1 Project Description

The purpose of this project is to (i) apply various text operations (i.e., stopword removal and stemming) on a text document collection \( C \) to create the corresponding indexed structure, and (ii) use the indexed structure to retrieve and rank documents in \( C \) that are relevant to a user’s query based on \( TF \times IDF \).

1.1 Text Processing

Using a small Wikipedia document collection (posted under http://students.cs.byu.edu/~cs453ta/projs.html), denoted Wiki, you are required to

a. Implement and run a word tokenizer on Wiki. The tokenizer you are to implement should remove capitalization, punctuation symbols, and hyphens. Note that if you have decided to simply remove hyphens and concatenate the words (before and after each hyphen), you should check the spelling of each concatenated word using the provided dictionary for the project assignment. If a concatenated word is a misspelled word, you should not concatenate the corresponding words in the first place.

b. Remove stopwords from (the documents in) Wiki. To facilitate this task we provide a Java implementation of a stopword-removal tool, along with the stopword list, which can be downloaded from http://students.cs.byu.edu/~cs453ta/projs.html.

c. Reduce the non-stopwords in (the documents in) Wiki to their grammatical stems using the Porter Stemmer algorithm. We provide a Java implementation of the Porter Stemmer, which can be downloaded from http://students.cs.byu.edu/~cs453ta/projs.html. You should make sure that before calling the Porter Stemmer algorithm, any spaces before or after the words to be stemmed MUST be removed.

d. Create an indexed structure for the Wiki collection, which should include for each stem \( s \) in Wiki (i) the documents (identified by their IDs) in which \( s \) appears and (ii) the frequency of occurrence of \( s \) in each document.

1.2 Evaluation of Keyword Queries

For each of the keyword queries listed in Section 2, you are required to retrieve and rank the top-10 most relevant documents from the Wiki collection based on their ranking scores. The ranking score of each document \( d \) (in the Wiki collection) with respect to a query \( q \) is computed as

\[
Score(q, d) = \sum_{w \in q} TF(w, d) \times IDF(w)
\]

\[
TF(w, d) = \frac{freq(w, d)}{\max_l(freq(l, d))}
\]

\[
IDF(w) = \log_2 \frac{N}{n_w}
\]
where $w$ is a non-stop, stemmed word in $q$, $\text{freq}(w, d)$ is the number of times $w$ appears in $d$, $N$ is the number of documents in the Wiki collection, and $n_w$ is the number of documents in which $w$ appears.

2 Keyword Queries to be Evaluated

For each of the ten test queries $q$ given below, you are required to retrieve and rank the top-10 documents with the highest ranking score (among the others) with respect to $q$. For each retrieved document you are required to include its ID, first sentence, and computed ranking score, as shown in Table 1. Note that you must perform *stopword removal* and *stemming* on the ten test queries prior to processing them.

1. killing incident
2. suspect charged with murder
3. court
4. jury sentenced murderer to prison
5. movie
6. entertainment films
7. court appeal
8. action film producer
9. drunk driving accusations
10. actor appeared in movie premiere

<table>
<thead>
<tr>
<th>Ranked Documents</th>
<th>Document ID</th>
<th>First Sentence</th>
<th>Ranking Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Expected information for the top-10 documents retrieved for each of the ten test queries to be processed

This assignment is worth 100 points.