Experiment-1.3

IR Evaluation

一、实验要求

1.输入输出要求：

在Homework1.2的基础上实现IR Evaluation

- **指标评价方法**：

  (1) Mean Average Precision (MAP)

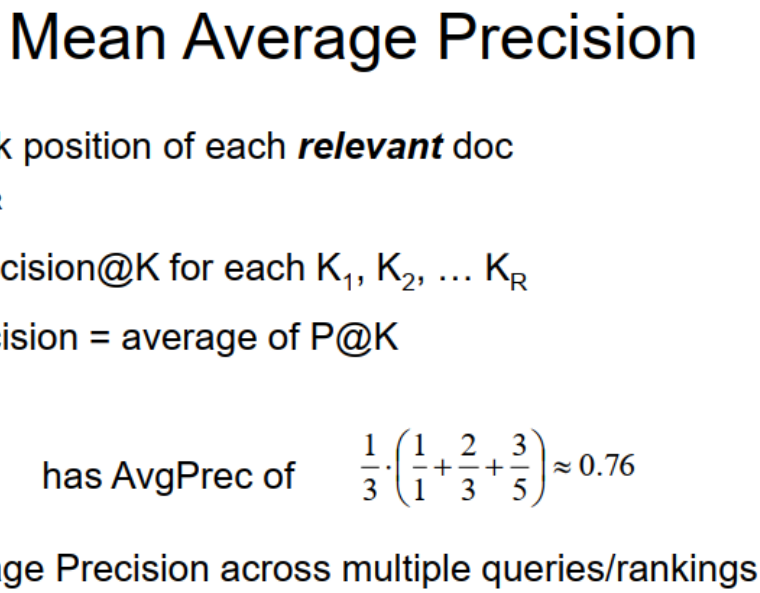
  (2) Mean Reciprocal Rank (MRR)

  (3) Normalized Discounted Cumulative Gain (NDCG)

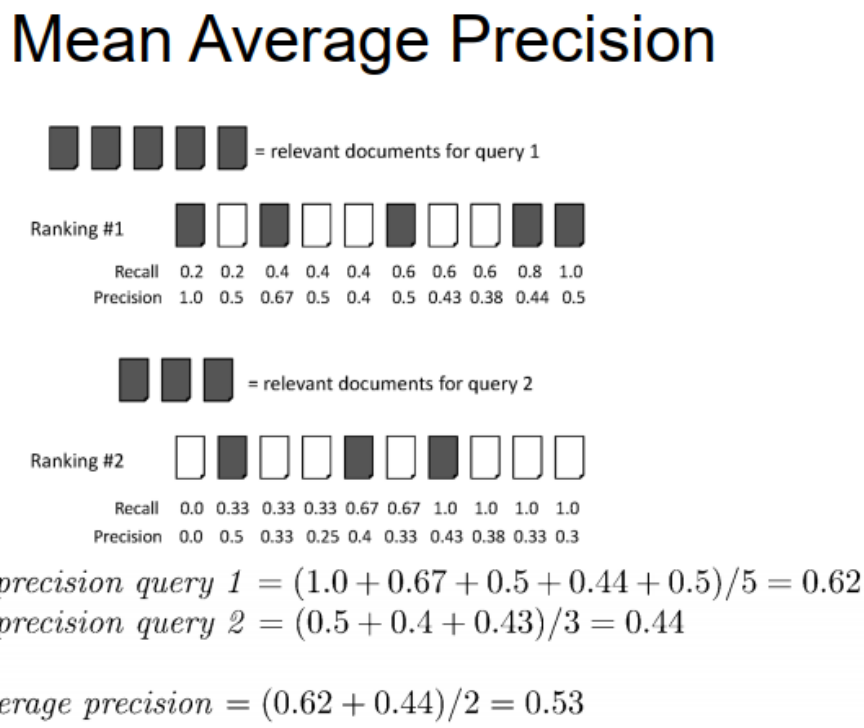
- **Input**： a query (like Ron Weasley birthday)
- **Output**: Return the top K (e.g.,K = 10) relevant tweets.
- **Query**：支持and, or ,not；查询优化可以选做；

2.评价方法解释

- **(1) MAP**:



MAP example



• **(2) MRR**:

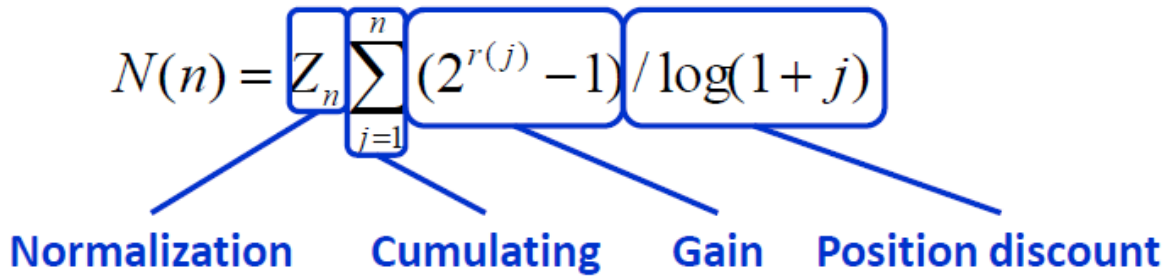
Consider rank position, K, of first relevant doc

Could be – only clicked doc

Reciprocal Rank score =1/K

MRR is the mean RR across multiple queries

• **(3) NDCG**:



二、实验步骤

1.针对query以及自己的检索系统生成结果

(1)首先，对55个queries(对应文件MB172-225.txt)进行格式化处理，得到num 和 query 内容的对应文件(MB-out.txt)。

结果展示如下：

```
171 Ron Weasley birthday
172 Merging of US Air and American
173 muscle pain from statins
174 Hubble oldest star
175 commentary on naming storm Nemo
176 book club members
177 Boko Haram kidnapped French tourists
178 Tiger Woods regains title
179 care of Iditarod dogs
180 Sherlock Elementary BBC CBS
181 Costa Concordia shipwreck
182 Chinua Achebe death
183 Evernote hacked
184 Election of Hugo Chavez successor
185 National Zoo Panda, insemination
186 Dorner, truck, compensation
187 Pope washed Muslims feet
188 Bombing police headquarters, Kirkuk
189 injuries by pets
190 Organized crime, sports doping, Australia
```

(2)将得到的55个query作为输入导入自己在Homework1-2中建立的检索系统中，将返回的结果(已经使用lncltn排序)导出到文件(my_query_result.txt)，同时，返回对应的tweetid。

```python
def generate_query_result():
    input_query=open("MB-out.txt",'r')
    output_query=open("my_query_result.txt",'w')
    for line in input_query.readlines():
        query = line[4:]
        terms = split_input1(query)
        answer = lncltn(terms,100)
        for docid in answer:
            output_query.write(line[:3]+' '+str(tweet_id[docid-1]))

```

2. Evaluation

(1) MAP

针对每一个query得到的词典，遍历每一个元素keys，如果出现在真实列表中，那么i_retrieval_true+1，同时，使用列表存储其查询精度，最后计算均值。其中AP_result 的列表长度为55，即对应55个queries。

相关代码如下：

```python
def MAP_eval(qrels_dict, test_dict, k = 100):
    AP_result = []
    for query in qrels_dict:
        test_result = test_dict[query]
        true_list = set(qrels_dict[query].keys())
        length_use = min(k, len(test_result))
        if length_use <= 0:
            print('query ', query, ' not found test list')
            return []
```

```
        P_result = []
        i = 0
        i_retrieval_true = 0
        for doc_id in test_result[0: length_use]:
            i += 1
            if doc_id in true_list:
                i_retrieval_true += 1
                P_result.append(i_retrieval_true / i)
        if P_result:
            #如果列表非空
            AP = np.sum(P_result) / len(true_list)
            #print('query:', query, ',AP:', AP)
            AP_result.append(AP)
        else:
            print('query:', query, ' not found a true value')
            AP_result.append(0)
    return np.mean(AP_result)
```

(2) MRR

相对于MAP，此处实现在原来MAP的基础上，将P_result每次添加的元素更改为1/i_retrieval_true即可。

(3) NDCG

首先从词典中获取relevance，然后计算DCG，IDCG，累加求和，并做商，得到NDCG，返回均值。相关代码如下

```
#c从词典中获取relevance
rel = qrels_dict[query].get(doc_id, 0)
#计算DCG
DCG += (pow(2, rel) - 1) / math.log(i, 2)
#计算IDCG
IDCG += (pow(2, true_list[i - 2]) - 1) / math.log(i, 2)
```

注意：用于计算三种评价结果的时候使用的字典长度是取的设定长度k和检索结果，真实结果之间的最小值，其中k设置为100.

三、实验结果

1.三种评估方法计算结果

```
MAP = 0.5878977903503264
MRR = 0.07691985298775675
NDCG = 0.7433658618001409
```

1.MAP计算结果

```
query: 171 ,AP: 0.9947950067063025

query: 172 ,AP: 0.3412969283276451

query: 173 ,AP: 0.5394754998726596

```

```
query: 174 ,AP: 0.8594866486170832

query: 175 ,AP: 0.38910505836575876

query: 176 ,AP: 0.9603814704708716

query: 177 ,AP: 0.5830572602784104

query: 178 ,AP: 0.438627515491519

query: 179 ,AP: 1.0001411305036154

query: 180 ,AP: 0.17271157167530224

query: 181 ,AP: 0.9907216297825171

query: 182 ,AP: 0.19305019305019305

query: 183 ,AP: 0.425531914893617

query: 184 ,AP: 0.5423412510980962

query: 185 ,AP: 0.8199044147573558

query: 186 ,AP: 0.7233610670784951

query: 187 ,AP: 1.0

query: 188 ,AP: 0.421163904805062

query: 189 ,AP: 0.4508922159542227

query: 190 ,AP: 0.7537282817812078

query: 191 ,AP: 0.7057554528997615

query: 192 ,AP: 0.6922999228607892

query: 193 ,AP: 0.42238806808196444

query: 194 ,AP: 1.0

query: 195 ,AP: 0.2560349838004482

query: 196 ,AP: 0.7325351726699327

query: 197 ,AP: 0.8562573583144859

query: 198 ,AP: 0.49210314303337777

query: 199 ,AP: 0.22671242168815173

query: 200 ,AP: 0.38862739161597376

query: 201 ,AP: 0.37037037037037035

query: 202 ,AP: 0.6802721088435374

```

```
query: 203 ,AP: 0.05273494125433347

query: 204 ,AP: 0.91558996232712

query: 205 ,AP: 0.6060606060606061

query: 206 ,AP: 0.8236821916487197

query: 207 ,AP: 0.7967834480252561

query: 208 ,AP: 0.303951367781155

query: 209 ,AP: 0.16447368421052633

query: 210 ,AP: 0.6990236536846707

query: 211 ,AP: 0.9803113422859036

query: 212 ,AP: 0.5672131465022131

query: 213 ,AP: 0.3944223107569721

query: 214 ,AP: 0.704225352112676

query: 215 ,AP: 0.2968099047773077

query: 216 ,AP: 0.5608453490673353

query: 217 ,AP: 0.41654804942768286

query: 218 ,AP: 0.20266634248258106

query: 219 ,AP: 0.3846409988437892

query: 220 ,AP: 0.5545262789781155

query: 221 ,AP: 0.1988071570576541

query: 222 ,AP: 0.5175179813421751

query: 223 ,AP: 0.8467824507971156

query: 224 ,AP: 0.9376190476190477

query: 225 ,AP: 0.9860135445362719


###### MAP = 0.5878977903503264
```

2.MRR计算结果

```
query: 171 ,RR: 1.0

query: 172 ,RR: 1.0

```

```
query: 173 ,RR: 1.0

query: 174 ,RR: 1.0

query: 175 ,RR: 1.0

query: 176 ,RR: 1.0

query: 177 ,RR: 1.0

query: 178 ,RR: 1.0

query: 179 ,RR: 1.0

query: 180 ,RR: 1.0

query: 181 ,RR: 1.0

query: 182 ,RR: 1.0

query: 183 ,RR: 1.0

query: 184 ,RR: 1.0

query: 185 ,RR: 1.0

query: 186 ,RR: 1.0

query: 187 ,RR: 1.0

query: 188 ,RR: 1.0

query: 189 ,RR: 0.5

query: 190 ,RR: 1.0

query: 191 ,RR: 1.0

query: 192 ,RR: 1.0

query: 193 ,RR: 1.0

query: 194 ,RR: 1.0

query: 195 ,RR: 1.0

query: 196 ,RR: 1.0

query: 197 ,RR: 1.0

query: 198 ,RR: 1.0

query: 199 ,RR: 1.0

query: 200 ,RR: 1.0

query: 201 ,RR: 1.0

```

```
query: 202 ,RR: 1.0

query: 203 ,RR: 1.0

query: 204 ,RR: 1.0

query: 205 ,RR: 1.0

query: 206 ,RR: 1.0

query: 207 ,RR: 1.0

query: 208 ,RR: 1.0

query: 209 ,RR: 1.0

query: 210 ,RR: 1.0

query: 211 ,RR: 1.0

query: 212 ,RR: 1.0

query: 213 ,RR: 1.0

query: 214 ,RR: 1.0

query: 215 ,RR: 1.0

query: 216 ,RR: 1.0

query: 217 ,RR: 1.0

query: 218 ,RR: 1.0

query: 219 ,RR: 1.0

query: 220 ,RR: 1.0

query: 221 ,RR: 1.0

query: 222 ,RR: 1.0

query: 223 ,RR: 1.0

query: 224 ,RR: 1.0

query: 225 ,RR: 1.0

###### MRR = 0.990909090909091
```

3.NDCG计算结果

```
query 171 , NDCG:  0.9741610197285601

query 172 , NDCG:  0.976267598809695
```

```

query 173 , NDCG:  0.5592590647689766

query 174 , NDCG:  0.8364253447569288

query 175 , NDCG:  0.6481396108560767

query 176 , NDCG:  0.8607975082008584

query 177 , NDCG:  0.7362022229001453

query 178 , NDCG:  0.7771970058688653

query 179 , NDCG:  0.96946915554352

query 180 , NDCG:  0.43205406604871577

query 181 , NDCG:  0.8865660618037104

query 182 , NDCG:  0.5227146959249794

query 183 , NDCG:  1.0

query 184 , NDCG:  0.6805789326304771

query 185 , NDCG:  0.8536744468767384

query 186 , NDCG:  0.6996910251929338

query 187 , NDCG:  0.9062438337772172

query 188 , NDCG:  0.5626660880576555

query 189 , NDCG:  0.4170732335649429

query 190 , NDCG:  0.8439560422299328

query 191 , NDCG:  0.780189037436402

query 192 , NDCG:  0.7775990358623345

query 193 , NDCG:  0.46137674288579106

query 194 , NDCG:  1.0

query 195 , NDCG:  0.6356537900281565

query 196 , NDCG:  0.798294443193272

query 197 , NDCG:  0.8637684507936801

query 198 , NDCG:  0.5220037900726465

query 199 , NDCG:  0.8677298107993553

query 200 , NDCG:  0.8009652862772505

query 201 , NDCG:  0.8077484806346881
```

```

query 202 , NDCG:  0.8543331297975348

query 203 , NDCG:  0.12522882485450773

query 204 , NDCG:  0.8784346866117554

query 205 , NDCG:  0.9532952623976307

query 206 , NDCG:  0.8058756222121726

query 207 , NDCG:  0.8374230518564247

query 208 , NDCG:  0.5709411792416991

query 209 , NDCG:  0.7172353312046215

query 210 , NDCG:  0.8163912308671866

query 211 , NDCG:  0.7995900380838883

query 212 , NDCG:  0.835975832240164

query 213 , NDCG:  0.976225496425557

query 214 , NDCG:  0.8275209448618122

query 215 , NDCG:  0.5215776530389581

query 216 , NDCG:  0.7791603659101373

query 217 , NDCG:  0.615149844314422

query 218 , NDCG:  0.7015111678704105

query 219 , NDCG:  0.5035965470989827

query 220 , NDCG:  0.5808288255962232

query 221 , NDCG:  0.8175278490834343

query 222 , NDCG:  0.45954898946439116

query 223 , NDCG:  0.6904517181453386

query 224 , NDCG:  0.9090714260165482

query 225 , NDCG:  0.8497615562894512

###### NDCG = 0.7433658618001409
```

四、实验分析与总结

(1) 实验中采用MAP，MRR，NDCG三种方式对homework1-2中建立的检索系统进行了评估，掌握了检索评价的方式。

(2)对于文本数据或者格式化文本数据的处理更加得心应手。