

COMP 474 UU,COMP 6741 UU 2214

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Lab Session #06

Introduction

Welcome to lab #6. This week, we'll practice working with *Vector Space Models* (VSMs), by applying them to the domain of recommender engines. Rather than implementing the methods discussed in the lecture from scratch, we will work with [scikit-learn](#), a popular Python toolkit for machine learning.

Follow-up Lab #5

Here are two example solutions for the queries from the Wikidata Task #1.1:

1. All member countries of the EU, with English labels:

```
SELECT ?countryLabel
WHERE
{
    ?country wdt:P463 wd:Q458 .
    SERVICE wikibase:label { bd:serviceParam wikibase:language "en". }
}
```

2. Same as above, but now printed with their capital on a map view:

```
#defaultView:Map
SELECT ?countryLabel ?coord ?capital ?capitalLabel
WHERE
{
    ?country wdt:P463 wd:Q458 .
    ?country wdt:P36 ?capital .
    ?capital wdt:P625 ?coord .
    SERVICE wikibase:label { bd:serviceParam wikibase:language "en". }
}
```

Confused about the labels above, which look like they are unbound in the query (like the `countryLabel`)? This is done through the *automatic mode* of Wikidata's [Label service](#). For more details on querying Wikidata, check out the online resources, starting from [Wikidata Query Help](#).

Task #1: Cosine Similarity

Let's reproduce the results from the lecture worksheet. The movie data can be encoded (using [NumPy](#)) as:

```
import numpy as np
movies = np.array([
    [4, 8, 6, 3, 0, 0],
    [0, 5, 0, 8, 5, 0],
    [1, 4, 0, 3, 0, 10]])
```

Now we can use the [cosine similarity implementation from scikit-learn](#) to compute the similarity matrix:

```
from sklearn.metrics.pairwise import cosine_similarity
similarity_scores = cosine_similarity(movies)
```

Print out the similarity matrix and compare it to your worksheet results. You can continue computing the user/movie similarity matrix in the same style.

Task #2: A Movie Recommender Engine

So that works: Now let's try this with some real data. We'll use the [MovieLens](#) datasets; for development, it's recommended to start with the small version: Download the [ml-latest-small.zip](#) dataset and uncompress it. This dataset has 100,000 ratings and 3,600 tag applications applied to 9,000 movies by 600 users.

Now you have to load the `movies.csv` and `tags.csv` files into your program. We'll use [pandas](#) to import the data (here is a nice [cheatsheet](#) for Python data imports from [DataCamp](#)):

```
import pandas as pd
movies = pd.read_csv("ml-latest-small/movies.csv", header=0)
tags = pd.read_csv("ml-latest-small/tags.csv", header=0, na_filter=False)
```

If you want to print out some intermediate results, best prepare some small test versions of the data files with only a few movies in them.

You'll notice that each tag comes on its own line (with a timestamp). However, for creating feature vectors it's easier to first group all tags by movie:

```
groupedtags = tags.groupby(["movieId"])['tag'].apply(', '.join).reset_index()
```

Now we can merge the tag data with the movie data:

```
movietags = pd.merge(movies, groupedtags, on='movieId', how='inner')
```

Now we have to create a *count* for each tag, similar to the matrix in Task #1 on the worksheet: Fortunately, *scikit-learn* has a helper function we can use, the [CountVectorizer](#):

```
from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer()
count_matrix = cv.fit_transform(movietags['tag'])
```

Print out the `count_matrix` to check if everything looks right. Computing the similarity matrix works just like before:

```
from sklearn.metrics.pairwise import cosine_similarity
similarity_scores = cosine_similarity(count_matrix)
```

Now you can start recommending movies. To access the dataframes, we'll use some helper functions to translate between movie titles and the index into the matrix:

```
def getMovieIdx(title):  
    return movietags.loc[movietags['title'] == title].index[0]  
def getMovieTitle(id):  
    return movietags[movietags.index == id]["title"].values[0]
```

With this, we can find the index into the similarity matrix by title, like here:

```
movieId = getMovieIdx('Toy Story (1995)')
```

and find all similar movies in our matrix:

```
similar_movies = list(enumerate(similarity_scores[movieId]))
```

You still need to sort this list (in descending order), based on the similarity score:

```
sorted_similar_movies = sorted(similar_movies, key=lambda x: x[1], reverse=True)[1:]
```

Now you can print out the most similar movies that you would recommend for a movie, based on the tags that were given by other users. Even with the limited example dataset, this gives some workable results:

```
Top 5 similar movies to 'Toy Story (1995)' are:  
1. Bug's Life, A (1998) (0.89)  
2. Toy Story 2 (1999) (0.54)  
3. Guardians of the Galaxy 2 (2017) (0.45)  
4. Up (2009) (0.22)  
5. The Lego Movie (2014) (0.16)
```

You could now extend this program to compute a user/movie similarity matrix and start giving personalized recommendations, as discussed in the lecture.

Bonus Task #2.1: An Intelligent Movie Agent

You can now build an intelligent movie agent, by combining your recommender code with the code from your smart university agent from the previous weeks: Note that the movie dataset also comes with a file `links.csv`, which provides externally resolvable ids. In particular, you can use the IMDBid to query Wikidata and find more information there (like [Q171048](#) for "Toy Story"). Now you can retrieve lots of additional information, like the directors, awards, etc. and present it to the user.

That's all for this lab!

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