

```

#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

#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

```
from google.colab import drive
```

```
drive.mount('/content/drive')
```

Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force\_remount=True).

```
sns.countplot(df.v1)
```

```
plt.xlabel('Label')
```

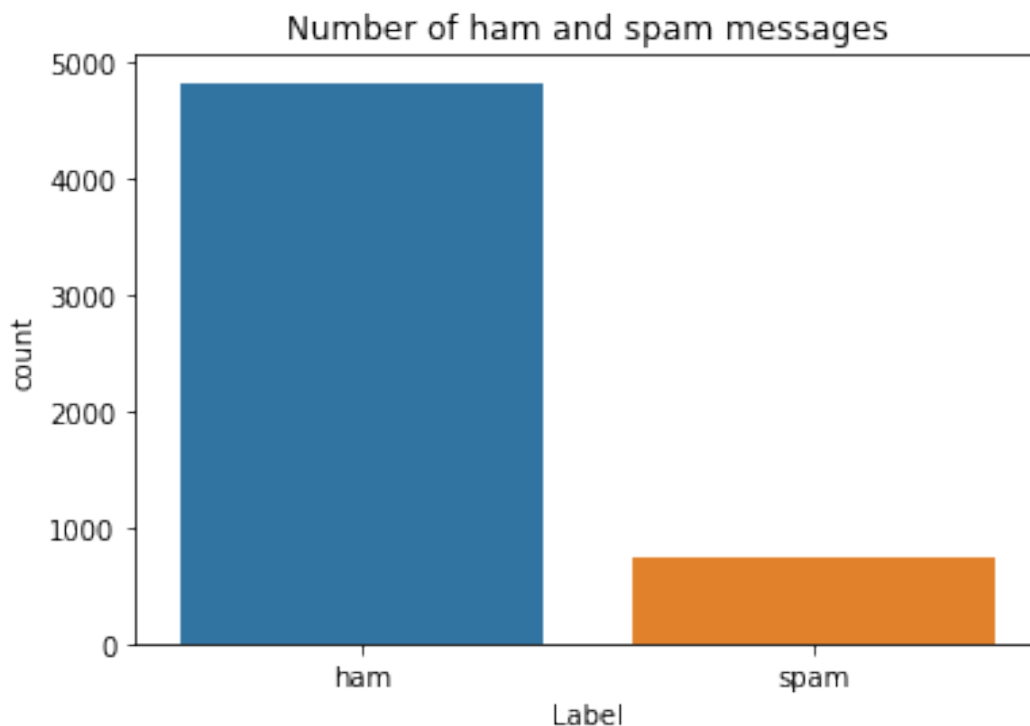
```
plt.title('Number of ham and spam messages')
```

/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')
```



#Process the Data

```

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)

```

```

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, ...,  1, 28, 14],
       [ 0,  0,  0, ...,  1, 64,  3],
       [ 0,  0,  0, ..., 140, 322, 195],
       ...,
       [ 0,  0,  0, ..., 35,  7, 459],
       [ 0,  0,  0, ..., 128, 454, 981],
       [ 0,  0,  0, ..., 86, 245, 66]], 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: '2',
20: 'that',
21: 'are',
22: 'now',
23: 'so',
24: 'or',
25: 'not',
26: 'do',

```

27: 'but',  
28: 'can',  
29: 'be',  
30: 'get',  
31: 'at',  
32: 'i'm',  
33: 'will',  
34: 'ur',  
35: 'with',  
36: 'if',  
37: 'just',  
38: 'no',  
39: 'this',  
40: 'we',  
41: 'gt',  
42: 'lt',  
43: '4',  
44: 'up',  
45: 'when',  
46: 'ok',  
47: 'free',  
48: 'out',  
49: 'how',  
50: 'go',  
51: 'from',  
52: 'all',  
53: 'what',  
54: 'like',  
55: 'know',  
56: 'then',  
57: 'good',  
58: 'was',  
59: 'got',  
60: 'come',  
61: 'its',  
62: 'am',  
63: 'day',  
64: 'love',  
65: 'time',  
66: 'only',  
67: 'want',  
68: 'there',  
69: 'text',  
70: 'he',  
71: 'send',  
72: 'as',  
73: 'txt',  
74: 'one',  
75: 'by',  
76: 'need',

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

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

177: 'sure',  
178: 'babe',  
179: 'cos',  
180: 'won',  
181: 'also',  
182: 'let',  
183: 'lol',  
184: 'sent',  
185: 'nokia',  
186: 'wait',  
187: 'would',  
188: 'keep',  
189: 'every',  
190: 'uk',  
191: '150p',  
192: 'cant',  
193: 'first',  
194: 'care',  
195: 'com',  
196: 'before',  
197: '5',  
198: "i've",  
199: 'us',  
200: 'something',  
201: 'urgent',  
202: 'anything',  
203: 'next',  
204: 'late',  
205: 's',  
206: 'min',  
207: 'contact',  
208: 'b',  
209: 'even',  
210: 'someone',  
211: 'pick',  
212: 'buy',  
213: 'again',  
214: 'thing',  
215: 'feel',  
216: 'tonight',  
217: 'around',  
218: 'place',  
219: 'tone',  
220: "can't",  
221: 'over',  
222: '50',  
223: 'which',  
224: 'sleep',  
225: 'money',  
226: 'things',

227: 'soon',  
228: 'dun',  
229: 'wan',  
230: 'co',  
231: 'went',  
232: 'off',  
233: 'ya',  
234: 'were',  
235: 'friends',  
236: 'nice',  
237: 'could',  
238: 'his',  
239: 'v',  
240: 'always',  
241: 'other',  
242: 'down',  
243: 'gonna',  
244: '16',  
245: '18',  
246: 'service',  
247: 'per',  
248: 'many',  
249: 'gud',  
250: 'customer',  
251: "that's",  
252: 'fine',  
253: 'x',  
254: 'leave',  
255: 'people',  
256: 'wish',  
257: 'chat',  
258: 'sms',  
259: 'haha',  
260: 'year',  
261: '6',  
262: 'help',  
263: 'heart',  
264: 'special',  
265: 'try',  
266: 'friend',  
267: "you're",  
268: 'use',  
269: 'told',  
270: 'same',  
271: 'mins',  
272: 'thk',  
273: 'yet',  
274: 'guaranteed',  
275: 'waiting',  
276: 'coming',



277: 'live',  
278: 'best',  
279: 'cs',  
280: 'lunch',  
281: 'few',  
282: 'may',  
283: 'thought',  
284: 'never',  
285: 'hello',  
286: 'stuff',  
287: 'ii',  
288: 'y',  
289: 'trying',  
290: '7',  
291: 'draw',  
292: 'name',  
293: 'getting',  
294: 'holiday',  
295: 'god',  
296: 'having',  
297: 'finish',  
298: 'days',  
299: 'house',  
300: 'thats',  
301: 'cool',  
302: 'man',  
303: 'meeting',  
304: "didn't",  
305: 'done',  
306: 'dat',  
307: 'end',  
308: 'class',  
309: 'ready',  
310: 'latest',  
311: 'ill',  
312: 'world',  
313: 'line',  
314: 'eat',  
315: 'car',  
316: 'wanna',  
317: 'check',  
318: 'half',  
319: 'better',  
320: 'lar',  
321: 'person',  
322: 'real',  
323: 'because',  
324: 'nothing',  
325: 'guess',  
326: 'long',

327: 'chance',  
328: 'than',  
329: 'åf1',  
330: 'talk',  
331: 'being',  
332: 'yup',  
333: 'enjoy',  
334: 'play',  
335: 'bit',  
336: 'job',  
337: 'shows',  
338: 'smile',  
339: 'mind',  
340: 'another',  
341: '1st',  
342: 'box',  
343: 'big',  
344: 'aight',  
345: 'problem',  
346: 'receive',  
347: 'guys',  
348: 'dinner',  
349: 'camera',  
350: 'watching',  
351: 'word',  
352: 'åf1000',  
353: 'cost',  
354: 'room',  
355: 'sweet',  
356: 'start',  
357: '150ppm',  
358: 'jus',  
359: 'boy',  
360: 'awarded',  
361: 'two',  
362: 'account',  
363: 'birthday',  
364: 'wk',  
365: 'lot',  
366: 'ah',  
367: 'apply',  
368: 'month',  
369: 'video',  
370: 'sir',  
371: 'maybe',  
372: 'princess',  
373: 'bt',  
374: 'plan',  
375: 'watch',  
376: 'early',

377: 'might',  
378: 'minutes',  
379: 'called',  
380: 'ever',  
381: 'xxx',  
382: '9',  
383: 'into',  
384: 'forgot',  
385: 'hear',  
386: 'liao',  
387: 'offer',  
388: 'quite',  
389: 'luv',  
390: 'girl',  
391: 'm',  
392: 'shit',  
393: 'dunno',  
394: 'bed',  
395: 'dis',  
396: 'landline',  
397: "he's",  
398: 'office',  
399: 'between',  
400: 'thank',  
401: 'code',  
402: 'does',  
403: 'weekend',  
404: 'part',  
405: 'shall',  
406: 'yo',  
407: 'pa',  
408: '10',  
409: 'hour',  
410: 'fun',  
411: 'without',  
412: 'easy',  
413: 'asked',  
414: 'rate',  
415: 'kiss',  
416: 'orange',  
417: 'look',  
418: 'leh',  
419: 'selected',  
420: 'baby',  
421: 'little',  
422: 'face',  
423: 'wont',  
424: 'left',  
425: 'working',  
426: 'll',

427: 'details',  
428: 'missing',  
429: 'network',  
430: 'bad',  
431: '000',  
432: 'didn't',  
433: 'town',  
434: 'probably',  
435: 'speak',  
436: 'ringtone',  
437: 'reach',  
438: 'den',  
439: 'po',  
440: 'fuck',  
441: 'put',  
442: 'entry',  
443: 'once',  
444: 'xmas',  
445: 'sexy',  
446: 'most',  
447: 'since',  
448: 'sat',  
449: 'thanx',  
450: 'hav',  
451: 'actually',  
452: 'looking',  
453: 'shopping',  
454: 'until',  
455: 'tv',  
456: 'means',  
457: 'though',  
458: 'made',  
459: 'dad',  
460: 'pay',  
461: 'update',  
462: 'collect',  
463: 'join',  
464: 'texts',  
465: 'award',  
466: 'bus',  
467: 'everything',  
468: 'enough',  
469: 'wanted',  
470: 'evening',  
471: "how's",  
472: 'anyway',  
473: 'important',  
474: "there's",  
475: 'plus',  
476: 'those',

477: 'afternoon',  
478: '8',  
479: 'g',  
480: 'remember',  
481: '£100',  
482: 'school',  
483: 'gift',  
484: 'de',  
485: 'pain',  
486: 'able',  
487: 'says',  
488: '2nd',  
489: 'came',  
490: 'tones',  
491: 'wake',  
492: 'tmr',  
493: 'till',  
494: 'double',  
495: 'wif',  
496: 'music',  
497: 'abt',  
498: 'bring',  
499: 'while',  
500: 'away',  
501: 'true',  
502: 'must',  
503: 'wife',  
504: 'wot',  
505: 'saw',  
506: 'else',  
507: 'juz',  
508: 'book',  
509: 'alright',  
510: 'worry',  
511: 'price',  
512: 'either',  
513: 'net',  
514: 'colour',  
515: 'run',  
516: 'collection',  
517: 'online',  
518: 'weekly',  
519: 'feeling',  
520: '500',  
521: 'oso',  
522: 'making',  
523: 'question',  
524: 'mail',  
525: 'okay',  
526: 'coz',

527: 'til',  
528: 'show',  
529: 'friendship',  
530: 'game',  
531: 'these',  
532: "what's",  
533: 'decimal',  
534: 'calls',  
535: 'messages',  
536: 'plz',  
537: 'family',  
538: 'yourself',  
539: 'attempt',  
540: 'havent',  
541: 'full',  
542: '10p',  
543: 'years',  
544: 'guy',  
545: 'hurt',  
546: 'sad',  
547: 'vouchers',  
548: 'answer',  
549: 'words',  
550: 'mob',  
551: 'hot',  
552: 'yesterday',  
553: 'id',  
554: 'dude',  
555: 'goes',  
556: 'makes',  
557: 'driving',  
558: 'points',  
559: 'nite',  
560: 'valid',  
561: "haven't",  
562: 'shop',  
563: 'set',  
564: 'wants',  
565: 'times',  
566: "won't",  
567: 'http',  
568: 'date',  
569: 'comes',  
570: 'both',  
571: 'test',  
572: 'busy',  
573: 'eve',  
574: 'happen',  
575: 'games',  
576: 'charge',

577: 'åf5000',  
578: 'close',  
579: 'trip',  
580: 'todays',  
581: 'believe',  
582: 'pic',  
583: 'movie',  
584: 'bored',  
585: 'wen',  
586: 're',  
587: 'cause',  
588: 'ard',  
589: 'neva',  
590: 'sae',  
591: 'åf500',  
592: 'yours',  
593: 'lose',  
594: 'lei',  
595: 'order',  
596: 'hours',  
597: 'pounds',  
598: 'story',  
599: '8007',  
600: 'national',  
601: 'top',  
602: 'hair',  
603: 'noe',  
604: 'stay',  
605: 'tot',  
606: 'food',  
607: 'lets',  
608: 'private',  
609: 'whats',  
610: 'w',  
611: 'missed',  
612: 'email',  
613: 'change',  
614: 'ring',  
615: 'post',  
616: 'saying',  
617: 'card',  
618: 'available',  
619: 'old',  
620: 'pm',  
621: 'leaving',  
622: 'haf',  
623: 'dreams',  
624: 'news',  
625: 'forget',  
626: 'delivery',

627: 'second',  
628: 'started',  
629: 'await',  
630: 'beautiful',  
631: 'finished',  
632: 'aft',  
633: 'bonus',  
634: 'together',  
635: 'rite',  
636: 'walk',  
637: 'congrats',  
638: 'mean',  
639: 'll',  
640: 'worth',  
641: 'huh',  
642: 'taking',  
643: 'expires',  
644: 'drink',  
645: 'everyone',  
646: 'lucky',  
647: 'lots',  
648: 'pub',  
649: 'auction',  
650: 'âf2000',  
651: 'pics',  
652: 'decided',  
653: 'final',  
654: 'alone',  
655: 'takes',  
656: 'tried',  
657: 'chikku',  
658: "she's",  
659: 'tho',  
660: 'drop',  
661: "c's",  
662: 'address',  
663: 'simple',  
664: 'tomo',  
665: '86688',  
666: 'pobox',  
667: 'ltd',  
668: 'winner',  
669: 'don',  
670: 'congratulations',  
671: "you've",  
672: 'touch',  
673: 'calling',  
674: 'choose',  
675: 'statement',  
676: 'identifier',



677: 'company',  
678: 'drive',  
679: 'visit',  
680: 'found',  
681: 'row',  
682: 'hows',  
683: 'goin',  
684: 'prob',  
685: 'thinking',  
686: 'land',  
687: 'services',  
688: 'okie',  
689: 'poly',  
690: 'type',  
691: 'smth',  
692: '08000930705',  
693: 'sch',  
694: 'kind',  
695: 'club',  
696: '750',  
697: 'fast',  
698: 'wid',  
699: 'minute',  
700: 'whatever',  
701: "we're",  
702: 'gd',  
703: 'smoke',  
704: "''",  
705: 'head',  
706: 'knw',  
707: 'far',  
708: 'mobileupd8',  
709: '08000839402',  
710: '100',  
711: 'hand',  
712: "we'll",  
713: 'oredi',  
714: 'open',  
715: 'happened',  
716: 'lesson',  
717: 'darlin',  
718: 'hard',  
719: 'åf3',  
720: 'camcorder',  
721: 'operator',  
722: '30',  
723: 'msgs',  
724: 'friday',  
725: 'gone',  
726: 'anytime',

727: 'voucher',  
728: 'break',  
729: 'awesome',  
730: 'mine',  
731: 'wil',  
732: 'mum',  
733: 'search',  
734: 'took',  
735: 'sleeping',  
736: 'savamob',  
737: 'offers',  
738: 'frnd',  
739: "doesn't",  
740: 'crazy',  
741: 'goodmorning',  
742: 'mates',  
743: 'fr',  
744: 'loving',  
745: 'pretty',  
746: 'wkly',  
747: 'support',  
748: 'whole',  
749: 'gr8',  
750: 'press',  
751: 'party',  
752: 'happiness',  
753: 'sounds',  
754: 'india',  
755: 'quiz',  
756: 'sun',  
757: 'xx',  
758: '12hrs',  
759: 'unsubscribe',  
760: 'gas',  
761: 'mate',  
762: "'",  
763: 'brother',  
764: 'sex',  
765: 'bout',  
766: 'credit',  
767: 'opt',  
768: 'o',  
769: 'fone',  
770: 'dating',  
771: 'nt',  
772: 'angry',  
773: 'smiling',  
774: 'each',  
775: 'ni8',  
776: 'boytoy',

777: 'un',  
778: 'wrong',  
779: 'saturday',  
780: 'case',  
781: 'mr',  
782: 'used',  
783: 'sister',  
784: 'tc',  
785: 'cut',  
786: 'wit',  
787: '\x89û',  
788: 'lovely',  
789: 'info',  
790: 'ends',  
791: 'phones',  
792: '87066',  
793: 'ans',  
794: 'treat',  
795: 'hee',  
796: 'mah',  
797: 'carlos',  
798: 'gal',  
799: 'knew',  
800: 'telling',  
801: 'dnt',  
802: 'least',  
803: 'project',  
804: 'light',  
805: 'lost',  
806: 'welcome',  
807: 'anyone',  
808: 'suite342',  
809: '2lands',  
810: 'cum',  
811: 'currently',  
812: 'parents',  
813: 'etc',  
814: 'almost',  
815: 'fucking',  
816: 'fancy',  
817: 'gym',  
818: 'couple',  
819: 'motorola',  
820: 'chennai',  
821: 'sis',  
822: 'hold',  
823: 'âf2',  
824: '03',  
825: 'girls',  
826: 'mobiles',

827: 'understand',  
828: 'tel',  
829: 'mom',  
830: 'unlimited',  
831: 'mu',  
832: 'wonderful',  
833: 'luck',  
834: 'through',  
835: 'park',  
836: 'b4',  
837: 'ten',  
838: 'bslvyl',  
839: 'ago',  
840: '2003',  
841: '800',  
842: 'redeemed',  
843: '04',  
844: 'snow',  
845: 'hit',  
846: 'outside',  
847: 'fri',  
848: 'secret',  
849: 'weeks',  
850: 'player',  
851: 'f',  
852: 'å£250',  
853: 'frnds',  
854: 'crave',  
855: "you'll",  
856: 'hmmm',  
857: 'meant',  
858: 'nope',  
859: 'remove',  
860: 'å£350',  
861: 'talking',  
862: 'read',  
863: 'christmas',  
864: 'college',  
865: 'numbers',  
866: 'difficult',  
867: 'listen',  
868: 'finally',  
869: 'abiola',  
870: 'course',  
871: 'seeing',  
872: 'st',  
873: 'tired',  
874: 'age',  
875: 'caller',  
876: 'information',

877: 'log',  
878: 'mrng',  
879: 'feels',  
880: 'earlier',  
881: 'th',  
882: 'loads',  
883: 'dogging',  
884: 'yr',  
885: 'rest',  
886: 'blue',  
887: 'safe',  
888: 'within',  
889: '20',  
890: 'ac',  
891: 'laptop',  
892: 'slowly',  
893: 'clean',  
894: 'thinks',  
895: 'direct',  
896: 'father',  
897: 'their',  
898: 'sea',  
899: 'yar',  
900: 'frm',  
901: 'via',  
902: 'semester',  
903: 'askd',  
904: 'loved',  
905: 'comin',  
906: 'die',  
907: 'comp',  
908: 'ipod',  
909: 'supposed',  
910: 'gn',  
911: 'txtng',  
912: 'invited',  
913: 'film',  
914: 'slow',  
915: 'knows',  
916: 'write',  
917: 'felt',  
918: 'point',  
919: 'met',  
920: 'std',  
921: '0800',  
922: 'rental',  
923: 'hmm',  
924: 'gets',  
925: 'figure',  
926: 'rs',

927: 'mayb',  
928: 'orchard',  
929: 'balance',  
930: 'freemsg',  
931: 'checking',  
932: 'hungry',  
933: 'reward',  
934: 'eh',  
935: 'england',  
936: 'call2optout',  
937: 'callertune',  
938: 'voice',  
939: 'reason',  
940: 'exam',  
941: 'area',  
942: 'jay',  
943: 'seen',  
944: 'bathe',  
945: 'discount',  
946: 'ass',  
947: 'bank',  
948: 'mm',  
949: 'surprise',  
950: 'lovable',  
951: 'song',  
952: '00',  
953: 'truth',  
954: 'red',  
955: 'shower',  
956: 'computer',  
957: 'correct',  
958: 'small',  
959: 'blood',  
960: 'monday',  
961: 'charged',  
962: 'confirm',  
963: 'complimentary',  
964: 'hospital',  
965: 'sort',  
966: 'ge',  
967: 'pass',  
968: 'stupid',  
969: "wasn't",  
970: 'picking',  
971: 'na',  
972: 'march',  
973: 'woke',  
974: 'content',  
975: 'rock',  
976: 'empty',

```

977: 'rply',
978: 'paper',
979: 'gotta',
980: 'heard',
981: 'sunday',
982: 'sound',
983: 'ntt',
984: 'tonite',
985: 'water',
986: 'somewhere',
987: 'dead',
988: 'lessons',
989: 'ive',
990: 'match',
991: 'months',
992: 'cd',
993: 'enter',
994: 'doin',
995: 'valentines',
996: 'oops',
997: 'different',
998: 'ugh',
999: 'download',
1000: 'al',
...}

```

#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\_1"

Layer (type)	Output Shape	Param #
embedding_1 (Embedding)	(None, 150, 32)	262240
lstm_1 (LSTM)	(None, 100)	53200

dropout_2 (Dropout)	(None, 100)	0
dense_2 (Dense)	(None, 20)	2020
dropout_3 (Dropout)	(None, 20)	0
dense_3 (Dense)	(None, 1)	21

```

=====
Total params: 317,481
Trainable params: 317,481
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 [=====] - 9s 224ms/step - loss: 0.4494
- accuracy: 0.8593 - val_loss: 0.2674 - val_accuracy: 0.8650
```

Epoch 2/10

```
30/30 [=====] - 6s 209ms/step - loss: 0.1906
- accuracy: 0.9430 - val_loss: 0.1178 - val_accuracy: 0.9747
```

<keras.callbacks.History at 0x7f35ed115790>

#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 19ms/step - loss: 0.1137 -
accuracy: 0.9725
```

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

Test set

Loss: 0.114

Accuracy:0.972