```
General libraries being loaded
In [1]: # Python ≥3.5 is required
         import sys
        assert sys.version_info >= (3, 5)
        # Scikit-Learn ≥0.20 is required
        import sklearn
        assert sklearn.__version__ >= "0.20"
        # Common imports
         import numpy as np
         import os, time
        import pandas as pd
        # Our new Deep Learning imports
         import tensorflow as tf
        from tensorflow import keras
        # To plot nice figures
        # %matplotlib widget
         %matplotlib inline
         import matplotlib as mpl
         import matplotlib.pyplot as plt
         mpl.rc('axes', labelsize=14)
        mpl.rc('xtick', labelsize=12)
        mpl.rc('ytick', labelsize=12)
        # For plotting statistical figures
         import seaborn as sns; sns.set()
        # For speeding up numpy operations
         import cupy as cp
        # For faster numpy computation
        from numba import jit, cuda
        # For Progress Bar
        from tqdm.auto import tqdm,trange
        tqdm.pandas()
        # Vaex Dataframe Library
         import vaex as vx
        # For Pyspark activation
         import os
        os.environ["PYARROW_IGNORE_TIMEZONE"] = "1"
        # Pyspark Dataframe
        from pyspark import pandas as ps
        os.environ['KMP_DUPLICATE_LIB_OK']='True'
        Loading the Abstract Sentences for Word2Vec Model (Gensim)
 In [2]: Article_Data_Cord_File_DF_Abstract = pd.read_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_abstract.pkl")
 In [3]: Article_Data_Cord_File_DF_Abstract['Type'] = Article_Data_Cord_File_DF_Abstract.shape[0] * ['Abstract']
In [4]: Article_Data_Cord_File_DF_Abstract.rename(columns = {'Abstract_Sentences':'Sentences'}, inplace = True)
        Loading the Body Text Sentences for Word2Vec Model (Gensim)
In [5]: Article_Data_Cord_File_DF_Body_Text = pd.read_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_body_text.pkl")
 In [6]: Article_Data_Cord_File_DF_Body_Text['Type'] = Article_Data_Cord_File_DF_Body_Text.shape[0] * ['Body Text']
 In [7]: Article_Data_Cord_File_DF_Body_Text.rename(columns = {'Body_Text_Sentences':'Sentences'}, inplace = True)
        Loading Results of Questions from Round 1 to 5
 In [8]: Article_Data_Cord_File_DF_Result_1 = pd.read_csv(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 1\qrels-covid_d1_j0.5-1.txt", sep=' ', header=None)
        Article_Data_Cord_File_DF_Result_1['Batch'] = Article_Data_Cord_File_DF_Result_1.shape[0] * ['1']
        Article_Data_Cord_File_DF_Result_2 = pd.read_csv(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 2\qrels-covid_d2_j0.5-2.txt", sep=' ', header=None)
        Article_Data_Cord_File_DF_Result_2['Batch'] = Article_Data_Cord_File_DF_Result_2.shape[0] * ['2']
        Article_Data_Cord_File_DF_Result_2[0] = Article_Data_Cord_File_DF_Result_2[0] + Article_Data_Cord_File_DF_Result_1[0][Article_Data_Cord_File_DF_Result_1.shape[0]-1]
        Article_Data_Cord_File_DF_Result_3 = pd.read_csv(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 3\qrels-covid_d3_j0.5-3.txt",sep=' ',header=None')
        Article_Data_Cord_File_DF_Result_3['Batch'] = Article_Data_Cord_File_DF_Result_3.shape[0] * ['3']
        Article_Data_Cord_File_DF_Result_3[0] = Article_Data_Cord_File_DF_Result_3[0] + Article_Data_Cord_File_DF_Result_2[0][Article_Data_Cord_File_DF_Result_2.shape[0]-1]
        Article_Data_Cord_File_DF_Result_4 = pd.read_csv(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 4\qrels-covid_d4_j0.5-4.txt", sep=' ', header=None)
        Article_Data_Cord_File_DF_Result_4['Batch'] = Article_Data_Cord_File_DF_Result_4.shape[0] * ['4']
        Article_Data_Cord_File_DF_Result_4[0] = Article_Data_Cord_File_DF_Result_4[0] + Article_Data_Cord_File_DF_Result_3[0][Article_Data_Cord_File_DF_Result_3.shape[0]-1]
        Article_Data_Cord_File_DF_Result_5 = pd.read_csv(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 5\qrels-covid_d5_j0.5-5.txt",sep=' ',header=None)
        Article_Data_Cord_File_DF_Result_5['Batch'] = Article_Data_Cord_File_DF_Result_5.shape[0] * ['5']
        Article_Data_Cord_File_DF_Result_5[0] = Article_Data_Cord_File_DF_Result_5[0] + Article_Data_Cord_File_DF_Result_4[0][Article_Data_Cord_File_DF_Result_4.shape[0]-1]
 In [9]: Article_Data_Cord_File_DF_Result = pd.concat([Article_Data_Cord_File_DF_Result_3,Article_Data_Cord_File_DF_Result_4,Article_Data_Cord_File_DF_Result_5],ignore_index=True)
        Article_Data_Cord_File_DF_Result[0] = Article_Data_Cord_File_DF_Result[0].progress_apply(str)
                      | 0/178007 [00:00<?, ?it/s]
        Loading the Round 1 Questions for Word2Vec Model (Gensim)
In [10]: Article_Data_Cord_File_DF_Ques_1 = pd.read_xml(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 1\topics-rnd1.xml")
In [11]: Article_Data_Cord_File_DF_Ques_1['batch'] = Article_Data_Cord_File_DF_Ques_1.shape[0] * ['1']
        Loading the Round 2 Questions for Word2Vec Model (Gensim)
In [12]: Article_Data_Cord_File_DF_Ques_2 = pd.read_xml(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 2\topics-rnd2.xml")
In [13]: Article_Data_Cord_File_DF_Ques_2['batch'] = Article_Data_Cord_File_DF_Ques_2.shape[0] * ['2']
        Loading the Round 3 Questions for Word2Vec Model (Gensim)
In [14]: Article_Data_Cord_File_DF_Ques_3 = pd.read_xml(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 3\topics-rnd3.xml")
In [15]: Article_Data_Cord_File_DF_Ques_3['batch'] = Article_Data_Cord_File_DF_Ques_3.shape[0] * ['3']
        Loading the Round 4 Questions for Word2Vec Model (Gensim)
In [16]: Article_Data_Cord_File_DF_Ques_4 = pd.read_xml(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 4\topics-rnd4.xml")
In [17]: Article_Data_Cord_File_DF_Ques_4['batch'] = Article_Data_Cord_File_DF_Ques_4.shape[0] * ['4']
        Loading the Round 5 Questions for Word2Vec Model (Gensim)
In [18]: Article_Data_Cord_File_DF_Ques_5 = pd.read_xml(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\Kaggle\Round 5\topics-rnd5.xml")
In [19]: Article_Data_Cord_File_DF_Ques_5['batch'] = Article_Data_Cord_File_DF_Ques_5.shape[0] * ['5']
        Concatenating the Round 1 to Round 5 Questions for Word2Vec Model (Gensim)
In [20]: Article_Data_Cord_File_DF_Ques = pd.concat([Article_Data_Cord_File_DF_Ques_3,Article_Data_Cord_File_DF_Ques_4,Article_Data_Cord_File_DF_Ques_5],ignore_index=True)
In [21]: Article_Data_Cord_File_DF_Ques['number'] = list(range(1,Article_Data_Cord_File_DF_Ques.shape[0]+1))
In [22]: Article_Data_Cord_File_DF_Ques_Use = (Article_Data_Cord_File_DF_Ques).copy()
         Article_Data_Cord_File_DF_Ques_Use.rename(columns = {'number':'Doc_Id_Meta_Parse'}, inplace = True)
In [23]: Article_Data_Cord_File_DF_Ques_Use_1 = Article_Data_Cord_File_DF_Ques_Use[['Doc_Id_Meta_Parse','query']].copy()
        Article_Data_Cord_File_DF_Ques_Use_2 = Article_Data_Cord_File_DF_Ques_Use[['Doc_Id_Meta_Parse','question']].copy()
        Article_Data_Cord_File_DF_Ques_Use_3 = Article_Data_Cord_File_DF_Ques_Use[['Doc_Id_Meta_Parse', 'narrative']].copy()
        Article_Data_Cord_File_DF_Ques_Use_1.rename(columns = {'query':'Sentences'}, inplace = True)
        Article_Data_Cord_File_DF_Ques_Use_2.rename(columns = {'question':'Sentences'}, inplace = True)
        Article_Data_Cord_File_DF_Ques_Use_3.rename(columns = {'narrative':'Sentences'}, inplace = True)
        Article_Data_Cord_File_DF_Ques_Use_1['Type'] = Article_Data_Cord_File_DF_Ques_Use_1.shape[0] * ['Query']
        Article_Data_Cord_File_DF_Ques_Use_2['Type'] = Article_Data_Cord_File_DF_Ques_Use_2.shape[0] * ['Question']
        Article_Data_Cord_File_DF_Ques_Use_3['Type'] = Article_Data_Cord_File_DF_Ques_Use_2.shape[0] * ['Narrative']
In [24]: del Article_Data_Cord_File_DF_Ques_Use
        Article_Data_Cord_File_DF_Ques_Use = pd.DataFrame()
In [25]: Article_Data_Cord_File_DF_Ques_Use = pd.concat([Article_Data_Cord_File_DF_Ques_Use_1,Article_Data_Cord_File_DF_Ques_Use_2,Article_Data_Cord_File_DF_Ques_Use_3],ignore_index=True)
In [26]: Article_Data_Cord_File_DF_Ques_Use['Doc_Id_Meta_Parse'] = Article_Data_Cord_File_DF_Ques_Use['Doc_Id_Meta_Parse'].progress_apply(str)
                      | 0/600 [00:00<?, ?it/s]
        Loading the Abstract Tokens for Word2Vec Model Training (Gensim)
In [27]: Article_Data_Cord_File_DF_Abstract_Tokens = pd.read_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_abstract_tokens.pkl")
In [28]: Article_Data_Cord_File_DF_Abstract_Tokens.columns = ['Doc_Id_Meta_Parse','Tokens']
In [29]: Article_Data_Cord_File_DF_Abstract_Tokens['Type'] = Article_Data_Cord_File_DF_Abstract_Tokens.shape[0] * ['Abstract']
        Loading the Body Text Tokens for Word2Vec Model Training (Gensim)
In [30]: Article_Data_Cord_File_DF_Body_Text_Tokens = pd.read_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_body_text_tokens.pkl")
In [31]: Article_Data_Cord_File_DF_Body_Text_Tokens.columns = ['Doc_Id_Meta_Parse','Tokens']
In [32]: Article_Data_Cord_File_DF_Body_Text_Tokens['Type'] = Article_Data_Cord_File_DF_Body_Text_Tokens.shape[0] * ['Body Text']
        Tokenizing Question Text for Word2Vec Model (Gensim)
        import tensorflow as tf
In [34]: Article_Data_Cord_File_DF_Ques_Use_Tokens = pd.DataFrame()
        Article_Data_Cord_File_DF_Ques_Use_Tokens['Doc_Id_Meta_Parse'] = Article_Data_Cord_File_DF_Ques_Use['Doc_Id_Meta_Parse']
        Article_Data_Cord_File_DF_Ques_Use_Tokens['Tokens'] = Article_Data_Cord_File_DF_Ques_Use_Tokens.shape[0] * [0]
        Article_Data_Cord_File_DF_Ques_Use_Tokens = Article_Data_Cord_File_DF_Ques_Use_Tokens.astype('object')
        Article_Data_Cord_File_DF_Ques_Use_Tokens['Tokens'] = Article_Data_Cord_File_DF_Ques_Use['Sentences'].progress_apply(tf.keras.preprocessing.text.text_to_word_sequence)
        Article_Data_Cord_File_DF_Ques_Use_Tokens['Type'] = Article_Data_Cord_File_DF_Ques_Use['Type']
                      | 0/600 [00:00<?, ?it/s]
        Concatenating the Abstract, Body Text and Questions for Word2Vec Model (Gensim)
In [35]: Article_Data_Cord_File_DF_Abstract_Body_Text_Ques_Tokens = pd.concat([Article_Data_Cord_File_DF_Body_Text_Tokens, Article_Data_Cord_File_DF_Ques_Use_Tokens], ignore_index=True)
In [36]: Article_Data_Cord_File_List_Abstract_Body_Text_Ques_Tokens = Article_Data_Cord_File_DF_Abstract_Body_Text_Ques_Tokens['Tokens'].to_list()
        Article_Data_Cord_File_List_Abstract_Body_Text_Ques_Tags = Article_Data_Cord_File_DF_Abstract_Body_Text_Ques_Tokens['Doc_Id_Meta_Parse'].to_list()
        Creating Word2Vec Model and Training it (Gensim)
In [37]: import gensim
In [38]: Word2Vec_Model_Abstract_Body_Text_Ques = gensim.models.word2vec.Word2Vec(vector_size=100, min_count=2, epochs=20, workers=4)
```

In [39]: Word2Vec_Model_Abstract_Body_Text_Ques.build_vocab(Article_Data_Cord_File_DF_Abstract_Body_Text_Ques_Tokens['Tokens'].to_list())

In [45]: Article_Data_Cord_File_DF_Abstract['Sentence Embeddings'] = Article_Data_Cord_File_DF_Abstract_Tokens['Tokens'].progress_apply(row_sentence_emb_gen_numpy)

Article_Data_Cord_File_DF_Abstract = (Article_Data_Cord_File_DF_Abstract.loc[~(Article_Data_Cord_File_DF_Abstract['Sentence Embeddings'] == 'NA/NAN'),:]).reset_index(drop=True)

In [47]: Article_Data_Cord_File_DF_Abstract.to_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_abstract_sentence_embeddings_gensim_tokens.pkl")

In [46]: Article_Data_Cord_File_DF_Abstract['Sentence Embeddings'] = Article_Data_Cord_File_DF_Abstract['Sentence Embeddings'].fillna('NA/NAN')

Word2Vec_Model_Abstract_Body_Text_Ques_DF['Keys'] = Word2Vec_Model_Abstract_Body_Text_Ques.wv.index_to_key
Word2Vec_Model_Abstract_Body_Text_Ques_DF['Values'] = Word2Vec_Model_Abstract_Body_Text_Ques_DF.shape[0] * [0]

(264514457, 332815560)

In [44]: **import** warnings

warnings.filterwarnings("ignore")

| 0/122754 [00:00<?, ?it/s]

In [41]: Word2Vec_Model_Abstract_Body_Text_Ques_DF = pd.DataFrame()

In [40]: Word2Vec_Model_Abstract_Body_Text_Ques.train(Article_Data_Cord_File_DF_Abstract_Body_Text_Ques.corpus_count, epochs=Word2Vec_Model_Abstract_Body_Text_Ques.train(Article_Data_Cord_File_DF_Abstract_Body_Text_Ques.epochs)

```
Body Text Tokens for Word2Vec Model Sentence Embeddings (Gensim) (Averaging Word Embedding)
In [48]: Article_Data_Cord_File_DF_Body_Text['Sentence Embeddings'] = Article_Data_Cord_File_DF_Body_Text_Tokens['Tokens'].progress_apply(row_sentence_emb_gen_numpy)
                          | 0/855743 [00:00<?, ?it/s]
In [49]: Article_Data_Cord_File_DF_Body_Text['Sentence Embeddings'] = Article_Data_Cord_File_DF_Body_Text['Sentence Embeddings'].fillna('NA/NAN')
          Article_Data_Cord_File_DF_Body_Text = (Article_Data_Cord_File_DF_Body_Text.loc[~(Article_Data_Cord_File_DF_Body_Text['Sentence Embeddings'] == 'NA/NAN'),:]).reset_index(drop=True)
In [50]: import warnings
           warnings.filterwarnings("always")
In [51]: Article_Data_Cord_File_DF_Body_Text.to_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_body_text_sentence_embeddings_gensim_tokens.pkl")
          Creating Sentence Embeddings of Questions
In [52]: Article_Data_Cord_File_DF_Ques.rename(columns = {'number':'Doc_Id_Meta_Parse','query':'Query','question':'Question','narrative':'Narrative','batch':'Batch'}, inplace = True)
          import tensorflow as tf
In [54]: Article_Data_Cord_File_DF_Ques_Tokens = pd.DataFrame()
          Article_Data_Cord_File_DF_Ques_Tokens['Doc_Id_Meta_Parse'] = Article_Data_Cord_File_DF_Ques['Doc_Id_Meta_Parse'].to_list()
In [55]: Article_Data_Cord_File_DF_Ques_Tokens['Query_Tokens'] = Article_Data_Cord_File_DF_Ques['Query'].progress_apply(tf.keras.preprocessing.text.text_to_word_sequence)
          Article_Data_Cord_File_DF_Ques_Tokens['Question_Tokens'] = Article_Data_Cord_File_DF_Ques['Question'].progress_apply(tf.keras.preprocessing.text.text_to_word_sequence)
          Article_Data_Cord_File_DF_Ques_Tokens['Narrative_Tokens'] = Article_Data_Cord_File_DF_Ques['Narrative'].progress_apply(tf.keras.preprocessing.text.text_to_word_sequence)
            0%
                           | 0/200 [00:00<?, ?it/s]
            0%|
                           | 0/200 [00:00<?, ?it/s]
                           | 0/200 [00:00<?, ?it/s]
          Article_Data_Cord_File_DF_Ques_Tokens['Batch'] = Article_Data_Cord_File_DF_Ques['Batch'].to_list()
          Article_Data_Cord_File_DF_Ques_Tokens.to_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_ques_tokens.pkl")
          Article_Data_Cord_File_DF_Ques.to_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_ques.pkl")
In [59]: Article_Data_Cord_File_DF_Ques['Query Sentence Embeddings'] = Article_Data_Cord_File_DF_Ques_Tokens'].progress_apply(row_sentence_emb_gen_numpy)
          Article_Data_Cord_File_DF_Ques['Question Sentence Embeddings'] = Article_Data_Cord_File_DF_Ques_Tokens['Question_Tokens'].progress_apply(row_sentence_emb_gen_numpy)
          Article_Data_Cord_File_DF_Ques['Narrative Sentence Embeddings'] = Article_Data_Cord_File_DF_Ques_Tokens['Narrative_Tokens'].progress_apply(row_sentence_emb_gen_numpy)
            0%
                           | 0/200 [00:00<?, ?it/s]
            0%|
                           | 0/200 [00:00<?, ?it/s]
                           | 0/200 [00:00<?, ?it/s]
          def row_concatenate_embeddings(row_query,row_question,row_narrative):
               return np.concatenate((row_query,row_question,row_narrative),axis=0)
In [61]: Article_Data_Cord_File_DF_Ques['Concatenated Sentence Embeddings'] = Article_Data_Cord_File_DF_Ques.progress_apply(lambda x: row_concatenate_embeddings'],x['Question Sentence Embeddings'],x['Question Sentence Embeddings'],x['Narrative Sentence Embeddings']),axis=1)
                           | 0/200 [00:00<?, ?it/s]
In [62]: def row_mean_embeddings(row_query,row_question,row_narrative):
               return np.mean((row_query,row_question,row_narrative),axis=0)
In [63]: Article_Data_Cord_File_DF_Ques['Mean Sentence Embeddings'] = Article_Data_Cord_File_DF_Ques['Mean Sentence Embeddings'],x['Question S
                          | 0/200 [00:00<?, ?it/s]
In [64]: Article_Data_Cord_File_DF_Abstract_Body_Text_Ques_Tokens.to_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_abstract_body_text_ques_tokens.pkl")
In [65]: Article_Data_Cord_File_DF_Ques.to_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df_abstract_body_text_ques_sentence_embeddings_gensim_tokens.pkl")
          Loading Cord-19 Sentence Embeddings
          from gensim.models import KeyedVectors
          Cord_19_Doc_Embeddings = KeyedVectors.load_word2vec_format(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\cord_19_embeddings_filtered.csv",no_header=True,binary=False)
          D:\Users\krita\Anaconda3\envs\R_Python\lib\site-packages\gensim\models\keyedvectors.py:1723: ResourceWarning: unclosed file <_io.BufferedReader name='D:\\UoA\\Tri 2\\Big Data Analysis and Projects\\Week 8\\archive\\cord_19_embeddings\\cord_19_embeddings_filtered.csv'>
            return _load_word2vec_format(
          ResourceWarning: Enable tracemalloc to get the object allocation traceback
In [67]: Cord_19_Doc_Embeddings_DF = pd.DataFrame()
          Cord_19_Doc_Embeddings_DF = Cord_19_Doc_Embeddings_DF.astype('object')
          Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'] = list(Cord_19_Doc_Embeddings.index_to_key)
          Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'] = Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'].fillna('')
          Cord_19_Doc_Embeddings_DF['Document Embeddings'] = list(Cord_19_Doc_Embeddings.vectors)
In [68]: Cord_19_Doc_Embeddings_DF = Cord_19_Doc_Embeddings_DF.loc[~(Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'] == ''),:].reset_index(drop=True)
          Padding the Sentence Embeddings of Questions, Abstract and Body Text to have equal Dimension
In [69]: Cord_19_Length_Concate_Ques = Cord_19_Doc_Embeddings_DF['Document Embeddings'][0].shape[0] - Article_Data_Cord_File_DF_Ques['Concatenated Sentence Embeddings'][0].shape[0]
          Cord_19_Length_Mean_Ques = Cord_19_Doc_Embeddings_DF['Document Embeddings'][0].shape[0] - Article_Data_Cord_File_DF_Ques['Mean Sentence Embeddings'][0].shape[0]
          Cord_19_Length_Abstract = Cord_19_Doc_Embeddings_DF['Document Embeddings'][0].shape[0] - Article_Data_Cord_File_DF_Abstract['Sentence Embeddings'][0].shape[0]
          Cord_19_Length_Body_Text = Cord_19_Doc_Embeddings'][0].shape[0] - Article_Data_Cord_File_DF_Body_Text['Sentence Embeddings'][0].shape[0]
In [70]: def row_padding_embeddings(row_embeddings,row_dimension):
               return np.pad(row_embeddings, (0, row_dimension), 'constant', constant_values=-1)
In [71]: Article_Data_Cord_File_DF_Ques['Concatenated Sentence Embeddings'] = Article_Data_Cord_File_DF_Ques['Concatenated Sentence Embeddings'].progress_apply(row_padding_embeddings,args=(Cord_19_Length_Concate_Ques,))
          Article_Data_Cord_File_DF_Ques['Mean Sentence Embeddings'] = Article_Data_Cord_File_DF_Ques['Mean Sentence Embeddings'].progress_apply(row_padding_embeddings,args=(Cord_19_Length_Mean_Ques,))
          Article_Data_Cord_File_DF_Abstract['Sentence Embeddings'] = Article_Data_Cord_File_DF_Abstract['Sentence Embeddings'].progress_apply(row_padding_embeddings,args=(Cord_19_Length_Abstract,))
          Article_Data_Cord_File_DF_Body_Text['Sentence Embeddings'] = Article_Data_Cord_File_DF_Body_Text['Sentence Embeddings'].progress_apply(row_padding_embeddings,args=(Cord_19_Length_Body_Text,))
                           | 0/200 [00:00<?, ?it/s]
                           | 0/200 [00:00<?, ?it/s]
                           | 0/122753 [00:00<?, ?it/s]
                           | 0/855742 [00:00<?, ?it/s]
          Loading Titles of All Documents in Cord-19
In [72]: Article_Data_Cord_File_DF = pd.read_pickle(r"D:\UoA\Tri 2\Big Data Analysis and Projects\Week 8\archive\cord_19_embeddings\article_data_cord_19_file_df.pkl")
In [73]: Article_Data_Cord_File_DF = Article_Data_Cord_File_DF.loc[Article_Data_Cord_File_DF['Doc_Id_Meta_Parse'].isin(list(Article_Data_Cord_File_DF_Abstract['Doc_Id_Meta_Parse'].unique())),:]
          Article_Data_Cord_File_DF = Article_Data_Cord_File_DF.loc[:,['Doc_Id_Meta_Parse','Title_Meta_Parse']].reset_index(drop=True)
In [74]: import gc
          gc.collect()
          print('',end='')
          Concatening Abstract and Body Text
In [75]: Article_Data_Cord_File_DF_Abstract_Body_Text = pd.concat([Article_Data_Cord_File_DF_Abstract,Article_Data_Cord_File_DF_Body_Text],ignore_index=True)
          Filtering Cord IDS
In [76]: Article_Data_Cord_File_DF_Result.columns = ['Ques_Id_Meta_Parse','1','Doc_Id_Meta_Parse','Relevance Score','Batch']
         Article_Data_Cord_File_DF_Abstract_Body_Text = pd.merge(Article_Data_Cord_File_DF_Result[['Doc_Id_Meta_Parse']], Article_Data_Cord_File_DF_Abstract_Body_Text, on="Doc_Id_Meta_Parse", how="inner")
In [78]: Article_Data_Cord_File_DF_Abstract_Body_Text.reset_index(drop=True,inplace=True)
In [79]: Cord_19_Doc_Embeddings_DF = pd.merge(Cord_19_Doc_Embeddings_DF,Article_Data_Cord_File_DF_Result[['Doc_Id_Meta_Parse']], on="Doc_Id_Meta_Parse", how="inner")
In [80]: Cord_19_Doc_Embeddings_DF.reset_index(drop=True,inplace=True)
          Extracting Relevant Sentences (Word2Vec Question Embedding Model)
In [81]: from scipy.spatial import distance
In [82]: from IPython.display import display, HTML
In [83]: pd.set_option('display.max_colwidth', None)
In [84]: summation = 0
          for Concat_Embeddings, Concat_Ques_ID in tqdm(zip(Article_Data_Cord_File_DF_Ques['Question Sentence Embeddings'],Article_Data_Cord_File_DF_Ques['Doc_Id_Meta_Parse']),total=Article_Data_Cord_File_DF_Ques.shape[0]):
               Concat_Embeddings = np.pad(Concat_Embeddings, (0, 668), 'constant', constant_values=-1)
               Cord_19_Doc_Embeddings_DF_Docu = pd.DataFrame()
               Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'] = Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'].copy()
               Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine'] = Cord_19_Doc_Embeddings_DF['Document Embeddings'].apply(distance.cosine, args=(Concat_Embeddings,))
               Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine'] = 1 - Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine']
               Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.sort_values(by='Document Embeddings Cosine',ascending=False).reset_index(drop=True)
               Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.iloc[0:50]
               Cord_19_Doc_Embeddings_DF_Docu_List_ID = Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'].to_list()
               Article_Data_Cord_File_DF_Abstract_Body_Text.Fin = Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc].
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = pd.DataFrame()
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Doc_Id_Meta_Parse']
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentences'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Sentences']
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Type'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Type']
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Sentence Embeddings'].apply(distance.cosine, args=(Concat_Embeddings,))
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine'] = 1 - Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine']
               Article_Data_Cord_File_DF_Relevant_Sentences = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.groupby(['Doc_Id_Meta_Parse'], sort=False, as_index=False)['Sentence Embeddings Cosine'].idxmax()
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.iloc[Article_Data_Cord_File_DF_Relevant_Sentences['Sentence Embeddings Cosine'].to_list()]
               Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.reset_index(drop=True,inplace=True)
               Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'].to_list()
               Article_Data_Cord_File_DF_Docu = Article_Data_Cord_File_DF.loc[Article_Data_Cord_File_DF['Doc_Id_Meta_Parse'].isin(Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu),:]
               Article_Data_Cord_File_DF_Docu.reset_index(drop=True,inplace=True)
               Article_Data_Cord_File_DF_Docu_Rel_Sen = pd.merge(Article_Data_Cord_File_DF_Docu,Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu, on="Doc_Id_Meta_Parse", how="inner")
               Article_Data_Cord_File_List_Docu_Rel_Sen = Article_Data_Cord_File_DF_Docu_Rel_Sen['Doc_Id_Meta_Parse'].to_list()
               Article_Data_Cord_File_DF_Result_Docu = Article_Data_Cord_File_DF_Result.loc[(Article_Data_Cord_File_DF_Result['Doc_Id_Meta_Parse'].isin(Article_Data_Cord_File_List_Docu_Rel_Sen)),:]
               sum_sub = Article_Data_Cord_File_DF_Result_Docu['Relevance Score'][0:10].sum()
               summation = summation+sum_sub
          print('\033[1m' + 'The Relevance Score of Question Sentence Embedding is:' + '\033[0m' + '\n')
          print(summation)
          print('\n')
                           | 0/200 [00:00<?, ?it/s]
          The Relevance Score of Question Sentence Embedding is:
          635
```

Extracting Relevant Sentences (Word2Vec Mean Embedding Model)

```
In [85]: summation = 0
         for Concat_Embeddings, Concat_Ques_ID in tqdm(zip(Article_Data_Cord_File_DF_Ques['Mean Sentence Embeddings'],Article_Data_Cord_File_DF_Ques['Doc_Id_Meta_Parse']),total=Article_Data_Cord_File_DF_Ques.shape[0]):
            Cord_19_Doc_Embeddings_DF_Docu = pd.DataFrame()
             Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'] = Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'].copy()
             Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine'] = Cord_19_Doc_Embeddings_DF['Document Embeddings'].apply(distance.cosine, args=(Concat_Embeddings,))
             Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine'] = 1 - Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine']
            Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.sort_values(by='Document Embeddings Cosine',ascending=False).reset_index(drop=True)
             Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.iloc[0:50]
             Cord_19_Doc_Embeddings_DF_Docu_List_ID = Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'].to_list()
             Article_Data_Cord_File_DF_Abstract_Body_Text.Fin = Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc].
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = pd.DataFrame()
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Doc_Id_Meta_Parse']
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentences'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Sentences']
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Type'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Type']
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Sentence Embeddings'].apply(distance.cosine, args=(Concat_Embeddings,))
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine'] = 1 - Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine']
             Article_Data_Cord_File_DF_Relevant_Sentences = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.groupby(['Doc_Id_Meta_Parse'], sort=False, as_index=False)['Sentence Embeddings Cosine'].idxmax()
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.iloc[Article_Data_Cord_File_DF_Relevant_Sentences['Sentence Embeddings Cosine'].to_list()]
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.reset_index(drop=True,inplace=True)
             Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'].to_list()
             Article_Data_Cord_File_DF_Docu = Article_Data_Cord_File_DF.loc[Article_Data_Cord_File_DF['Doc_Id_Meta_Parse'].isin(Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu),:]
             Article_Data_Cord_File_DF_Docu.reset_index(drop=True,inplace=True)
             Article_Data_Cord_File_DF_Docu_Rel_Sen = pd.merge(Article_Data_Cord_File_DF_Docu,Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu, on="Doc_Id_Meta_Parse", how="inner")
             Article_Data_Cord_File_List_Docu_Rel_Sen = Article_Data_Cord_File_DF_Docu_Rel_Sen['Doc_Id_Meta_Parse'].to_list()
             Article_Data_Cord_File_DF_Result_Docu = Article_Data_Cord_File_DF_Result.loc[(Article_Data_Cord_File_DF_Result['Doc_Id_Meta_Parse'].isin(Article_Data_Cord_File_List_Docu_Rel_Sen)),:]
             sum_sub = Article_Data_Cord_File_DF_Result_Docu['Relevance Score'][0:10].sum()
             summation = summation+sum_sub
         print('\n')
         print('\033[1m' + 'The Relevance Score of Mean Sentence Embedding is:' + '\033[0m' + '\n')
         print(summation)
        print('\n')
                       | 0/200 [00:00<?, ?it/s]
         The Relevance Score of Mean Sentence Embedding is:
```

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```
Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'] = Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'].copy()
    Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine'] = Cord_19_Doc_Embeddings_DF['Document Embeddings'].apply(distance.cosine, args=(Concat_Embeddings,))
    Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine'] = 1 - Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine']
    Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.sort_values(by='Document Embeddings Cosine',ascending=False).reset_index(drop=True)
    Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.iloc[0:50]
    Cord_19_Doc_Embeddings_DF_Docu_List_ID = Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'].to_list()
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin = Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc[(Article_Data_Cord_File_DF_Abstract_Body_Text.loc]].reset_index(drop=True)
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = pd.DataFrame()
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Doc_Id_Meta_Parse']
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentences'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Sentences']
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Type'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Type']
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Sentence Embeddings'].apply(distance.cosine, args=(Concat_Embeddings,))
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine'] = 1 - Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine']
    Article_Data_Cord_File_DF_Relevant_Sentences = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.groupby(['Doc_Id_Meta_Parse'], sort=False, as_index=False)['Sentence Embeddings Cosine'].idxmax()
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.iloc[Article_Data_Cord_File_DF_Relevant_Sentences['Sentence Embeddings Cosine'].to_list()]
    Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.reset_index(drop=True,inplace=True)
    Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'].to_list()
    Article_Data_Cord_File_DF_Docu = Article_Data_Cord_File_DF.loc[Article_Data_Cord_File_DF['Doc_Id_Meta_Parse'].isin(Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu),:]
    Article_Data_Cord_File_DF_Docu.reset_index(drop=True,inplace=True)
    Article_Data_Cord_File_DF_Docu_Rel_Sen = pd.merge(Article_Data_Cord_File_DF_Docu,Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu, on="Doc_Id_Meta_Parse", how="inner")
    Article_Data_Cord_File_List_Docu_Rel_Sen = Article_Data_Cord_File_DF_Docu_Rel_Sen['Doc_Id_Meta_Parse'].to_list()
    Article_Data_Cord_File_DF_Result_Docu = Article_Data_Cord_File_DF_Result.loc[(Article_Data_Cord_File_DF_Result['Doc_Id_Meta_Parse'].isin(Article_Data_Cord_File_List_Docu_Rel_Sen)),:]
    sum_sub = Article_Data_Cord_File_DF_Result_Docu['Relevance Score'][0:10].sum()
    summation = summation+sum_sub
print('\n')
print('\033[1m' + 'The Relevance Score of Concatenated Sentence Embedding is:' + '\033[0m' + '\n')
print(summation)
print('\n')
              | 0/200 [00:00<?, ?it/s]
The Relevance Score of Concatenated Sentence Embedding is:
```

```
Concatenated Word2Vec Model ChatBot (Making ChatBot of only Best Model) (Extracting Relevant Sentences)
In [88]: while (True):
              Cord_19_User_Input = input("\nEnter the Question: \nEnter Command 'List All Questions' to see All Available Questions \nEnter Command 'Close' to Close ChatBot\n\n")
              if Cord_19_User_Input == 'Close':
                break
              elif Cord_19_User_Input == 'List All Questions':
                 display(HTML(Article_Data_Cord_File_DF_Ques[['Question']].copy().to_html()))
              elif ~(Article_Data_Cord_File_DF_Ques['Question'].isin([Cord_19_User_Input]).any()):
                  print("\nPlease Enter Another Question, the Sentence Embeddings does not exist for this Question")
                  continue
              else:
              Cord_19_Doc_Embeddings_DF_Docu = pd.DataFrame()
              Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'] = Cord_19_Doc_Embeddings_DF['Doc_Id_Meta_Parse'].copy()
              Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings'].progress_apply(distance.cosine, args=(Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc],))
              Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine'] = 1 - Cord_19_Doc_Embeddings_DF_Docu['Document Embeddings Cosine']
              Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.sort_values(by='Document Embeddings Cosine',ascending=False).reset_index(drop=True)
              Cord_19_Doc_Embeddings_DF_Docu = Cord_19_Doc_Embeddings_DF_Docu.iloc[0:50]
              Cord_19_Doc_Embeddings_DF_Docu_List_ID = Cord_19_Doc_Embeddings_DF_Docu['Doc_Id_Meta_Parse'].to_list()
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin = Article_Data_Cord_File_DF_Abstract_Body_Text['Doc_Id_Meta_Parse'].isin(Cord_19_Doc_Embeddings_DF_Docu_List_ID),:].reset_index(drop=True)
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = pd.DataFrame()
             Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Doc_Id_Meta_Parse']
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentences'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Sentences']
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Type'] = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin['Type']
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings'].apply(distance.cosine, args=(Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc[Article_Data_Cord_File_DF_Ques.loc]],))
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine'] = 1 - Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Sentence Embeddings Cosine']
              Article_Data_Cord_File_DF_Relevant_Sentences = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.groupby(['Doc_Id_Meta_Parse'], sort=False, as_index=False)['Sentence Embeddings Cosine'].idxmax()
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.iloc[Article_Data_Cord_File_DF_Relevant_Sentences['Sentence Embeddings Cosine'].to_list()]
              Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu.reset_index(drop=True,inplace=True)
              Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu = Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu['Doc_Id_Meta_Parse'].to_list()
             Article_Data_Cord_File_DF_Docu = Article_Data_Cord_File_DF.loc[Article_Data_Cord_File_DF['Doc_Id_Meta_Parse'].isin(Article_Data_Cord_File_List_Abstract_Body_Text_Fin_Docu),:]
Article_Data_Cord_File_DF_Docu.reset_index(drop=True,inplace=True)
              Article_Data_Cord_File_DF_Docu_Rel_Sen = pd.merge(Article_Data_Cord_File_DF_Docu,Article_Data_Cord_File_DF_Abstract_Body_Text_Fin_Docu, on="Doc_Id_Meta_Parse", how="inner")
              print('\033[1m' + 'The Loaded Meta Dataset is:' + '\033[0m' + '\n')
              display(HTML(Article_Data_Cord_File_DF_Docu_Rel_Sen.loc[0:9,['Title_Meta_Parse','Sentences']].to_html()))
```

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print('\n')

0 1 2 3	what is	Question s the origin of COVID-19
3	how does the coronavirus respond to will SARS-CoV2 infected people develop immunity? Is cre	changes in the weather
4	what cause what drugs have been active against SARS-CoV or SARS-C	es death from Covid-19? CoV-2 in animal studies?
5 6	what types of rapid testing for Covid-19	tibodies to coronavirus?
7 8	how has lack of testing availability led to underreporting of true	e incidence of Covid-19?
9 10	has social distancing had an impact on slowing the what are the guidelines for triaging patients info	
11 12	what are best practices in hospitals and at home in r	
13 14	what evidence is there related to CC how long can the coronavir	
15 16	how long does coronavirus rer are there any clinical trials avail	
17 18	what are the best masks for preventing what type of hand sanitizer is need.	g infection by Covid-19?
19	are patients taking Angiotensin-converting enzyme inhibitors (ACE) at incre	eased risk for COVID-19?
21	are cardiac complications likely in put what kinds of complications related to COVID-19 are associ	patients with COVID-19?
23	what kinds of complications related to COVID-19 are a	associated with diabetes
24 25		symptoms of Covid-19?
26 27	what is known about those infected with Covid-19 what evidence is there for the value of hydroxychloroqui	,
28 wh 29	nich SARS-CoV-2 proteins-human proteins interactions indicate potential for drug targets. Are there approved drugs that can be repurposed bas is remdesivir an effective	
30 31	what is how does the coronavirus respond to	s the origin of COVID-19 changes in the weather
32 33	will SARS-CoV2 infected people develop immunity? Is crew	oss protection possible? es death from Covid-19?
34 35	what drugs have been active against SARS-CoV or SARS-C	
36 37	are there serological tests that detect an	
38 39	how has CO has social distancing had an impact on slowing t	VID-19 affected Canada he spread of COVID-19?
40	what are the guidelines for triaging patients inf	fected with coronavirus?
41 42 43	what are best practices in hospitals and at home in respect to the transmission what evidence is there related to CC	n routes of coronavirus?
43 44 45	what evidence is there related to CC how long can the coronavirus rer	rus live outside the body
45 46	how long does coronavirus rer are there any clinical trials avail	able for the coronavirus
47 48	what are the best masks for preventing what type of hand sanitizer is need	ed to destroy Covid-19?
49 50	are patients taking Angiotensin-converting enzyme inhibitors (ACE) at incre what are the mortality rates overall and	d in specific populations
51 52	are cardiac complications likely in positions what kinds of complications related to COVID-19 are associ	ated with hypertension?
53 54	what kinds of complications related to COVID-19 are a	
55 56	what are the initial what is known about those infected with Covid-19	symptoms of Covid-19? but are asymptomatic?
57 58 wh	what evidence is there for the value of hydroxychloroquinich SARS-CoV-2 proteins-human proteins interactions indicate potential for drug targets. Are there approved drugs that can be repurposed based	_
59 60	is remdesivir an effective How does the coronavirus	treatment for COVID-19
61 62	Does SARS-CoV-2 have any subtypes, What vaccine candidates are bei	
63 64	What are the longer-term complications of those who r	recover from COVID-19?
65 66		s the origin of COVID-19
67	will SARS-CoV2 infected people develop immunity? Is cre	oss protection possible?
68 69	what drugs have been active against SARS-CoV or SARS-C	
70 71	what types of rapid testing for Covid-19	·
72 73	how has lack of testing availability led to underreporting of true	e incidence of Covid-19? OVID-19 affected Canada
74 75	has social distancing had an impact on slowing the social distance had a social dist	
76 77	what are best practices in hospitals and at home in r	
78 79	what evidence is there related to CC how long can the coronavir	
80 81	how long does coronavirus rer are there any clinical trials avail	
82 83	what are the best masks for preventing what type of hand sanitizer is need	-
84 85	are patients taking Angiotensin-converting enzyme inhibitors (ACE) at incre	eased risk for COVID-19?
86 87	are cardiac complications likely in positions what kinds of complications related to COVID-19 are associ	patients with COVID-19?
88	what kinds of complications related to COVID-19 are a	associated with diabetes
89 90		symptoms of Covid-19?
91 92	what is known about those infected with Covid-19 what evidence is there for the value of hydroxychloroquin	ne in treating Covid-19?
93 wh 94	nich SARS-CoV-2 proteins-human proteins interactions indicate potential for drug targets. Are there approved drugs that can be repurposed bas	sed on this information?
95	How does the coronavirus	
96	Does SARS-CoV-2 have any subtypes,	treatment for COVID-19 differ from seasonal flu?
97	Does SARS-CoV-2 have any subtypes, What vaccine candidates are bei What are the longer-term complications of those who re	treatment for COVID-19 differ from seasonal flu? and if so what are they? ing tested for Covid-19?
97 98 99	What vaccine candidates are bei	differ from seasonal flu? and if so what are they? ing tested for Covid-19? recover from COVID-19?
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	Question	
156	are there serological tests that detect antibodies to coronavirus?	
157		
158	how has COVID-19 affected Canada	
159	has social distancing had an impact on slowing the spread of COVID-19?	
160	what are the guidelines for triaging patients infected with coronavirus?	
161	what are best practices in hospitals and at home in maintaining quarantine?	
162	what are the transmission routes of coronavirus?	
163	what evidence is there related to COVID-19 super spreaders	
164	how long can the coronavirus live outside the body	
165	how long does coronavirus remain stable on surfaces?	
166	are there any clinical trials available for the coronavirus	
167	what are the best masks for preventing infection by Covid-19?	
168	what type of hand sanitizer is needed to destroy Covid-19?	
169 170	are patients taking Angiotensin-converting enzyme inhibitors (ACE) at increased risk for COVID-19?	
170	what are the mortality rates overall and in specific populations	
171	are cardiac complications likely in patients with COVID-19?	
172	what kinds of complications related to COVID-19 are associated with hypertension? what kinds of complications related to COVID-19 are associated with diabetes	
173	which biomarkers predict the severe clinical course of 2019-nCOV infection?	
175	what are the initial symptoms of Covid-19?	
176	what is known about those infected with Covid-19 but are asymptomatic?	
177	what evidence is there for the value of hydroxychloroquine in treating Covid-19?	
178	which SARS-CoV-2 proteins-human proteins interactions indicate potential for drug targets. Are there approved drugs that can be repurposed based on this information?	
179	is remdesivir an effective treatment for COVID-19	
180	How does the coronavirus differ from seasonal flu?	
181	Does SARS-CoV-2 have any subtypes, and if so what are they?	
182	What vaccine candidates are being tested for Covid-19?	
183	What are the longer-term complications of those who recover from COVID-19?	
184	What new public datasets are available related to COVID-19?	
185	What is the protein structure of the SARS-CoV-2 spike?	
186	What is the result of phylogenetic analysis of SARS-CoV-2 genome sequence?	
187	What is the mechanism of inflammatory response and pathogenesis of COVID-19 cases?	
188	What is the mechanism of cytokine storm syndrome on the COVID-19?	
189	What are the observed mutations in the SARS-CoV-2 genome and how often do the mutations occur?	
190	What are the impacts of COVID-19 among African-Americans that differ from the rest of the U.S. population?	
191	Does Vitamin D impact COVID-19 prevention and treatment?	
192	How has the COVID-19 pandemic impacted violence in society, including violent crimes?	
193	How much impact do masks have on preventing the spread of the COVID-19	
194	4 How has the COVID-19 pandemic impacted mental health	
195	what evidence is there for dexamethasone as a treatment for COVID-19?	
196	what are the health outcomes for children who contract COVID-19?	
197	what are the benefits and risks of re-opening schools in the midst of the COVID-19 pandemic?	
198	do individuals who recover from COVID-19 show sufficient immune response, including antibody levels and T-cell mediated immunity, to prevent re-infection?	

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The Loaded Meta Dataset is:

	Title_Meta_Parse	Sentences
Nasal Airway Obstruction Study (NAIROS): a phase III, open-	abel, mixed-methods, multicentre randomised controlled trial of septoplasty versus medical management of a septal deviation with nasal obstruction	On the sidewalls of the nose are 'turbinates', tissue structures which are rich in blood vessels and glands.
1	Simulation Based Exploration of Bacterial Cross Talk Between Spatially Separated Colonies in a Multispecies Biofilm Community	Cross-talk refers to bacteria of one species or strain responding to signals produced by another one [3, 4] .
2	On the utility of cloth facemasks for controlling ejecta during respiratory events	SARS-CoV2, the virus responsible for the Covid-19 pandemic, infects cells in the upper respiratory system.
3	Abnormal pulmonary function in COVID-19 patients at time of hospital discharge	However, until now, there is no report in regard to pulmonary function in discharged COVID-19 survivors.
4	The Italian paediatric society raccomandations on children and adolescents extra-domestic activities during the SARS COV-2 emergency phase 2	Abbreviations COVID-19: Novel coronavirus; SARS COV 2: Severe acute respiratory syndrome coronavirus 2
5	Anosmia and Dysgeusia in the Absence of Other Respiratory Diseases: Should COVID-19 Infection Be Considered?	SARS-CoV-2 is a novel Coronavirus which was first detected in China and is now spreading globally [1] .
6	Anosmia and ageusia are emerging as symptoms in patients with COVID-19: What does the current evidence say? Currently, there is no published evidence or case reports noting anosmia or ageusia as symptoms of Covince of Co	
7	Triage	How triage is applied differs across the surge response spectrum from conventional to crisis response.
8	Pediatric anesthetic implications of COVID-19—A review of current literature	15 A study from Japan that looked at 2496 people who were exposed to the virus found 313 positive cases.

Revisión sistemática sobre la utilidad pronóstica del dímero-D, coagulación intravascular diseminada y tratamiento anticoagulante en pacientes graves con COVID-19

These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

what is known about an mRNA vaccine for the SARS-CoV-2 virus?

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The Loaded Meta Dataset is:

Sentence	Title_Meta_Parse
For NAIROS, it is anticipated that baseline severity will be the most important determinant of outcome	0 Nasal Airway Obstruction Study (NAIROS): a phase III, open-label, mixed-methods, multicentre randomised controlled trial of septoplasty versus medical management of a septal deviation with nasal obstruction
The results from this fundamental study should guide the design of ssDNA probe for anti-sense sensing	1 Fiber Optic Particle Plasmon Resonance Biosensor for Label-Free Detection of Nucleic Acids and Its Application to HLA-B27 mRNA Detection in Patients with Ankylosing Spondylitis
This concept of cross-talk challenges the notion that quorum sensing is purely an autoinduction mechanism	2 Simulation Based Exploration of Bacterial Cross Talk Between Spatially Separated Colonies in a Multispecies Biofilm Community
Despite its high prevalence, a sound understanding of the mechanisms underlying mTBI remains elusive	Recurrent Neural Network-based Acute Concussion Classifier using Raw Resting State EEG Data
This will help to determine water hotspots that are often critical to structure-based drug development	4 Deep learning model can predict water binding sites on the surface of proteins using limited-resolution data
It can be seen that as the particle velocity increases, the stress distribution in the substrate is higher	5 Effect of Velocity and Impact Angle on Residual Stress Generation in Cold Spray Process – A Molecular Dynamics Simulation Study
This has been cited 15 as an important factor in controlling the transmission of Covid-19 infections	6 On the utility of cloth facemasks for controlling ejecta during respiratory events
Recently, a special mode of pollutant transmission, known as interunit dispersion, has gained popularity	7 Investigation of interunit dispersion in 2D street canyons: A scaled outdoor experiment
Study data refer to a single center and are related to a specific population in our metropolitan area	8 Management of diabetic persons with foot ulceration during COVID-19 health care emergency: effectiveness of a new triage pathway
They may wonder if echocardiographic examinations could become so automated that sonographers become obsolete	9 Artificial Intelligence and Echocardiography: A Primer for Cardiac Sonographers