In [1]:
```
from google.colab import drive
drive.mount('/drive/')
import os
os.chdir('/drive/My Drive/SKRA/NLP')
```

```
Drive already mounted at /drive/; to attempt to forcibly remount, call drive.mo
unt("/drive/", force_remount=True).
```

In [0]:
```
import os
os.chdir('/drive/My Drive/SKRA/NLP')
```

In [3]:
```
ls
```

```
 chatbot-countvectorizer-cosine.ipynb            TextRanking.ipynb
 chat_bot.csv                                    tfidfmatrix.csv
'Copy of chatbot-countvectorizer-cosine.ipynb'   tfidfmatrix.gsheet
```

In [4]:
```
import numpy as np
import pandas as pd
import nltk
from nltk import word_tokenize, sent_tokenize # tokenization
from nltk.stem import WordNetLemmatizer # Lemmatization
from nltk import pos_tag # pos tagging
#from nltk.stem import PorterStemmer # stemming
from nltk.corpus import wordnet # wordnet
import re # regular expression
from nltk.corpus import stopwords
stop = stopwords.words('english')
stop.remove('what')
stop.remove('which')
print(stop)
```

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're",
"you've", "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he',
'him', 'his', 'himself', 'she', "she's", 'her', 'hers', 'herself', 'it', "i
t's", 'its', 'itself', 'they', 'them', 'their', 'theirs', 'themselves', 'who',
'whom', 'this', 'that', "that'll", 'these', 'those', 'am', 'is', 'are', 'was',
'were', 'be', 'been', 'being', 'have', 'has', 'had', 'having', 'do', 'does', 'd
id', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'as', 'unt
il', 'while', 'of', 'at', 'by', 'for', 'with', 'about', 'against', 'between',
'into', 'through', 'during', 'before', 'after', 'above', 'below', 'to', 'from',
'up', 'down', 'in', 'out', 'on', 'off', 'over', 'under', 'again', 'further', 't
hen', 'once', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'any', 'bo
th', 'each', 'few', 'more', 'most', 'other', 'some', 'such', 'no', 'nor', 'no
t', 'only', 'own', 'same', 'so', 'than', 'too', 'very', 's', 't', 'can', 'wil
l', 'just', 'don', "don't", 'should', "should've", 'now', 'd', 'll', 'm', 'o',
're', 've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'didn', "did
n't", 'doesn', "doesn't", 'hadn', "hadn't", 'hasn', "hasn't", 'haven', "have
n't", 'isn', "isn't", 'ma', 'mightn', "mightn't", 'mustn', "mustn't", 'needn',
"needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'wasn', "wasn't", 'weren',
"weren't", 'won', "won't", 'wouldn', "wouldn't"]
```

In [5]:
```
nltk.download('punkt')
nltk.download('averaged_perceptron_tagger')
nltk.download('wordnet')
nltk.download('stopwords')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package averaged_perceptron_tagger to
[nltk_data]     /root/nltk_data...
[nltk_data]   Package averaged_perceptron_tagger is already up-to-
[nltk_data]       date!
[nltk_data] Downloading package wordnet to /root/nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

Out[5]: True

In [6]:
```
chatbot = pd.read_csv('chat_bot.csv',encoding='latin-1')
chatbot.head()
```

Out[6]:

	Questions	Answers
0	What are the prerequisites for this Hadoop Tra...	There are no prerequisites for learning this c...
1	Do I need to know anything before leaning the ...	There are no prerequisites for learning this c...
2	Do I need to have some programming knowledge t...	There are no prerequisites for learning this c...
3	Is it mandatory to know some kind of programmi...	There are no prerequisites for learning this c...
4	Is programming important to learn Hadoop?	There are no prerequisites for learning this c...

In [0]:
```
def postag(pos):
  if pos.startswith('N'):
      wp = wordnet.NOUN
  elif pos.startswith('V'):
    wp = wordnet.VERB
  elif pos.startswith('R'):
    wp = wordnet.ADV
  elif pos.startswith('J'):
    wp = wordnet.ADJ
  else:
    wp = wordnet.NOUN

  return wp

wnl = WordNetLemmatizer() # intilize wordnetlemmatizer

def texprocess(doc):

  # step-1: lower the text
  doc = doc.lower()
  # step-2: remove special characters
  doc = re.sub(r'[^a-z]',' ',doc)
  # step-3: pos tagging (parts of speech)
  token = word_tokenize(doc) # tokenization - get the words
  token_pos = pos_tag(token) # tagging parts of speech
  # step-4: stemming
  #ps = PorterStemmer()
  #stemming = [ps.stem(word) for word in token]
  # step-4 : lemma and remove stopwords
  lemma = [wnl.lemmatize(word,pos=postag(pos)) for word,pos in token_pos if word

  clean = " ".join(lemma)
  return clean

def cosine(a,b):
  moda = np.linalg.norm(a) # magnitude of a
  modb = np.linalg.norm(b) # magnitude of b
  dotprod = np.dot(a,b) # dot product of vector a and vector b
  # a[0] , b[0] -> remove shape in it , we don't want vector to have some shape
  # i.e, neither column matrix nor row matrix
  cos = dotprod/(moda*modb)
  # print('INFO: similarity between document a and b is =',cos_theta)
  return cos
```

Word Embedding

- Count Vectorizer

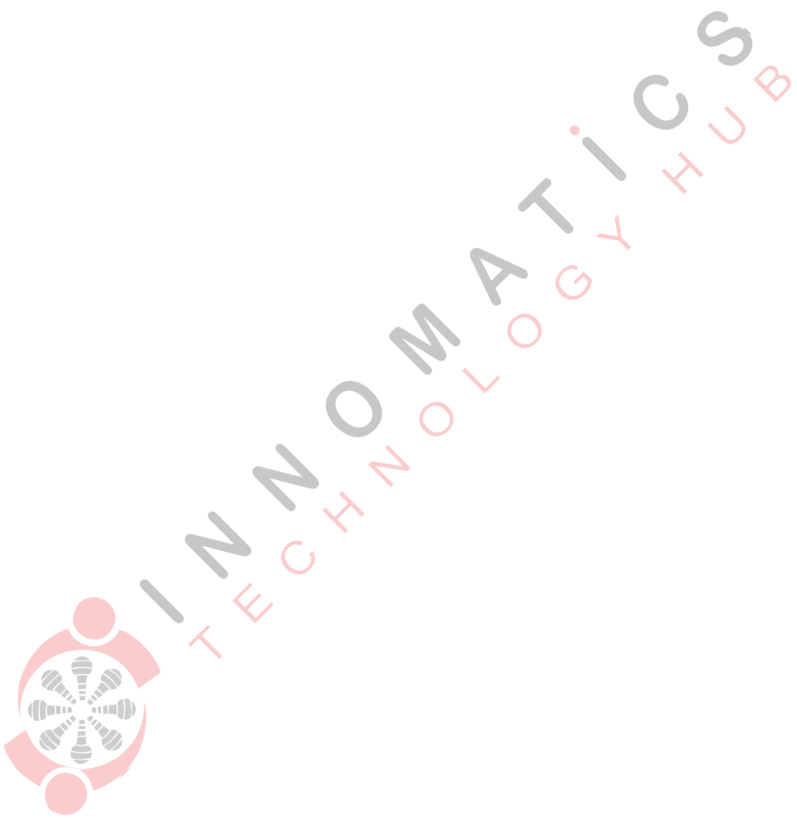
Ranking Documents

- cosine similarity

$$cos(a,b) = \frac{\bar{a}.\bar{b}}{|a||b|}$$

In [0]:
```
documents = list(chatbot['Questions'])
# Step-1: Text processing
documents = [texprocess(doc) for doc in documents] # text processing of the all t
```

Step-2 : Word Embedding



In [9]:
```
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf = TfidfVectorizer()

X = tfidf.fit_transform(documents).toarray() # word embedding count vectorizer
print('INFO: shape of array =',X.shape)
print('INFO: Features list =',tfidf.get_feature_names())
print('INFO: length of features =',len(tfidf.get_feature_names()))
```

```
INFO: shape of array = (726, 484)
INFO: Features list = ['able', 'accept', 'access', 'accredit', 'achive', 'acron
ym', 'actually', 'advantage', 'afternoon', 'agile', 'agility', 'ai', 'algorith
m', 'amason', 'amazon', 'analysis', 'analyst', 'analytics', 'anything', 'anywah
re', 'apace', 'apache', 'application', 'apply', 'approach', 'approch', 'archite
ch', 'architect', 'article', 'artificial', 'assistance', 'associate', 'attend',
'automation', 'available', 'average', 'aws', 'back', 'background', 'backup', 'b
ecome', 'behind', 'benefit', 'benificear', 'benifits', 'best', 'big', 'bigdat
a', 'blog', 'blue', 'body', 'bot', 'branch', 'break', 'buesness', 'build', 'bui
lding', 'bulk', 'bye', 'call', 'cancel', 'candidate', 'capstone', 'card', 'car
e', 'career', 'case', 'cd', 'certifaction', 'certificate', 'certification', 'ce
rtified', 'certify', 'chalenges', 'challenge', 'chef', 'ci', 'ciao', 'class',
'classification', 'classroom', 'cleaning', 'cloud', 'cod', 'come', 'common', 'c
ompany', 'complete', 'component', 'compponents', 'comprise', 'compute', 'comput
er', 'concept', 'conceptual', 'conduct', 'connect', 'consider', 'contact', 'con
tent', 'continue', 'continuo', 'continuous', 'cost', 'coureses', 'course', 'cou
rsework', 'cover', 'credit', 'dat', 'data', 'datasets', 'day', 'degree', 'deliv
ery', 'demand', 'demo', 'depend', 'deployment', 'desirable', 'developer', 'deve
lopment', 'device', 'devopa', 'devops', 'devovps', 'devsecops', 'difference',
'different', 'differentiate', 'differnt', 'difficult', 'discount', 'docker', 'd
omains', 'dude', 'dvoups', 'earn', 'economics', 'effective', 'effort', 'eligibi
lity', 'employer', 'engineer', 'enrol', 'enroll', 'enrollment', 'entail', 'envi
ronment', 'etc', 'even', 'evening', 'everyone', 'exam', 'example', 'expect', 'e
xpectation', 'experience', 'explain', 'express', 'extention', 'extremely', 'fac
e', 'factor', 'faculti', 'faculty', 'fail', 'fee', 'field', 'find', 'finish',
'flume', 'follow', 'form', 'framework', 'free', 'fresher', 'future', 'get', 'gi
ve', 'global', 'go', 'good', 'guarantee', 'guidance', 'hadoop', 'hand', 'happen
ing', 'hear', 'heard', 'hello', 'help', 'helpful', 'hey', 'heyyo', 'hi', 'hir
e', 'history', 'hit', 'hive', 'hope', 'hot', 'hour', 'hub', 'implement', 'imple
mentation', 'implemetation', 'implrmentation', 'important', 'improve', 'includ
e', 'increase', 'independent', 'india', 'indusry', 'industry', 'innomatics', 'i
nstitute', 'institution', 'integration', 'intelligence', 'interview', 'involv
e', 'issue', 'jenkins', 'job', 'join', 'key', 'kind', 'know', 'knowledge', 'la
b', 'language', 'laptop', 'lean', 'learn', 'learning', 'leave', 'less', 'licens
e', 'like', 'listen', 'little', 'live', 'locate', 'location', 'log', 'long', 'l
ook', 'machine', 'macro', 'macros', 'main', 'makeup', 'management', 'mandator
y', 'many', 'mapreduce', 'market', 'material', 'math', 'mathematics', 'matter',
'mean', 'median', 'mention', 'methodology', 'mine', 'mining', 'miss', 'ml', 'mo
de', 'model', 'money', 'morning', 'much', 'must', 'name', 'near', 'necessary',
'need', 'new', 'next', 'night', 'objective', 'offer', 'office', 'one', 'onlin
e', 'open', 'opperations', 'option', 'organisation', 'organization', 'others',
'overall', 'part', 'pas', 'pass', 'past', 'path', 'pay', 'payment', 'payslip',
'pega', 'perfect', 'period', 'person', 'personal', 'perspective', 'pipeline',
'place', 'placement', 'plan', 'platform', 'podcasts', 'policy', 'popular', 'pos
se', 'possible', 'post', 'powerful', 'practice', 'pre', 'prediction', 'preferre
d', 'prepare', 'prepping', 'prerecord', 'prerequisite', 'present', 'price', 'pr
ior', 'priority', 'prism', 'problem', 'process', 'product', 'profession', 'prof
essional', 'program', 'programming', 'project', 'prolific', 'proper', 'prospe
```

```
r', 'provide', 'purpose', 'put', 'python', 'qualifications', 'rdm', 'real', 're
ally', 'receive', 'recommend', 'recommended', 'record', 'recruit', 'reduce', 'r
eduction', 'reexamination', 'reference', 'refund', 'register', 'relate', 'remot
e', 'replace', 'require', 'requirement', 'result', 'resume', 'retake', 'retur
n', 'robotic', 'role', 'rpa', 'run', 'salary', 'scala', 'schedule', 'science',
'scientist', 'scope', 'script', 'scripting', 'scrum', 'security', 'see', 'selec
t', 'selenium', 'service', 'session', 'set', 'significance', 'similar', 'simpli
learn', 'skill', 'skills', 'solution', 'soon', 'source', 'spark', 'spend', 'sq
l', 'stage', 'stand', 'start', 'statistic', 'step', 'store', 'study', 'succee
d', 'successful', 'suggest', 'suitable', 'sup', 'support', 'sure', 'syllabus',
'system', 'ta', 'take', 'taught', 'teach', 'teacher', 'teaching', 'team', 'tech
nical', 'technique', 'technologies', 'technology', 'tell', 'testimonial', 'thin
g', 'think', 'time', 'tipical', 'today', 'tool', 'top', 'topic', 'train', 'trai
ner', 'training', 'transformation', 'type', 'typical', 'ui', 'uipath', 'unloc
k', 'us', 'use', 'used', 'useful', 'usefull', 'user', 'usually', 'valid', 'vali
dation', 'valuable', 'video', 'waht', 'waive', 'waiver', 'want', 'watch', 'wate
rfall', 'way', 'wazzup', 'web', 'week', 'well', 'wep', 'what', 'whats', 'whic
h', 'without', 'wonderful', 'work', 'world', 'would', 'ya', 'yes']
INFO: length of features = 484
```

Finding Similar documents

In [0]:
```
import operator
```

In [0]:
```
def chatanswers(query):

  # step-1: text processing
  clean = texprocess(query)
  # step-2: word embedding (count vectorizer)
  b = tfidf.transform([query]).toarray() # query in list

  cosvalue ={}
  for i,vector in enumerate(X):
    cos = cosine(vector,b[0]) # b[0] -> remove shape in it
    cosvalue.update({i:cos}) # append values in dictonary

  #df['cos'] = cosvalue.values()
  #df.sort_values(by='cos',ascending=False)
  sort = sorted(cosvalue.items(), key=operator.itemgetter(1),reverse=True)
  ind = [index for index,cosv in sort[:5]]
  return ind,str(chatbot.loc[ind])#['Answers'])
```

In [20]:
```
query = 'what is data science ?'
index, ans = chatanswers(query)
print(ans)
```

```
                        Questions  \
458         What is Data Science?
595  What does Data Science have?
623         What is Data Science?
624      What is in Data Science?
627  What does Data Science have?

                                                 Answers
458  More than one-third of the time in a Data Scie...
595  Python, R, Statistics, Machine Learning, Artif...
623  The process of data science consists of data m...
624  The process of data science consists of data m...
627  The process of data science consists of data m...

/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:41: RuntimeWarnin
g: invalid value encountered in double_scalars
```

In [17]:
```
chatbot.loc[index]
```

Out[17]:

	Questions	Answers
458	What is Data Science?	More than one-third of the time in a Data Scie...
595	What does Data Science have?	Python, R, Statistics, Machine Learning, Artif...
623	What is Data Science?	The process of data science consists of data m...
624	What is in Data Science?	The process of data science consists of data m...
627	What does Data Science have?	The process of data science consists of data m...

In [21]:
```
while True:

  chatinput = input('Srikanth: ')
  if chatinput == 'exit':
    print('Thank you very much have a nice day !!!')
    break

  ind, ans = chatanswers(chatinput)
  print(ans)
```

```
Srikanth: best technology to learn

/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:41: RuntimeWarnin
g: invalid value encountered in double_scalars

                                              Questions  \
403        Best Institute to learn Data Science from?
605                   Best place to learn Data Mining?
162                           Is rpa a new technology?
398  What is the most popular Data Science technology?
153             What does RPA stand for in technology?

                                               Answers
403  Innomatics Technology Hub is a centrally locat...
605  Learn R and Python and check available data re...
162  There are a few reasons many of us in the midm...
398  TensorFlow is the most popular Deep Learning f...
153  The RPA  acronym stands for Robotics Process A...
Srikanth: eixt
                                            Questions  \
0  What are the prerequisites for this Hadoop Tra...
1  Do I need to know anything before leaning the ...
2  Do I need to have some programming knowledge t...
3  Is it mandatory to know some kind of programmi...
4          Is programming important to learn Hadoop?

                                             Answers
0  There are no prerequisites for learning this c...
1  There are no prerequisites for learning this c...
2  There are no prerequisites for learning this c...
3  There are no prerequisites for learning this c...
4  There are no prerequisites for learning this c...
Srikanth: exit
Thank you very much have a nice day !!!
```

In [0]:
```
```