points for using the code in https://bytes.usc.edu/~saty/tools/xem/run.html?x=lunr-cs572-hw4 to run the 'state' search on docs of 3 sizes and report result counts, index another field rather than the 'state' one, and do a sample search for it, submit screenshots of the search results
- 3 points for going off of https://replit.com/@satychary/TrivialGrouchyScreenscraper and modifying the .jsonl file to put in a different kind of data, doing a 'range' search and printing out the aggregated result as an array
- 2 points for using StackBlitz [https://stackblitz.com/edit/lunr-getting-started-z5rtjm?file=index.ts] to add paragraph text data from HW3, and doing two different searches of terms known to occur in multiple docs
- 3 points for running Solr under Docker, and doing a simple query (field:value), and a 'range' one as well

Getting help

There is a hw4 'forum' on Piazza, for you to post questions/answers. You can also meet w/ the TAs, CPs, or me.

Have fun! This is a quick+easy+useful+fun one!