

# WSM-Project3

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# TOC

1. TFIDF
2. ItemCF
3. N-Gram
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**TFIDF**

# TFIDF

- Port projectl's code

```
1  # Build dimension dictionary, indicates key's index
2  index = 0
3  for word in self.parser.parse(" ".join([doc["doc"] for doc in docs]), language):
4      if word not in self.dimensions:
5          self.dimensions[word] = index
6          index += 1
7  self.tf = np.zeros((len(docs), len(self.dimensions)))
8
9  # Count tf, df, idf, and tfidf by using numpy functions, and store them for further usage.
10 for i, doc in enumerate(tqdm.tqdm(docs, postfix="Building Index")):
11     processedDoc = self.parser.parse(doc["doc"], language)
12     doc["parsed"] = processedDoc
13     for word in processedDoc:
14         self.tf[i][self.dimensions[word]] += 1
```

14k sessions \* 1m songs = 140,000,000,000 ints / shorts / bit

# ItemCF

# ItemCF

## Concept

Predict user preferences based on **user's historical behavior**, instead of **attributes of the item**.

## Formula

- Basic

$$W_{\mu v} = \frac{|N(\mu) \cap N(v)|}{|N(\mu)|}$$

- Adding penalty term

$$W_{\mu v} = \frac{|N(\mu) \cap N(v)|}{\sqrt{|N(\mu)| |N(v)|}}$$

# ItemCF

## Implementation

- Use `dict` to create co-occurrence matrix.

	Song1	Song2	...	Song10000
Song1	1000	512	...	201
Song2	512	1	...	345
...	...	...	...	...
Song10000	201	345	...	2000

- Do cosine similarity search based on the matrix
- Randomly fill with top 20 songs if recommendation less than 5 songs.
- **Basic Score: 0.14537**

# ItemCF

## Consider Listening Time

- Give weights based on listening time.
- Use `unix_played_at` to get listening time.

song1

<-diff->

song2

<-diff->

song3

- Our weight:
  - < 10 sec: 0.1
  - 11 ~ 150 sec: 0.7
  - > 150 sec: 1
- **Score: 0.10981** (worse)



# ItemCF

## Consider Repeat Time

- If **last 3 songs are the same song** or more than **8 repeated songs among top 20 songs**
  - Recommend the same song 5 times
- **Score: 0.12708** (worse)

# ItemCF

## Conclusion

### Listening Time

- < 10 sec: 0.1, 11 ~ 150 sec: 0.7, > 150 sec: 1 => **Score: 0.10981**
- < 10 sec: 0.1, > 11 sec: 1 => **Score: 0.115**
- Predict what KKbox predicts, instead of what the user would like.

### Repeat Time

- more than 8 repeated songs among top 20 songs => **Score: 0.12708**
- more than 20 repeated songs among top 20 songs => **Score: 0.12755**
- Rating Criteria: Recommend a variety of unique songs get higher scores.

# N-Gram

# N-Gram

## Prepare Data

- Join tables together for further usage

```
andyjjrt ~/c/wsm-project3 python main.py
session_id song_id unix_played_at ... lid
0 1 s_354122 1660012505 ... NaN
1 1 s_1030665 1660012730 ... NaN
2 1 s_642781 1660015113 ... l_440385
3 1 s_280722 1660015289 ... l_169111
4 1 s_90294 1660015841 ... l_196433
...
14306470 715323 s_355651 1664707185 ... NaN
14306471 715323 s_170450 1664707201 ... NaN
14306472 715323 s_233844 1664707400 ... l_29174.l_257878
14306473 715323 s_931390 1664707449 ... l_284779
14306474 715323 s_935948 1664707668 ... l_294002
```

```
✓ wsm-project3 Py andyjjrt@nccucs108 master ?8
pid title_text_id
NaN c1079ef109db2aba72f78c632ab73803
NaN NaN
p_288113 f9b7f48dbd07a9979e64ccf88af181aa
NaN c1079ef109db2aba72f78c632ab73803
p_192217 9f25d97515a9e19da4c7ad6dba6d8776
...
NaN 0025132fbe92679e3472ba869b60af35
p_71934.p_72220.p_72837.p_314936 c1079ef109db2aba72f78c632ab73803
NaN 5bb36dbeb12e9e4149eed8166a60fcf8
NaN 859a2ae6d55da7cdfc57bc85d2008a99
NaN 0d42e410deb1c569568ba132e738d6aa
```

- Trigram

```
1 n = 3
2 train_data, padded_sents = padded_everygram_pipeline(n, allWords)
```

# N-Gram

## model.score

```
1 result = list(model.score(words[-2:]))
2 result = [r for r in result if r[0] != "<s>" and r[0] != "</s>"]
3 result.sort(key=lambda x: x[1])
4 length = len(result)
5 return [session_id] + result[:5]
```

```
1 [|||||] 100.0% 7 [|||||] 7.0% 13 [|||||] 92.9% 19 [|||||] 100.0%
2 [|||||] 75.5% 8 [|||||] 100.0% 14 [|||||] 100.0% 20 [|||||] 100.0%
3 [|||||] 98.7% 9 [|||||] 100.0% 15 [|||||] 100.0% 21 [|||||] 100.0%
4 [|||||] 100.0% 10 [|||||] 100.0% 16 [|||||] 96.2% 22 [|||||] 100.0%
5 [|||||] 55.2% 11 [|||||] 100.0% 17 [|||||] 100.0% 23 [|||||] 98.7%
6 [|||||] 90.4% 12 [|||||] 100.0% 18 [|||||] 100.0% 24 [|||||] 100.0%
Mem[|||||] 29.9G/94.3G Tasks: 411, 2087 thr; 23 running
Swp[|||||] 0K/0K Load average: 22.66 23.00 23.11
Uptime: 3 days, 16:19:16
```

+ 成為 Ticket Plus 遠大售票系統 會員

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
2985048	andyjjrt	20	0	7184M	2322M	17476	R	101.	2.4	11h27:41	python main.py
2985038	andyjjrt	20	0	7184M	2322M	17552	R	100.	2.4	11h27:43	python main.py
2985041	andyjjrt	20	0	7184M	2322M	17552	R	100.	2.4	11h27:49	python main.py
2985043	andyjjrt	20	0	7184M	2322M	17552	R	100.	2.4	11h27:45	python main.py
2985046	andyjjrt	20	0	7184M	2322M	17492	R	100.	2.4	11h27:45	python main.py
2985049	andyjjrt	20	0	7184M	2322M	17408	R	100.	2.4	11h27:48	python main.py
2985031	andyjjrt	20	0	7184M	2322M	17552	R	99.8	2.4	11h27:47	python main.py
2985032	andyjjrt	20	0	7184M	2322M	17552	R	99.8	2.4	11h27:48	python main.py
2985033	andyjjrt	20	0	7184M	2322M	17552	R	99.8	2.4	11h27:46	python main.py
2985034	andyjjrt	20	0	7184M	2322M	17552	R	99.8	2.4	11h27:46	python main.py

- 12hr per run with 22 threads, **Basic Score: 0.20894**

# N-Gram

## model.count

```
1  if words[-1] == words[-2]: return [session_id] + [songIdMapping[words[-1]]] * 5
2  result = list(model.counts[words[-2:]].items())
3  result = [r for r in result if r[0] != "<s>" and r[0] != "</s>"]
4  result.sort(key=lambda x: x[1])
5  length = len(result)
6  if length >= 5:
7      return [session_id] + [songIdMapping[r[0]] for r in result[:5]]
8  else:
9      tmp = [songIdMapping[r[0]] for r in result]
10     for i in range(5 - len(tmp)):
11         tmp.append(random.choice(list(songIdMapping.items()))[1])
12     return [session_id] + tmp
```

- 6hr per run with 22 threads, 30% replacement to **0.22006**

# N-Gram

## What we should do

- Randomly choose songs from same `genre`, `titletext`, etc.
- Use `model.generate()` instead.
- Try 4-gram.
- Reciprocal Rank Fusion

$$RRFScore(d \in D) = \sum_{r \in R} \frac{1}{k + r(d)}, k = 60$$

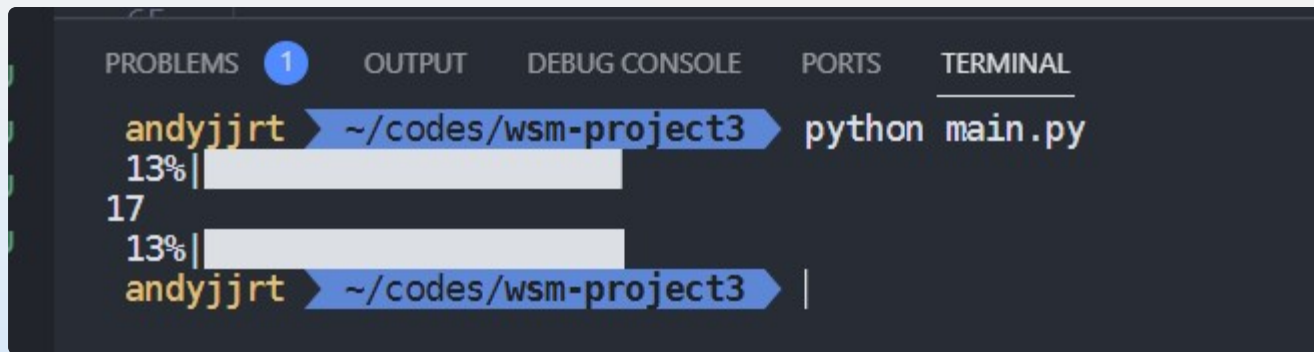
- Data validation (important).

# Discussions & Feedbacks



# Discussions & Feedbacks

- Data validation



A screenshot of a terminal window with a dark background. At the top, there are tabs: 'PROBLEMS' (with a blue circle containing the number 1), 'OUTPUT', 'DEBUG CONSOLE', 'PORTS', and 'TERMINAL'. The terminal shows a prompt 'andyjjrt' followed by a blue arrow pointing to the path '~/codes/wsm-project3'. The command 'python main.py' has been entered. Below this, there are two progress bars, each preceded by '13%|'. The first progress bar is followed by the number '17'. The second progress bar is followed by another '13%|'. At the bottom, the prompt 'andyjjrt' is shown again with a blue arrow pointing to '~/codes/wsm-project3' and a vertical cursor line.

```
for i in tqdm.tqdm(range(recordLength)):
    words = list()
    for j in range(25):
        words.append(recordTable.loc[i*25 + j, "song_id"])
    allWords.append(words)
```

**Thanks for listening**