الهيئة السعودية للتخصصات الصحية
Saudi Commission for Health Specialties

Data Science Assignment

Overview

You are working in a team of software engineers, data scientists, developers and yourself. The team is dedicated to push the boundaries in the area of information retrieval, but needs help with obtaining a baseline to compare their results against. You have been assigned to implement this baseline method.

Baseline method

A popular task in information retrieval is to find a document *d* in a collection of documents *D* (known as a 'corpus') that is most relevant to a query string *s* .
A basic problem in retrieval is to measure how relevant a word is to a document in a corpus. The following sections describe one possible such measure, given a word *w* and a document *d* in a corpus *D* .

Word Importance (wi)

This value measures how important a word is in a document. While there are a number of ways in practice to calculate the word importance, for the purposes of this project, assume the importance of a word *w* in a document *d* is given by:

$$wi(w,d) = \frac{f_{w,d}}{M}$$

where:

- $f_{w,d}$ is the frequency of *w* in *d*
- M is the total number of words in *d*

Generality Discount (*gd*)

Some words occur in natural language much more frequently than others. For example, the word 'is' will occur much more frequently than the word 'magical'. The *gd* value seeks to inversely weigh a word based on how frequently it occurs in a corpus. For this project, the *gd* value of a word w in a corpus *D* is given as follows.

$$gd(w,D) = log\frac{N}{n}$$

where:

- N is the number of documents in the corpus
- n is the number of documents that contain w

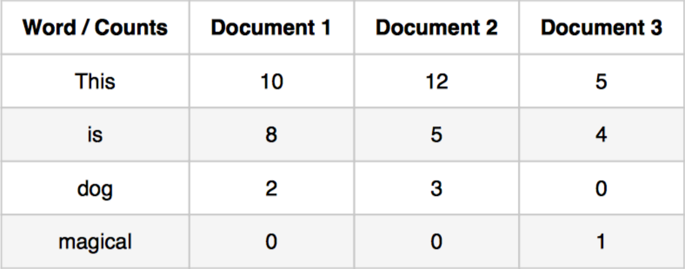
Word Relevance (*wr*)

After calculating the word importance and generality discount, the word relevance value is calculated as the element-wise matrix multiplication of the *wi* and *gd* values.

$$wr(w,d,D) = wi(w,d) \bullet gd(w,D)$$

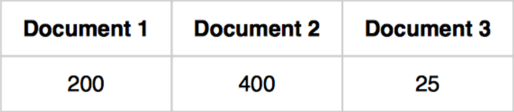
Example

Consider the following table, which lists the counts of some words in a corpus consisting of 3 documents.



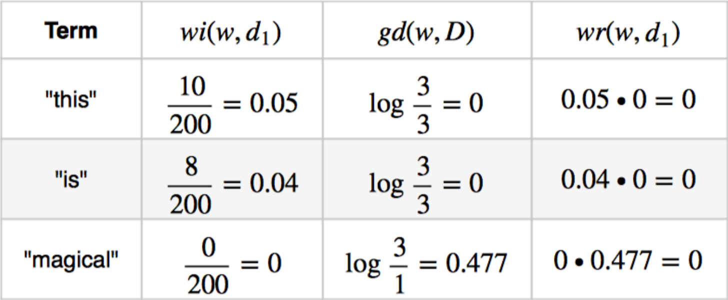
Word / Counts	Document 1	Document 2	Document 3
This	10	12	5
is	8	5	4
dog	2	3	0
magical	0	0	1

The total words in each document are:



Document 1	Document 2	Document 3
200	400	25

Given the above corpus and a search string "**This is magical**", the *wr* calculations for document 1 are as follows.



Term	$wi(w,d_1)$	$gd(w,D)$	$wr(w,d_1)$
"this"	$\frac{10}{200} = 0.05$	$\log \frac{3}{3} = 0$	$0.05 \bullet 0 = 0$
"is"	$\frac{8}{200} = 0.04$	$\log \frac{3}{3} = 0$	$0.04 \bullet 0 = 0$
"magical"	$\frac{0}{200} = 0$	$\log \frac{3}{1} = 0.477$	$0 \bullet 0.477 = 0$

The Challenge

Given the following query strings and the 20 documents included under the "documents" directory, design and implement a system to calculate the *wr* values. You must use ***Python*** and you may use any Python library you prefer.

Query Strings

1. "tennis match"
2. "88 thousand people!"
3. "the plastic container; see <img src='drawing.jpg' alt=''>"

Hints

- Only plain text, alpha-numeric characters are useful for analysis. You may filter out any punctuation or markup.
- If you think there is information missing, you may use any resource (except enlisting the help of others) and your own judgement to make assumptions about the problem.
- Please document your assumptions and design decisions. We will discuss these during the in-person interview.

Deliverables

1. For each of the query strings above, print the wr values into a text file called **Results.txt.**
2. At the very least, you must give implementations for functions to calculate the *wi, gd* and *wr* values.
3. Package your solution along with the results into a file called **SCFHS_DS_<your_name>.zip.**
4. **Important:** The deliverable code should be one or multiple files (modular code) in **.py** format.
5. **Bonus:** Generate setup and execution instructions for the research team. Name this file **README. <extension>** (you may use any file format you prefer).