

#### Assignment-4

Assignment date	09-10-2022
Student Name	Logesh K
Student Roll Number	610819106028
Maximum Mark	2 mark

### Importing the libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from keras.models import Model, Sequential
from keras.layers import LSTM, Activation, Dense, Dropout, Input,
Embedding
from keras.optimizers import Adam
from keras.preprocessing.text import Tokenizer
from keras.preprocessing import sequence
from keras.utils import pad_sequences
from keras.utils import to_categorical
from keras.callbacks import EarlyStopping
%matplotlib inline

from google.colab import drive
drive.mount('/content/drive')

Mounted at /content/drive
```

### Reading the dataset

```
df = pd.read_csv('/content/drive/MyDrive/spam.csv', encoding='latin-1')
df.head()
```

	v1	v2	Unnamed: 2
\			
0	ham	Go until jurong point, crazy.. Available only ...	NaN
1	ham	Ok lar... Joking wif u oni...	NaN
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	NaN
3	ham	U dun say so early hor... U c already then say...	NaN
4	ham	Nah I don't think he goes to usf, he lives aro...	NaN

	Unnamed: 3	Unnamed: 4
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	NaN	NaN

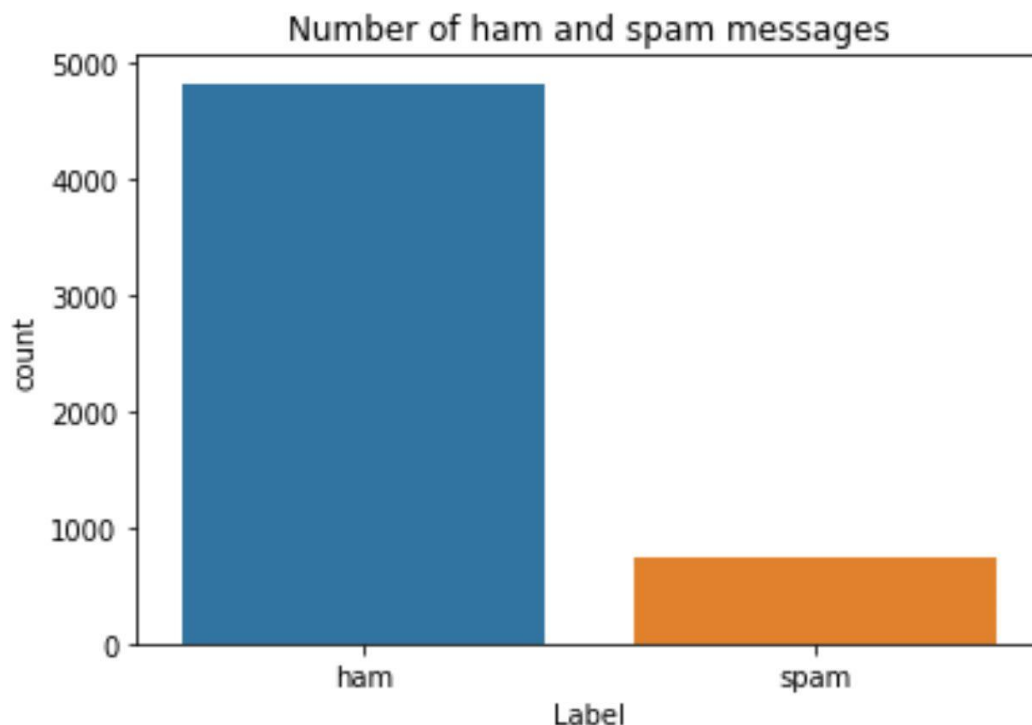
```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'], axis=1, inplace=True)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype
---  -
 0    v1      5572 non-null    object
 1    v2      5572 non-null    object
dtypes: object(2)
memory usage: 87.2+ KB
```

```
sns.countplot(df.v1)
plt.xlabel('Label')
plt.title('Number of ham and spam messages')
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py: 43:
FutureWarning: Pass the following variable as a keyword arg: x. From
version 0.12, the only valid positional argument will be `data`, and
passing other arguments without an explicit keyword will result in an
error or misinterpretation.
FutureWarning
```

```
Text(0.5, 1.0, 'Number of ham and spam messages')
```



```

X = df.v2
Y = df.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)

X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.15)

```

### Process the data

```

max_words = 1000
max_len = 150
tok = Tokenizer(num_words=max_words)
tok.fit_on_texts(X_train)
sequences = tok.texts_to_sequences(X_train)
sequences_matrix = pad_sequences(sequences,maxlen=max_len)
sequences_matrix

array([[ 0,  0,  0, ..., 15,  2, 27],
       [ 0,  0,  0, ..., 260, 10,  2],
       [ 0,  0,  0, ..., 13, 222, 23],
       ...,
       [ 0,  0,  0, ..., 259,  9, 11],
       [ 0,  0,  0, ..., 16, 10, 353],
       [ 0,  0,  0, ..., 901, 200, 196]], dtype=int32)

```

```
tok.index_word
```

```

{1: 'i',
 2: 'to',
 3: 'you',
 4: 'a',
 5: 'the',
 6: 'u',
 7: 'and',
 8: 'in',
 9: 'is',
10: 'me',
11: 'my',
12: 'for',
13: 'your',
14: 'it',
15: 'of',
16: 'call',
17: 'have',
18: 'on',
19: 'that',
20: 'now',
21: '2',
22: 'are',
23: 'so',

```

24: 'not',  
25: 'or',  
26: 'but',  
27: 'do',  
28: 'can',  
29: 'ur',  
30: 'at',  
31: 'get',  
32: "i'm",  
33: 'if',  
34: 'will',  
35: 'be',  
36: 'just',  
37: 'with',  
38: 'no',  
39: 'we',  
40: 'this',  
41: '4',  
42: 'up',  
43: 'gt',  
44: 'lt',  
45: 'ok',  
46: 'when',  
47: 'from',  
48: 'free',  
49: 'how',  
50: 'all',  
51: 'go',  
52: 'know',  
53: 'out',  
54: 'what',  
55: 'like',  
56: 'then',  
57: 'got',  
58: 'come',  
59: 'good',  
60: 'was',  
61: 'am',  
62: 'only',  
63: 'love',  
64: 'its',  
65: 'day',  
66: 'time',  
67: 'send',  
68: 'text',  
69: 'he',  
70: 'there',  
71: 'want',  
72: 'as',  
73: 'txt',

74: 'by',  
75: 'going',  
76: 'one',  
77: 'home',  
78: 'about',  
79: 'sorry',  
80: "i'll",  
81: 'lor',  
82: 'need',  
83: 'r',  
84: 'still',  
85: 'da',  
86: 'dont',  
87: 'back',  
88: 'stop',  
89: 'n',  
90: 'today',  
91: 'see',  
92: 'mobile',  
93: 'our',  
94: 'reply',  
95: "don't",  
96: 'take',  
97: 'tell',  
98: 'pls',  
99: 'k',  
100: 'please',  
101: 'she',  
102: 'later',  
103: 'hi',  
104: 'think',  
105: 'any',  
106: 'been',  
107: 'l',  
108: 'i',  
109: 'dear',  
110: 'they',  
111: 'her',  
112: 'much',  
113: 'phone',  
114: 'new',  
115: 'week',  
116: 'hope',  
117: 'did',  
118: 'who',  
119: 'here',  
120: 'night',  
121: 'some',  
122: 'msg',  
123: 'has',

124: 'claim',  
125: 'an',  
126: 'well',  
127: 'great',  
128: 'yes',  
129: 'too',  
130: 'd',  
131: 'where',  
132: 'had',  
133: 'make',  
134: 'more',  
135: 'e',  
136: 'oh',  
137: 'hey',  
138: "it's",  
139: 'message',  
140: 'him',  
141: 'way',  
142: 'number',  
143: 'c',  
144: 'tomorrow',  
145: 'happy',  
146: 'say',  
147: 'wat',  
148: 'work',  
149: 'give',  
150: 'right',  
151: 'should',  
152: 'amp',  
153: 'www',  
154: 'doing',  
155: 'prize',  
156: 'already',  
157: 'after',  
158: 'ask',  
159: 'cash',  
160: 'them',  
161: 'said',  
162: 'im',  
163: '3',  
164: 'why',  
165: 'meet',  
166: 'miss',  
167: 'yeah',  
168: 'last',  
169: 'really',  
170: 'very',  
171: 't',  
172: 'life',  
173: 'would',

174: 'morning',  
175: 'babe',  
176: 'find',  
177: 'b',  
178: 'cos',  
179: 'every',  
180: 'thanks',  
181: 'also',  
182: '150p',  
183: 'urgent',  
184: 'contact',  
185: 'pick',  
186: 'nokia',  
187: 'anything',  
188: 'win',  
189: 'sent',  
190: 'sure',  
191: 'let',  
192: 'won',  
193: 'buy',  
194: 'care',  
195: 'lol',  
196: 'min',  
197: "i' ve",  
198: 'keep',  
199: 'com',  
200: '5',  
201: 'cant',  
202: 'wait',  
203: 'over',  
204: 'uk',  
205: 'off',  
206: 'something',  
207: 'before',  
208: 'around',  
209: 'even',  
210: '50',  
211: 'many',  
212: 'tone',  
213: 'first',  
214: 'thing',  
215: 'could',  
216: 'next',  
217: 'which',  
218: 'feel',  
219: 'nice',  
220: 'again',  
221: 'leave',  
222: 'always',  
223: "can' t",

224: 'were',  
225: 'late',  
226: 'sleep',  
227: 'gonna',  
228: 'place',  
229: 'chat',  
230: 'his',  
231: 'soon',  
232: 'us',  
233: 'per',  
234: "that' s",  
235: 'co',  
236: 'money',  
237: 'customer',  
238: 'service',  
239: 'sms',  
240: 'x',  
241: 'down',  
242: 'friends',  
243: 'ya',  
244: 'dun',  
245: '16',  
246: 'wan',  
247: 'things',  
248: 'v',  
249: 'someone',  
250: 'help',  
251: 'hello',  
252: 's',  
253: 'waiting',  
254: 'coming',  
255: 'went',  
256: 'ìì',  
257: 'tonight',  
258: 'getting',  
259: 'wish',  
260: 'told',  
261: 'fine',  
262: 'same',  
263: 'name',  
264: 'special',  
265: 'thk',  
266: 'best',  
267: 'guaranteed',  
268: 'friend',  
269: 'year',  
270: 'heart',  
271: 'gud',  
272: 'holiday',  
273: 'done',



274: '18',  
275: 'mins',  
276: 'stuff',  
277: 'may',  
278: 'cs',  
279: 'thought',  
280: 'class',  
281: 'other',  
282: 'yet',  
283: "you're",  
284: '7',  
285: 'draw',  
286: 'thats',  
287: 'talk',  
288: 'try',  
289: 'people',  
290: 'having',  
291: 'line',  
292: 'haha',  
293: '6',  
294: 'man',  
295: 'never',  
296: 'person',  
297: 'yup',  
298: 'lot',  
299: 'better',  
300: 'lunch',  
301: 'long',  
302: 'meeting',  
303: 'being',  
304: 'cool',  
305: 'trying',  
306: 'few',  
307: 'y',  
308: '1st',  
309: 'days',  
310: 'use',  
311: 'mind',  
312: 'live',  
313: 'latest',  
314: 'camera',  
315: 'job',  
316: 'ill',  
317: 'wk',  
318: 'dat',  
319: 'check',  
320: 'god',  
321: 'big',  
322: 'car',  
323: 'ready',

324: 'guys',  
325: "didn' t",  
326: 'because',  
327: 'chance',  
328: 'real',  
329: 'awarded',  
330: 'shit',  
331: 'enjoy',  
332: 'shows',  
333: 'liao',  
334: 'girl',  
335: 'finish',  
336: 'bit',  
337: 'receive',  
338: 'åf1',  
339: 'wanna',  
340: 'smile',  
341: 'lar',  
342: 'end',  
343: 'guess',  
344: 'start',  
345: 'half',  
346: 'house',  
347: 'world',  
348: '150ppm',  
349: 'word',  
350: 'sweet',  
351: 'dinner',  
352: 'landline',  
353: 'sir',  
354: 'account',  
355: 'play',  
356: 'box',  
357: 'problem',  
358: 'watch',  
359: 'another',  
360: 'into',  
361: 'offer',  
362: 'luv',  
363: 'birthday',  
364: 'quite',  
365: '10',  
366: 'dis',  
367: 'cost',  
368: 'might',  
369: 'video',  
370: 'eat',  
371: 'than',  
372: 'xxx',  
373: 'apply',

374: 'ever',  
375: 'remember',  
376: 'rate',  
377: 'sat',  
378: '9',  
379: 'tv',  
380: 'left',  
381: 'thanx',  
382: 'early',  
383: 'plan',  
384: 'code',  
385: 'princess',  
386: 'does',  
387: 'kiss',  
388: 'jus',  
389: 'month',  
390: 'po',  
391: 'ringtone',  
392: 'part',  
393: 'forgot',  
394: 'll',  
395: 'bt',  
396: 'looking',  
397: 'yo',  
398: 'orange',  
399: 'didnt',  
400: 'speak',  
401: 'baby',  
402: 'bed',  
403: 'actually',  
404: 'nothing',  
405: 'probably',  
406: 'once',  
407: 'two',  
408: 'leh',  
409: 'dunno',  
410: 'ah',  
411: 'hear',  
412: 'fun',  
413: 'room',  
414: 'pay',  
415: "how's",  
416: 'maybe',  
417: 'look',  
418: 'aight',  
419: 'update',  
420: 'enough',  
421: 'face',  
422: 'åf1000',  
423: 'award',

424: 'minutes',  
425: 'texts',  
426: 'came',  
427: 'town',  
428: 'network',  
429: 'reach',  
430: 'weekend',  
431: 'collection',  
432: '8',  
433: 'wont',  
434: 'watching',  
435: 'pa',  
436: 'true',  
437: 'g',  
438: 'called',  
439: 'thank',  
440: 'hour',  
441: 'boy',  
442: 'put',  
443: 'since',  
444: 'while',  
445: '000',  
446: 'everything',  
447: '2nd',  
448: 'bad',  
449: 'between',  
450: 'fuck',  
451: 'm',  
452: "he's",  
453: 'school',  
454: 'sexy',  
455: 'join',  
456: 'wen',  
457: 'says',  
458: 'though',  
459: 'asked',  
460: 'selected',  
461: 'those',  
462: 'bring',  
463: 'evening',  
464: 'times',  
465: 'price',  
466: 'until',  
467: 'valid',  
468: 'details',  
469: 'tmr',  
470: 'most',  
471: 'entry',  
472: 'dad',  
473: 'shopping',

474: 'missing',  
475: 'shall',  
476: 'pain',  
477: 'den',  
478: 'goes',  
479: 'hav',  
480: 'away',  
481: 'plz',  
482: 'xmas',  
483: 'easy',  
484: 'anyway',  
485: 'working',  
486: 'office',  
487: 'wif',  
488: 'wake',  
489: 'made',  
490: 'afternoon',  
491: 'able',  
492: 'mail',  
493: 'little',  
494: 'de',  
495: 'top',  
496: 'yourself',  
497: 'plus',  
498: 'else',  
499: 'music',  
500: 'okay',  
501: 'wife',  
502: 'gift',  
503: 'saw',  
504: 'mob',  
505: 'attempt',  
506: 'driving',  
507: 'double',  
508: 'yours',  
509: "we're",  
510: 'till',  
511: 'bored',  
512: "there's",  
513: 'id',  
514: 'show',  
515: 'must',  
516: '£100',  
517: 'nite',  
518: 'test',  
519: 'collect',  
520: 'bus',  
521: 're',  
522: 'order',  
523: 'sae',

524: 'wants',  
525: 'means',  
526: 'ard',  
527: 'run',  
528: 'coz',  
529: 'messages',  
530: "won' t",  
531: 'worry',  
532: 'important',  
533: 'abt',  
534: 'colour',  
535: 'calls',  
536: 'tones',  
537: '10p',  
538: 'wot',  
539: 'wanted',  
540: 'weekly',  
541: 'making',  
542: 'todays',  
543: 'alright',  
544: 'guy',  
545: 'yesterday',  
546: 'family',  
547: 'hair',  
548: 'decimal',  
549: 'juz',  
550: 'sch',  
551: 'await',  
552: 'dude',  
553: 'without',  
554: 'wid',  
555: 'beautiful',  
556: 'national',  
557: 'full',  
558: 'saying',  
559: 'hours',  
560: 'til',  
561: '8007',  
562: 'hurt',  
563: 'date',  
564: 'tot',  
565: 'havent',  
566: 'words',  
567: 'pm',  
568: 'book',  
569: 'net',  
570: 'congrats',  
571: 'drive',  
572: 'lei',  
573: 'calling',

574: 'happen',  
575: 'feeling',  
576: 'comes',  
577: 'old',  
578: 'missed',  
579: 'email',  
580: 'pub',  
581: 'auction',  
582: 'points',  
583: 'ring',  
584: 'row',  
585: 'noe',  
586: 'friendship',  
587: 'sleeping',  
588: 'aft',  
589: '500',  
590: 'question',  
591: 'address',  
592: 'pic',  
593: 'final',  
594: 'charge',  
595: 'years',  
596: 'tried',  
597: 'mean',  
598: 'movie',  
599: 'stay',  
600: 'land',  
601: 'busy',  
602: 'brother',  
603: 'games',  
604: 'food',  
605: 'tomo',  
606: 'makes',  
607: 'online',  
608: 'second',  
609: 'everyone',  
610: 'both',  
611: 'answer',  
612: '£2000',  
613: "haven't",  
614: 'story',  
615: 'voucher',  
616: 'either',  
617: 'walk',  
618: 'dreams',  
619: 'trip',  
620: '86688',  
621: 'post',  
622: 'news',  
623: 'wil',

624: 'leaving',  
625: 'vouchers',  
626: 'private',  
627: 'dating',  
628: 'together',  
629: 'åf5000',  
630: 'these',  
631: 'started',  
632: '12hrs',  
633: 'haf',  
634: 'change',  
635: 'pics',  
636: 'eve',  
637: 'shop',  
638: 'card',  
639: 'believe',  
640: 'hot',  
641: 'oso',  
642: 'goin',  
643: 'rite',  
644: 'chikku',  
645: 'åf500',  
646: 'sad',  
647: 'choose',  
648: 'tho',  
649: 'break',  
650: 'don',  
651: 'alone',  
652: 'bonus',  
653: 'search',  
654: 'club',  
655: "c' s",  
656: 'prob',  
657: 'okie',  
658: 'lose',  
659: 'statement',  
660: 'close',  
661: 'game',  
662: 'available',  
663: 'anyone',  
664: 'expires',  
665: 'pobox',  
666: 'finished',  
667: 'angry',  
668: 'ha',  
669: 'kind',  
670: 'frnd',  
671: '11',  
672: 'cause',  
673: 'needs',



674: 'worth',  
675: '100',  
676: '08000930705',  
677: 'used',  
678: 'goodmorning',  
679: 'set',  
680: 'xx',  
681: 'mine',  
682: 'sounds',  
683: 'unsubscribe',  
684: 'minute',  
685: 'forget',  
686: '750',  
687: 'anytime',  
688: 'delivery',  
689: 'suite342',  
690: '2lands',  
691: 'sis',  
692: 'huh',  
693: "she's",  
694: 'pounds',  
695: 'lets',  
696: 'happened',  
697: 'drink',  
698: "what's",  
699: 'touch',  
700: 'hand',  
701: 'services',  
702: '30',  
703: 'identifier',  
704: 'knw',  
705: 'saturday',  
706: 'sister',  
707: 'gd',  
708: "''",  
709: 'mates',  
710: 'hard',  
711: 'neva',  
712: 'wonderful',  
713: 'lots',  
714: 'http',  
715: 'chennai',  
716: 'wit',  
717: 'company',  
718: 'sun',  
719: 'listen',  
720: 'åf3',  
721: 'lovely',  
722: 'far',  
723: 'took',

724: 'taking',  
725: 'light',  
726: 'meant',  
727: 'camcorder',  
728: 'gone',  
729: 'parents',  
730: 'pretty',  
731: 'gr8',  
732: "you' ve",  
733: 'sunday',  
734: 'content',  
735: 'head',  
736: 'thinks',  
737: 'savamob',  
738: 'smth',  
739: 'whatever',  
740: 'o',  
741: 'sea',  
742: 'boytoy',  
743: 'treat',  
744: 'friday',  
745: 'opt',  
746: 'whats',  
747: 'oredi',  
748: 'finally',  
749: 'visit',  
750: 'takes',  
751: 'gas',  
752: 'wrong',  
753: 'crazy',  
754: 'side',  
755: 'loving',  
756: "''",  
757: 'drop',  
758: 'girls',  
759: 'quiz',  
760: 'congratulations',  
761: 'fr',  
762: 'earlier',  
763: 'fancy',  
764: 'each',  
765: 'hold',  
766: 'phones',  
767: 'tel',  
768: 'tired',  
769: '08000839402',  
770: 'nope',  
771: 'offers',  
772: 'darlin',  
773: 'type',

774: "we' ll",  
775: 'etc',  
776: '2003',  
777: 'secret',  
778: 'wkly',  
779: 'fri',  
780: 'hows',  
781: 'bslvyl',  
782: 'hmm',  
783: 'w',  
784: 'mobileupd8',  
785: '800',  
786: 'un',  
787: 'thinking',  
788: 'smiling',  
789: 'their',  
790: 'ten',  
791: 'rs',  
792: 'outside',  
793: 'f',  
794: 'weeks',  
795: 'smoke',  
796: 'ltd',  
797: 'unlimited',  
798: 'bout',  
799: 'hmmm',  
800: 'winner',  
801: 'frnds',  
802: 'press',  
803: 'through',  
804: 'talking',  
805: 'charged',  
806: 'blue',  
807: 'rental',  
808: 'cut',  
809: 'download',  
810: 'nt',  
811: 'msgs',  
812: 'balance',  
813: 'currently',  
814: 'reading',  
815: 'uncle',  
816: 'college',  
817: 'india',  
818: "you' ll",  
819: 'fone',  
820: 'fucking',  
821: 'mate',  
822: 'valued',  
823: 'complimentary',

824: 'hee' ,  
825: 'march' ,  
826: 'ends' ,  
827: 'reveal' ,  
828: 'stupid' ,  
829: 'åf250' ,  
830: 'redeemed' ,  
831: '04' ,  
832: '20' ,  
833: 'lesson' ,  
834: 'tc' ,  
835: 'dnt' ,  
836: 'fast' ,  
837: 'mayb' ,  
838: 'awesome' ,  
839: 'credit' ,  
840: 'support' ,  
841: 'happiness' ,  
842: 'mobiles' ,  
843: 'bath' ,  
844: '\x89û' ,  
845: 'gets' ,  
846: 'almost' ,  
847: 'whole' ,  
848: 'couple' ,  
849: 'christmas' ,  
850: 'enter' ,  
851: '87066' ,  
852: 'park' ,  
853: 'laptop' ,  
854: 'yar' ,  
855: 'least' ,  
856: 'luck' ,  
857: 'via' ,  
858: 'cum' ,  
859: 'numbers' ,  
860: 'åf350' ,  
861: 'lost' ,  
862: 'gn' ,  
863: 'hg' ,  
864: 'hit' ,  
865: 'poly' ,  
866: 'mum' ,  
867: 'loads' ,  
868: 'info' ,  
869: 'player' ,  
870: 'caller' ,  
871: '03' ,  
872: 'call2optout' ,  
873: 'read' ,

874: ' ago' ,  
875: ' case' ,  
876: ' met' ,  
877: ' 12' ,  
878: ' freemsg' ,  
879: ' lovable' ,  
880: ' wlj6hl' ,  
881: ' comp' ,  
882: ' bcoz' ,  
883: ' die' ,  
884: ' song' ,  
885: ' open' ,  
886: ' remove' ,  
887: ' mom' ,  
888: ' age' ,  
889: ' darren' ,  
890: ' st' ,  
891: ' carlos' ,  
892: ' somebody' ,  
893: ' project' ,  
894: ' sending' ,  
895: ' frm' ,  
896: ' slowly' ,  
897: ' 0800' ,  
898: ' direct' ,  
899: ' found' ,  
900: ' welcome' ,  
901: ' within' ,  
902: ' mu' ,  
903: ' txtting' ,  
904: ' txts' ,  
905: ' simple' ,  
906: ' pass' ,  
907: ' lucky' ,  
908: ' months' ,  
909: ' checking' ,  
910: ' seen' ,  
911: ' ni8' ,  
912: ' operator' ,  
913: ' nyt' ,  
914: " doesn' t" ,  
915: ' callertune' ,  
916: ' booked' ,  
917: ' pray' ,  
918: ' seeing' ,  
919: ' åf10' ,  
920: ' picking' ,  
921: ' yep' ,  
922: ' åf2' ,  
923: ' gave' ,

924: 'correct',  
925: 'ans',  
926: 'hoping',  
927: 'b4',  
928: 'telling',  
929: 'comin',  
930: 'area',  
931: 'sony',  
932: 'bank',  
933: 'pete',  
934: "wasn' t",  
935: '00',  
936: 'computer',  
937: 'discount',  
938: 'std',  
939: 'ldn',  
940: 'normal',  
941: 'gym',  
942: 'somewhere',  
943: 'john',  
944: 'understand',  
945: 'kate',  
946: 'admirer',  
947: 'mrng',  
948: 'red',  
949: 'write',  
950: 'semester',  
951: 'paper',  
952: 'jay',  
953: 'felt',  
954: 'sex',  
955: 'sound',  
956: 'reward',  
957: 'point',  
958: 'cheap',  
959: 'wana',  
960: 'del',  
961: 'blood',  
962: 'wap',  
963: 'motorola',  
964: 'shower',  
965: 'na',  
966: 'monday',  
967: 'reason',  
968: 'save',  
969: 'course',  
970: 'confirm',  
971: 'across',  
972: 'wine',  
973: 'lazy',

```

974: 'mode',
975: 'less',
976: 'silent',
977: 'truth',
978: 'safe',
979: 'own',
980: 'swing',
981: 'heard',
982: "isn't",
983: 'dead',
984: 'copy',
985: 'store',
986: 'ts',
987: 'ldew',
988: 'accept',
989: 'knew',
990: 'water',
991: 'entered',
992: 'usual',
993: 'supposed',
994: 'doesn't',
995: 'abiola',
996: 'ipod',
997: 'asap',
998: 'sofa',
999: 'short',
1000: 'poor',
...}

```

### Creating model and Adding the layers

```

TOT_SIZE = len(tok.word_index)+1
lstm_model = Sequential()
lstm_model.add(Embedding(TOT_SIZE, 32, input_length=max_len))
lstm_model.add(LSTM(100))
lstm_model.add(Dropout(0.4))
lstm_model.add(Dense(20, activation="relu"))
lstm_model.add(Dropout(0.3))
lstm_model.add(Dense(1, activation = "sigmoid"))

```

### Compile the model

```

lstm_model.compile(loss = "binary_crossentropy", optimizer = "adam",
metrics = ["accuracy"])
lstm_model.summary()

```

Model: "sequential"

Layer (type)	Output Shape	Param #
=====		
embedding (Embedding)	(None, 150, 32)	262304

lstm (LSTM)	(None, 100)	53200
dropout (Dropout)	(None, 100)	0
dense (Dense)	(None, 20)	2020
dropout_1 (Dropout)	(None, 20)	0
dense_1 (Dense)	(None, 1)	21

```
=====
Total params: 317,545
Trainable params: 317,545
Non-trainable params: 0
=====
```

---

### Fit the model

```
lstm_model.fit(sequences_matrix, Y_train, batch_size=128, epochs=10,
               validation_split=0.2,
               workers=10,

callbacks=[EarlyStopping(monitor='val_loss', min_delta=0.0001)])

Epoch 1/10
30/30 [=====] - 14s 336ms/step - loss: 0.4534
- accuracy: 0.8508 - val_loss: 0.2814 - val_accuracy: 0.8787
Epoch 2/10
30/30 [=====] - 6s 212ms/step - loss: 0.1870
- accuracy: 0.9388 - val_loss: 0.1044 - val_accuracy: 0.9757

<keras.callbacks.History at 0x7fd849a023d0>
```

### Save the model

```
lstm_model.save('sms.h5')
```

### Test the model

```
test_sequences = tok.texts_to_sequences(X_test)
test_sequences_matrix = pad_sequences(test_sequences, maxlen=max_len)

acc = lstm_model.evaluate(test_sequences_matrix, Y_test)

27/27 [=====] - 1s 20ms/step - loss: 0.0805 -
accuracy: 0.9880

print('Test set\n Loss: {:.3f}\n Accuracy:
{:.3f}'.format(acc[0], acc[1]))
```



Test set

Loss: 0.081

Accuracy: 0.988