Information Retrieval Project | Monsoon 2020

MiniStack

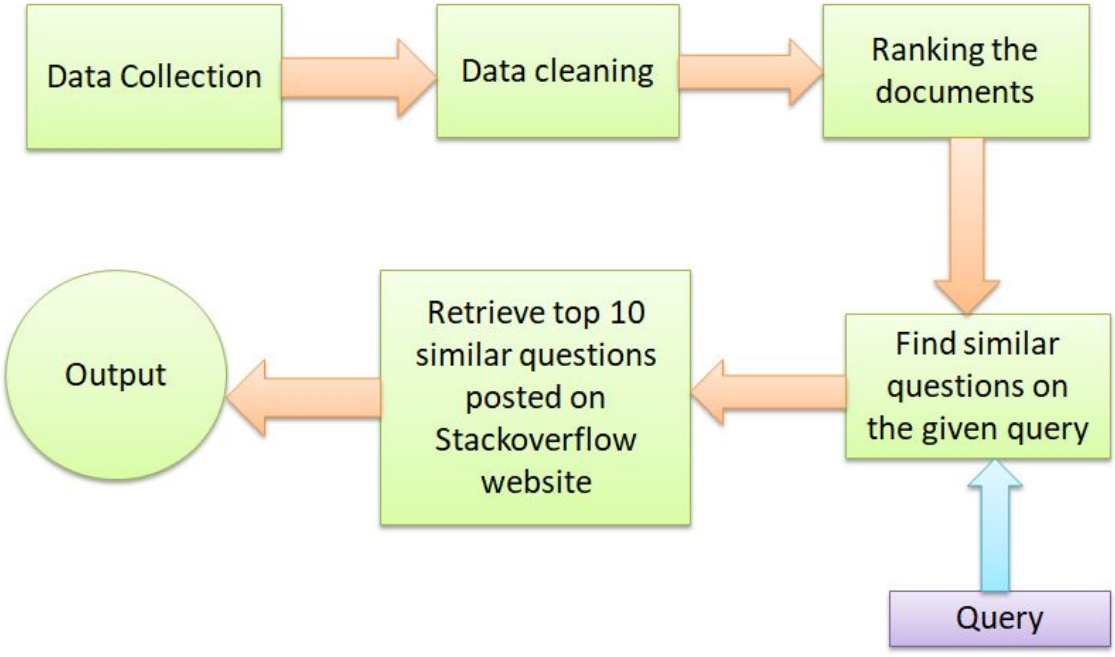
ABOUT STACK OVERFLOW

Stack Overflow is the largest, most trusted online community for developers to learn and share their knowledge

Task-1 PROBLEM STATEMENT

Build a search engine on Stack-overflow corpus

OVERVIEW



Dataset collection

I collected a dataset from [Stack Exchange Data Dump](#) . The URL contains a link to stack overflow corpus which contains a large number of questions along with that it had some other information like tags, URL ,up-vote. The stack overflow dump corpus contains data on several topics which is nearly 63GB but for the project I would consider a part of it.

- Artificial intelligence
- Computer Science
- Computer graphics
- DataScience

The above mentioned are the part of stack overflow corpus which I have considered. The data in this link are in XML Files . This is the format of the XML files

```
<?xml version="1.0" encoding="UTF-8"?>
<posts>
  <row ContentLicense="CC BY-SA 4.0" FavoriteCount="1" CommentCount="0" AnswerCount="5" Tags="<neural-networks><backpropagation><terminology><definitions>" Title="What is "backprop"?" LastActivityDate="2020-04-22T00:49:46.747" LastEditDate="2019-11-16T17:56:22.093" LastEditorUserId="2444" OwnerUserId="8" Body="<p>What does "backprop" mean? Is the "backprop" term basically the same as "backpropagation" or does it have a different meaning?</p> " ViewCount="499" Score="8" CreationDate="2016-08-02T15:39:14.947" AcceptedAnswerId="3" PostTypeId="1" Id="1"/>
  <row ContentLicense="CC BY-SA 4.0" FavoriteCount="2" CommentCount="0" AnswerCount="3" Tags="<neural-networks><machine-learning><statistical-ai><generalization>" Title="How does noise affect generalization?" LastActivityDate="2019-02-23T22:36:37.133" LastEditDate="2019-02-23T22:36:19.090" LastEditorUserId="2444" OwnerUserId="8" Body="<p>Does increasing the noise in data help to improve the learning ability of a network? Does it make any difference or does it depend on the problem being solved? How is it affect the generalization process overall?</p> " ViewCount="649" Score="11" CreationDate="2016-08-02T15:40:20.623" AcceptedAnswerId="9" PostTypeId="1" Id="2"/>
  <row ContentLicense="CC BY-SA 3.0" CommentCount="0" LastActivityDate="2016-08-02T15:40:24.820" OwnerUserId="4" Body="<p>"Backprop" is the same as "backpropagation": it's just a shorter way to say it. It is sometimes abbreviated as "BP".</p> " Score="13" CreationDate="2016-08-02T15:40:24.820" PostTypeId="2" Id="3" ParentId="1"/>
  <row ContentLicense="CC BY-SA 3.0" FavoriteCount="11" CommentCount="0" AnswerCount="4" Tags="<deep-neural-networks><search><neurons>" Title="How to find the optimal number of neurons per layer?" LastActivityDate="2018-10-18T10:45:15.213" LastEditDate="2018-10-18T10:45:15.213" LastEditorUserId="10135" OwnerUserId="8" Body="<p>When you're writing your algorithm, how do you know how many neurons you need per single layer? Are there any methods for finding the optimal number of them, or is it a rule of thumb?</p> " ViewCount="955" Score="29" CreationDate="2016-08-02T15:41:22.020"
```

I should convert the XML files into csv files. However all the tags are not useful hence I extracted body(questions) and topic from XML by using XML parser and converted the extracted tag's into a data frame and then stored each of the data frame in a csv file.

Once the csv files are available for each of the xml files, my next step would be merging all the csv files into one single file. Now this single csv file would look as shown

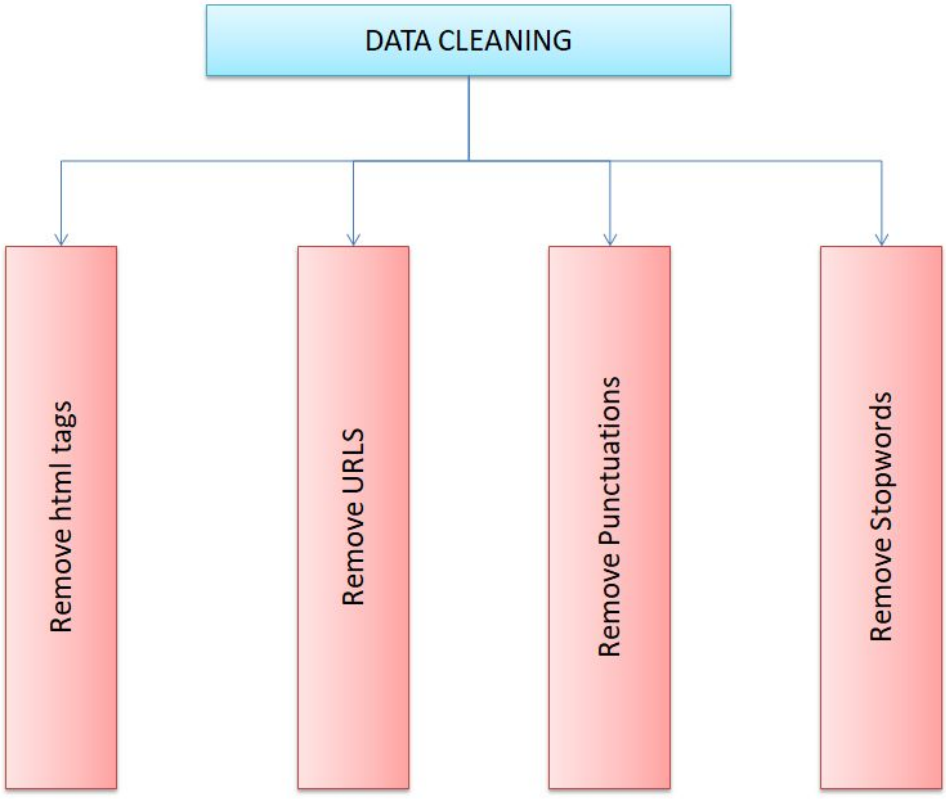
	Id	Text	Topic
0	0	<p>Besides being "one of the 7 meta questions ...	AIMeta
1	1	<p>I've clicked on chat link, but the...	AIMeta
2	2	<p>I think this will be a crucial thing to fig...	AIMeta
3	3	<p>Are all questions asked on stats and data s...	AIMeta
4	4	<p>I've seen several questions that use the <a...	AIMeta

Next I removed posts which has no text (null values)

This single csv file has 161423 posts with 3 attributes (Id ,Text , Topic)

Data Cleaning

Since all the posts are not merely text it is a html components, some preprocessing is required



Remove html tags

Input :

' My data set contains a number of numeric attributes and one categorical. \n\n Say, <code>NumericAttr1, NumericAttr2, ..., NumericAttrN, CategoricalAttr</code>, \n\n where <code>CategoricalAttr</code> takes one of three possible values: <code>CategoricalAttrValue1</code>, <code>CategoricalAttrValue2</code> or <code>CategoricalAttrValue3</code>. \n\n I\'m using default k-means clustering algorithm implementation for Octave https://blog.west.uni-koblenz.de/2012-07-14/a-working-k-means-code-for-octave/.\nIt works with numeric data only. \n\n So my question: is it correct to split the categorical attribute <code>CategoricalAttr</code> into three numeric (binary) variables, like <code>IsCategoricalAttrValue1, IsCategoricalAttrValue2, IsCategoricalAttrValue3</code> ? \n'

This input contains html tags which has to be removed

Function :

```
def cleanhtml(raw_html):

    cleanr = re.compile('<.*?>')

    cleantext = re.sub(cleanr, '', raw_html)
    return cleantext.lower()
```

Output:

" my data set contains a number of numeric attributes and one categorical. \n\n say, , \n\n where takes one of three possible values: , or . \n\n i'm using default k-means clustering algorithm implementation for octave https://blog.west.uni-koblenz.de/2012-07-14/a-working-k-means-code-for-octave/ .\nit works with numeric data only. \n\n so my question: is it correct to split the categorical attribute into three numeric (binary) variables, like ? \n"

Now the html tags are removed and everything is in lower case

Remove URLS

Input :

" my data set contains a number of numeric attributes and one categorical. \n\n say, , \n\n where takes one of three possible values: , or . \n\n i'm using default k-means clustering algorithm implementation for octave *https://blog.west.uni-koblenz.de/2012-07-14/a-working-k-means-code-for-octave/* .\nit works with numeric data only. \n\n so my question: is it correct to split the categorical attribute into three numeric (binary) variables, like ? \n"

Function:

```
url_regex = 'http[s]?://(?:[a-zA-Z]|[0-9]|[$-_@.&+]|[!*\(\),]|(?:%[0-9a-fA-F][0-9a-fA-F]))+';

for i in range(preprocessed_post_text.shape[0]):
    preprocessed_post_text[i] = re.sub(url_regex, '', preprocessed_post_text[i]);
```

Output:

" my data set contains a number of numeric attributes and one categorical. \n\n say, , \n\n where takes one of three possible values: , or . \n\n i'm using default k-means clustering algorithm implementation for octave .\nit works with numeric data only. \n\n so my question: is it correct to split the categorical attribute into three numeric (binary) variables, like ? \n"

URLS are removed

Remove Punctuations

Input:

" my data set contains a number of numeric attributes and one categorical**.** \n\n say**, ,** \n\n where takes one of three possible values**: ,** or **.** \n\n i'm using default k-means clustering algorithm implementation for octave **.**\nit works with numeric data only**.** \n\n so my question**:** is it correct to split the categorical attribute into three numeric (binary) variables**,** like ***?*** \n"

Function:

```
def cleanpunc(sentence):
    cleaned = re.sub(r'[?|!|"|#|:|=|+|_|{|}|[|]|-|$|%|^|&|]',r'',sentence)
    cleaned = re.sub(r'[.|,|)|(|\|/|-|~|`|>|<|*|$|@|;|→]',r'',cleaned)
    return  cleaned
```

Output:

" my data set contains a number of numeric attributes and one categorical \n\n say \n\n where takes one of three possible values or \n\n i'm using default kmeans clustering algorithm implementation for octave \nit works with numeric data only \n\n so my question is it correct to split the categorical attribute into three numeric binary variables like \n"

Removed the punctuations

Remove Stopwords

Input:

" my data set contains a number of numeric attributes and one categorical \n\n say \n\n where takes one of three possible values or \n\n i'm using default kmeans clustering algorithm implementation for octave \nit works with numeric data only \n\n so my question is it correct to split the categorical attribute into three numeric binary variables like \n"

Function:

```
from nltk.corpus import stopwords
stop_words = set(stopwords.words('english'))
print ('list of stop words:', stop_words)

def nlp_preprocessing(total_text):
    """Removes stop words and alpha numeric values"""
    if type(total_text) is not int:# Numbers doesn't make any sense in searching them
        string = ""
        for words in total_text.split():
            # remove the special chars in review like '"#$@!%^&*()_+-~?>< etc.
            word = ("".join(e for e in words if e.isalnum()))
            # stop-word removal
            if not word in stop_words:
                string += word + " "
        return string
```

Output:

'data set contains number numeric attributes one categorical say takes one three possible values using default kmeans clustering algorithm implementation octave works numeric data question correct split categorical attribute three numeric binary variables like '

Data is cleaned and stored in the a separate column as shown

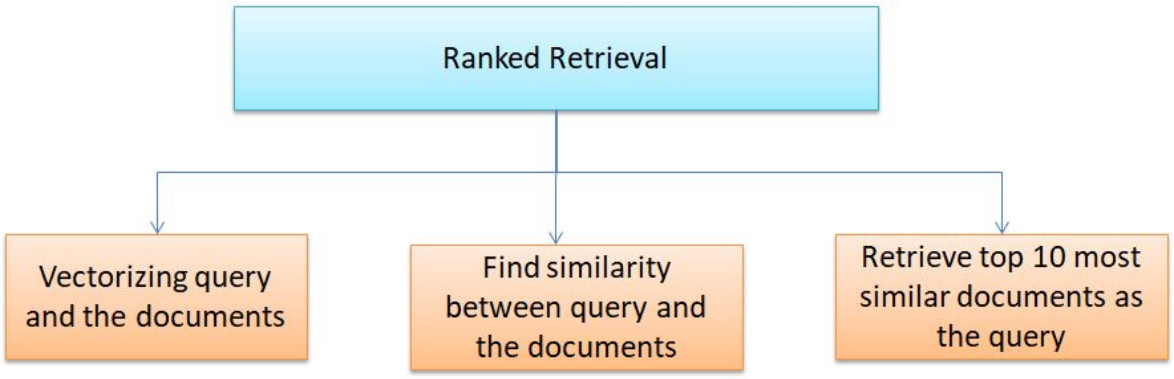
Shape (161423, 5)

	Id	Text	Topic	non_stopword_removed_preprocessed_text	preprocessed_text
0	0	<p>Besides being "one of the 7 meta questions ...	/Almeta	besides being one of the 7 meta questions ever...	besides one 7 meta questions every site ask pl...
1	1	<p>I've clicked on chat link, but the...	/Almeta	i have clicked on chat link but the list is em...	clicked chat link list empty also tried create...
2	2	<p>I think this will be a crucial thing to fig...	/Almeta	i think this will be a crucial thing to figure...	think crucial thing figure one hand think impo...
3	3	<p>Are all questions asked on stats and data s...	/Almeta	are all questions asked on stats and data scie...	questions asked stats data science se also top...
4	4	<p>I've seen several questions that use the <a...	/Almeta	i have seen several questions that use the art...	seen several questions use artificialintellige...

Non_stopword_removed_preprocessed_text is the data after removing html tags, urls and punctuations

Preprocessed_text is the data after removing stop words also

Ranked Retrieval



TF-IDF Vectorization

For vectorizing the data and the query I did TF-IDF vectorization (Term frequency inverse term frequency)

Function:

```
from sklearn.feature_extraction.text import TfidfVectorizer
vectorizer = TfidfVectorizer()
X = vectorizer.fit_transform(total_df['non_stopword_removed_preprocessed_text'].values)
```

As the size of the data is very large I used in-built function for vectorization

For example let's consider a query **Query = "What is artificial intelligence"**

Code:

```
Query_Bow = vectorizer.transform([Query])
```

Cosine Similarity

For finding the similarity between two vectors i.e each sentence and the query I used cosine similarity

Function:

```
doc_dict = dict()

for i in range(X.shape[0]):
    doc_dict[i] = cosine_similarity(X[i], Query_Bow)
```

After finding similarity scores between sentences and the query, I stored them in the dictionary

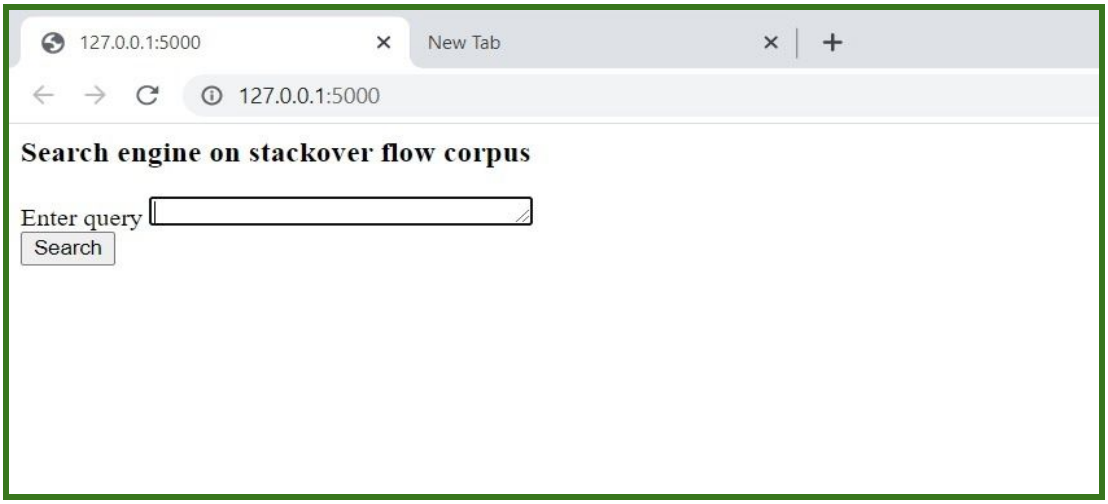
Get Top 10

After storing the similarity scores in the dictionary I sorted them and retrieved top 10 documents

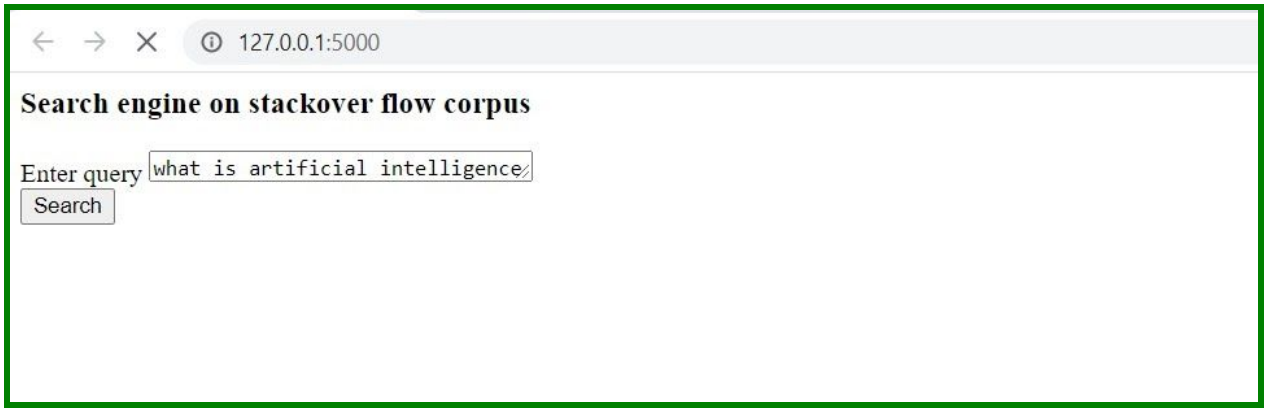
Code:

```
a = sorted(doc_dict.items(), key=lambda x: x[1], reverse=True) [:10]
```

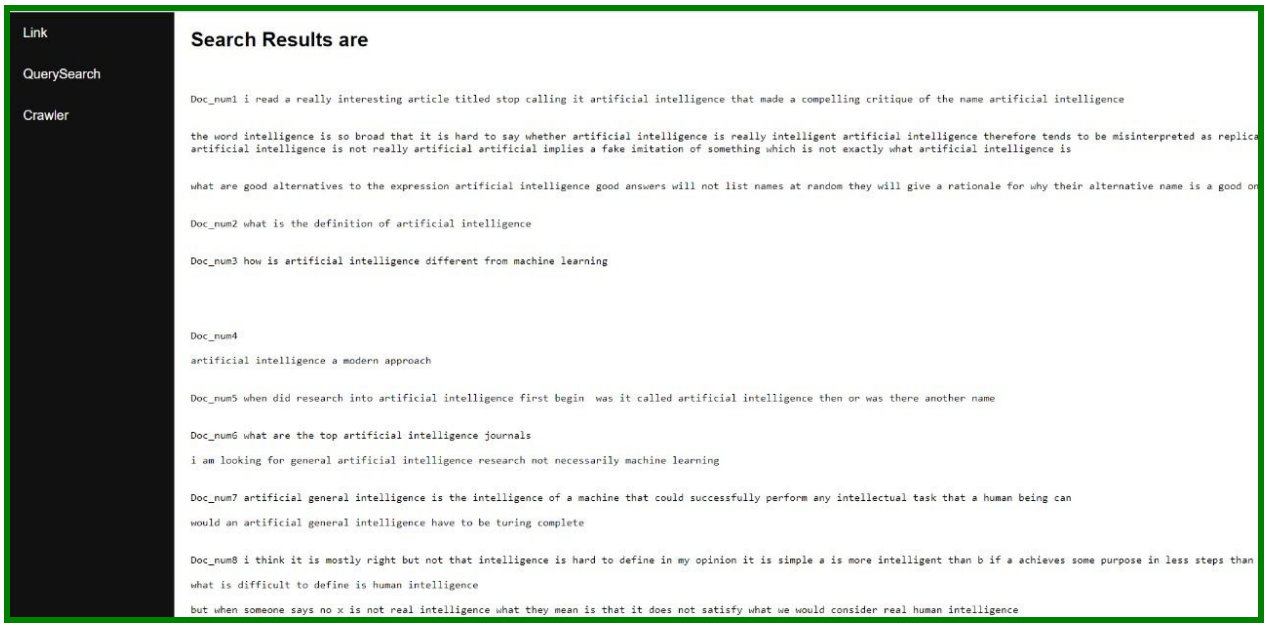
UI-Application



Query enter



Similar questions as the given query



Retrieved top 10 similar questions as the given query that are posted on the Stackoverflow website