```
In [1]: import pandas as pd
        data=pd.read_csv("C:/Users/User/Documents/IMDB Dataset.csv")
        data
```

Out[1]:

	review	sentiment
0	One of the other reviewers has mentioned that ...	positive
1	A wonderful little production. The...	positive
2	I thought this was a wonderful way to spend ti...	positive
3	Basically there's a family where a little boy ...	negative
4	Petter Mattei's "Love in the Time of Money" is...	positive
...	...	...
49995	I thought this movie did a down right good job...	positive
49996	Bad plot, bad dialogue, bad acting, idiotic di...	negative
49997	I am a Catholic taught in parochial elementary...	negative
49998	I'm going to have to disagree with the previou...	negative
49999	No one expects the Star Trek movies to be high...	negative

50000 rows × 2 columns

there's two columns review and sentiment, for example we get one row value

In [2]:
```python
review_1=data.loc[0,'review']
review_1
```

Out[2]: "One of the other reviewers has mentioned that after watching just 1 Oz episode you'll be hooked. They are r
ight, as this is exactly what happened with me.

The first thing that struck me about Oz was its b
rutality and unflinching scenes of violence, which set in right from the word GO. Trust me, this is not a sh
ow for the faint hearted or timid. This show pulls no punches with regards to drugs, sex or violence. Its is
hardcore, in the classic use of the word.

It is called OZ as that is the nickname given to the Os
wald Maximum Security State Penitentary. It focuses mainly on Emerald City, an experimental section of the p
rison where all the cells have glass fronts and face inwards, so privacy is not high on the agenda. Em City
is home to many..Aryans, Muslims, gangstas, Latinos, Christians, Italians, Irish and more....so scuffles, de
ath stares, dodgy dealings and shady agreements are never far away.

I would say the main appeal o
f the show is due to the fact that it goes where other shows wouldn't dare. Forget pretty pictures painted f
or mainstream audiences, forget charm, forget romance...OZ doesn't mess around. The first episode I ever saw
struck me as so nasty it was surreal, I couldn't say I was ready for it, but as I watched more, I developed
a taste for Oz, and got accustomed to the high levels of graphic violence. Not just violence, but injustice
(crooked guards who'll be sold out for a nickel, inmates who'll kill on order and get away with it, well man
nered, middle class inmates being turned into prison bitches due to their lack of street skills or prison ex
perience) Watching Oz, you may become comfortable with what is uncomfortable viewing....thats if you can get
in touch with your darker side."

the text is not clean, there're are syntax html and noise in word like punctuatuons and many more. we
want to remove them

In [3]:
```python
#remove html tags
from bs4 import BeautifulSoup
clean_text=BeautifulSoup(review_1,"html.parser").get_text()
clean_text
```

Out[3]: "One of the other reviewers has mentioned that after watching just 1 Oz episode you'll be hooked. They are right, as this is exactly what happened with me.The first thing that struck me about Oz was its brutality and unflinching scenes of violence, which set in right from the word GO. Trust me, this is not a show for the faint hearted or timid. This show pulls no punches with regards to drugs, sex or violence. Its is hardcore, in the classic use of the word.It is called OZ as that is the nickname given to the Oswald Maximum Security State Penitentary. It focuses mainly on Emerald City, an experimental section of the prison where all the cells have glass fronts and face inwards, so privacy is not high on the agenda. Em City is home to many..Aryans, Muslims, gangstas, Latinos, Christians, Italians, Irish and more....so scuffles, death stares, dodgy dealings and shady agreements are never far away.I would say the main appeal of the show is due to the fact that it goes where other shows wouldn't dare. Forget pretty pictures painted for mainstream audiences, forget charm, forget romance...OZ doesn't mess around. The first episode I ever saw struck me as so nasty it was surreal, I couldn't say I was ready for it, but as I watched more, I developed a taste for Oz, and got accustomed to the high levels of graphic violence. Not just violence, but injustice (crooked guards who'll be sold out for a nickel, inmates who'll kill on order and get away with it, well mannered, middle class inmates being turned into prison bitches due to their lack of street skills or prison experience) Watching Oz, you may become comfortable with what is uncomfortable viewing....thats if you can get in touch with your darker side."

There's no html text in the sentence. but there'es elipsis (three dots in the text), we should remove unless there're important test for meaning

In [4]:
```python
#\.\.\./\.\. remove .... and .. in text and change " " spacing
import re
clean_text_elip=re.sub(r"\.\.\.|\.\.", " ",clean_text)
clean_text_elip
```

Out[4]: "One of the other reviewers has mentioned that after watching just 1 Oz episode you'll be hooked. They are r
ight, as this is exactly what happened with me.The first thing that struck me about Oz was its brutality and
unflinching scenes of violence, which set in right from the word GO. Trust me, this is not a show for the fa
int hearted or timid. This show pulls no punches with regards to drugs, sex or violence. Its is hardcore, in
the classic use of the word.It is called OZ as that is the nickname given to the Oswald Maximum Security Sta
te Penitentary. It focuses mainly on Emerald City, an experimental section of the prison where all the cells
have glass fronts and face inwards, so privacy is not high on the agenda. Em City is home to many Aryans, Mu
slims, gangstas, Latinos, Christians, Italians, Irish and more .so scuffles, death stares, dodgy dealings an
d shady agreements are never far away.I would say the main appeal of the show is due to the fact that it goe
s where other shows wouldn't dare. Forget pretty pictures painted for mainstream audiences, forget charm, fo
rget romance OZ doesn't mess around. The first episode I ever saw struck me as so nasty it was surreal, I co
uldn't say I was ready for it, but as I watched more, I developed a taste for Oz, and got accustomed to the
high levels of graphic violence. Not just violence, but injustice (crooked guards who'll be sold out for a n
ickel, inmates who'll kill on order and get away with it, well mannered, middle class inmates being turned i
nto prison bitches due to their lack of street skills or prison experience) Watching Oz, you may become comf
ortable with what is uncomfortable viewing .thats if you can get in touch with your darker side."

missing space after .: find the word using ?<= (before) and ?=(after) in regex. write in () like grouping in write in [] matching that you want search

In [5]:
```python
find_word=re.findall(r"(\b[a-zA-Z\s]+)\.(?=[a-zA-Z])", clean_text_elip)
#  Irish and more .so scuffles,
#f the word.It is called OZ
find_word
```

Out[5]: ['as this is exactly what happened with me',
 'in the classic use of the word',
 'Irish and more ',
 'dodgy dealings and shady agreements are never far away',
 'you may become comfortable with what is uncomfortable viewing ']

r"(\b[a-zA-Z\s]+).(?=[a-zA-Z]) explanation:

- we want find sentence so using \b (boundary text)
- "+" means that one and more letter, so we can get full words, without it we get single letter, + heplp us extract full words

- \s is space

In [6]:
```python
#add space after . if after . in the text is not space
clean_text2=re.sub(r"(?<=[a-zA-Z\s])\.(?=[a-zA-Z])",". ",clean_text_elip)
clean_text2
```

Out[6]: "One of the other reviewers has mentioned that after watching just 1 Oz episode you'll be hooked. They are right, as this is exactly what happened with me. The first thing that struck me about Oz was its brutality and unflinching scenes of violence, which set in right from the word GO. Trust me, this is not a show for the faint hearted or timid. This show pulls no punches with regards to drugs, sex or violence. Its is hardcore, in the classic use of the word. It is called OZ as that is the nickname given to the Oswald Maximum Security State Penitentary. It focuses mainly on Emerald City, an experimental section of the prison where all the cells have glass fronts and face inwards, so privacy is not high on the agenda. Em City is home to many Aryans, Muslims, gangstas, Latinos, Christians, Italians, Irish and more . so scuffles, death stares, dodgy dealings and shady agreements are never far away. I would say the main appeal of the show is due to the fact that it goes where other shows wouldn't dare. Forget pretty pictures painted for mainstream audiences, forget charm, forget romance OZ doesn't mess around. The first episode I ever saw struck me as so nasty it was surreal, I couldn't say I was ready for it, but as I watched more, I developed a taste for Oz, and got accustomed to the high levels of graphic violence. Not just violence, but injustice (crooked guards who'll be sold out for a nickel, inmates who'll kill on order and get away with it, well mannered, middle class inmates being turned into prison bitches due to their lack of street skills or prison experience) Watching Oz, you may become comfortable with what is uncomfortable viewing . thats if you can get in touch with your darker side."

```
In [7]:  #remove space before .
         clean_text3=re.sub(r"\s\.",".",clean_text2)
         clean_text3
```

Out[7]: "One of the other reviewers has mentioned that after watching just 1 Oz episode you'll be hooked. They are r
         ight, as this is exactly what happened with me. The first thing that struck me about Oz was its brutality an
         d unflinching scenes of violence, which set in right from the word GO. Trust me, this is not a show for the
         faint hearted or timid. This show pulls no punches with regards to drugs, sex or violence. Its is hardcore,
         in the classic use of the word. It is called OZ as that is the nickname given to the Oswald Maximum Security
         State Penitentary. It focuses mainly on Emerald City, an experimental section of the prison where all the ce
         lls have glass fronts and face inwards, so privacy is not high on the agenda. Em City is home to many Aryan
         s, Muslims, gangstas, Latinos, Christians, Italians, Irish and more. so scuffles, death stares, dodgy dealin
         gs and shady agreements are never far away. I would say the main appeal of the show is due to the fact that
         it goes where other shows wouldn't dare. Forget pretty pictures painted for mainstream audiences, forget cha
         rm, forget romance OZ doesn't mess around. The first episode I ever saw struck me as so nasty it was surrea
         l, I couldn't say I was ready for it, but as I watched more, I developed a taste for Oz, and got accustomed
         to the high levels of graphic violence. Not just violence, but injustice (crooked guards who'll be sold out
         for a nickel, inmates who'll kill on order and get away with it, well mannered, middle class inmates being t
         urned into prison bitches due to their lack of street skills or prison experience) Watching Oz, you may beco
         me comfortable with what is uncomfortable viewing. thats if you can get in touch with your darker side."

In [8]:
```python
#change uppercase when after .  is lowercase
#group (1) only first word. group(1) get info from [a-z] or get first letter after .
def upper(x):
    return ". "+x.group(1).upper()
clean_text4=re.sub(r"\.\s([a-z])",upper,clean_text3)
clean_text4
```

Out[8]: "One of the other reviewers has mentioned that after watching just 1 Oz episode you'll be hooked. They are r
ight, as this is exactly what happened with me. The first thing that struck me about Oz was its brutality an
d unflinching scenes of violence, which set in right from the word GO. Trust me, this is not a show for the
faint hearted or timid. This show pulls no punches with regards to drugs, sex or violence. Its is hardcore,
in the classic use of the word. It is called OZ as that is the nickname given to the Oswald Maximum Security
State Penitentary. It focuses mainly on Emerald City, an experimental section of the prison where all the ce
lls have glass fronts and face inwards, so privacy is not high on the agenda. Em City is home to many Aryan
s, Muslims, gangstas, Latinos, Christians, Italians, Irish and more. So scuffles, death stares, dodgy dealin
gs and shady agreements are never far away. I would say the main appeal of the show is due to the fact that
it goes where other shows wouldn't dare. Forget pretty pictures painted for mainstream audiences, forget cha
rm, forget romance OZ doesn't mess around. The first episode I ever saw struck me as so nasty it was surrea
l, I couldn't say I was ready for it, but as I watched more, I developed a taste for Oz, and got accustomed
to the high levels of graphic violence. Not just violence, but injustice (crooked guards who'll be sold out
for a nickel, inmates who'll kill on order and get away with it, well mannered, middle class inmates being t
urned into prison bitches due to their lack of street skills or prison experience) Watching Oz, you may beco
me comfortable with what is uncomfortable viewing. Thats if you can get in touch with your darker side."

```
In [9]: find_word2=re.findall(r"(?<=\s)(?<!\.\s)\b[A-Z][a-z0-9]+", clean_text4)
        find_word2
```

```
Out[9]: ['Oz',
         'Oz',
         'Oswald',
         'Maximum',
         'Security',
         'State',
         'Penitentary',
         'Emerald',
         'City',
         'City',
         'Aryans',
         'Muslims',
         'Latinos',
         'Christians',
         'Italians',
         'Irish',
         'Oz',
         'Watching',
         'Oz']
```

In [10]:
```python
import spacy
nlp=spacy.load("en_core_web_sm")
doc=nlp(" ".join(find_word2))
for i in doc:
    print(i.text+":"+i.pos_)
```

```
Oz:PROPN
Oz:PROPN
Oswald:PROPN
Maximum:PROPN
Security:PROPN
State:PROPN
Penitentary:PROPN
Emerald:PROPN
City:PROPN
City:PROPN
Aryans:PROPN
Muslims:PROPN
Latinos:PROPN
Christians:PROPN
Italians:PROPN
Irish:PROPN
Oz:PROPN
Watching:PROPN
Oz:PROPN
```

    since its dificult to distingusih word noun or not we using spacy

```
In [11]: ### import spacy
         nlp=spacy.load("en_core_web_sm")
         #make doc
         doc=nlp(clean_text4)
         #token sentences
         sentence=[i.text for i in doc.sents]
         sentence
```

Out[11]: ["One of the other reviewers has mentioned that after watching just 1 Oz episode you'll be hooked.",
 'They are right, as this is exactly what happened with me.',
 'The first thing that struck me about Oz was its brutality and unflinching scenes of violence, which set in right from the word GO.',
 'Trust me, this is not a show for the faint hearted or timid.',
 'This show pulls no punches with regards to drugs, sex or violence.',
 'Its is hardcore, in the classic use of the word.',
 'It is called OZ as that is the nickname given to the Oswald Maximum Security State Penitentary.',
 'It focuses mainly on Emerald City, an experimental section of the prison where all the cells have glass fronts and face inwards, so privacy is not high on the agenda.',
 'Em City is home to many Aryans, Muslims, gangstas, Latinos, Christians, Italians, Irish and more.',
 'So scuffles, death stares, dodgy dealings and shady agreements are never far away.',
 "I would say the main appeal of the show is due to the fact that it goes where other shows wouldn't dare.",
 "Forget pretty pictures painted for mainstream audiences, forget charm, forget romance OZ doesn't mess around.",
 "The first episode I ever saw struck me as so nasty it was surreal, I couldn't say I was ready for it, but as I watched more, I developed a taste for Oz, and got accustomed to the high levels of graphic violence.",
 "Not just violence, but injustice (crooked guards who'll be sold out for a nickel, inmates who'll kill on order and get away with it, well mannered, middle class inmates being turned into prison bitches due to their lack of street skills or prison experience)",
 'Watching Oz, you may become comfortable with what is uncomfortable viewing.',
 'Thats if you can get in touch with your darker side.']

SCORING SENTIMENT

- lexicon based (+positive, -negative, and netral)
- Machine learning approach

Machine Learning Approach : using BERT, its deep learning like brain human who can recognize context of the text

1. Embbeding : convert raw text into number

```
In [12]:    from transformers import BertTokenizer, BertModel
            #define tokenizer
            tokenizer=BertTokenizer.from_pretrained('bert-base-uncased')
            #token the sentence
            sentence_1=sentence[0]
            token=tokenizer(sentence_1,return_tensors="pt")
            print(token)
```

```
C:\Users\User\Anaconda3\envs\nlp_env\lib\site-packages\tqdm\auto.py:21: TqdmWarning: IProgress not found. Pl
ease update jupyter and ipywidgets. See https://ipywidgets.readthedocs.io/en/stable/user_install.html (http
s://ipywidgets.readthedocs.io/en/stable/user_install.html)
  from .autonotebook import tqdm as notebook_tqdm

{'input_ids': tensor([[  101,  2028,  1997,  1996,  2060, 15814,  2038,  3855,  2008,  2044,
          3666,  2074,  1015, 11472,  2792,  2017,  1005,  2222,  2022, 13322,
          1012,   102]]), 'token_type_ids': tensor([[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0]]), 'attention_mask': tensor([[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1]])}
```

- retur_tensors = pt, the output is tensor array
- input_ids = 101 is penanda awal kalimat, dan 102 merupakan penanda akhir pada kalimat, kemudian setiap kata pada kalimat memiliki id
- token type id= karena inpunt nya cuma singgle input maka type id 0 semua, (token type id digunakan jka ada pairing antra context dan pertanyaan, kegunaaannya untuk membedakan tersebut
- attenti mask 1 means they are real token and should use to input the model, attention mask is 0 they are padding

Bagaimana dengan satu paragraph

In [15]:
```python
from transformers import BertTokenizer, BertModel
tokenizer=BertTokenizer.from_pretrained('bert-base-uncased')
review=clean_text4
token_review=tokenizer(
    review,
    truncation=True, #if token excedd number of token
    max_length=512, #maximum tokeno
    padding="max_length",
    return_tensors="pt"


)

print(token_review["input_ids"])
```

```
tensor([[  101,   2028,   1997,   1996,   2060, 15814,   2038,   3855,   2008,   2044,
          3666,   2074,   1015, 11472,   2792,   2017,   1005,   2222,   2022, 13322,
          1012,   2027,   2024,   2157,   1010,   2004,   2023,   2003,   3599,   2054,
          3047,   2007,   2033,   1012,   1996,   2034,   2518,   2008,   4930,   2033,
          2055, 11472,   2001,   2049, 24083,   1998,   4895, 10258,   2378,   8450,
          5019,   1997,   4808,   1010,   2029,   2275,   1999,   2157,   2013,   1996,
          2773,   2175,   1012,   3404,   2033,   1010,   2023,   2003,   2025,   1037,
          2265,   2005,   1996,   8143, 18627,   2030,   5199,   3593,   1012,   2023,
          2265,   8005,   2053, 17957,   2007, 12362,   2000,   5850,   1010,   3348,
          2030,   4808,   1012,   2049,   2003, 13076,   1010,   1999,   1996,   4438,
          2224,   1997,   1996,   2773,   1012,   2009,   2003,   2170, 11472,   2004,
          2008,   2003,   1996,   8367,   2445,   2000,   1996, 17411,   4555,   3036,
          2110,   7279,   4221, 12380,   2854,   1012,   2009,   7679,   3701,   2006,
         14110,   2103,   1010,   2019,   6388,   2930,   1997,   1996,   3827,   2073,
          2035,   1996,   4442,   2031,   3221, 21430,   1998,   2227, 20546,   2015,
          1010,   2061,   9394,   2003,   2025,   2152,   2006,   1996, 11376,   1012,
          7861,   2103,   2003,   2188,   2000,   2116, 26030,   2015,   1010,   7486,
          1010, 18542, 10230,   1010,   7402,   2015,   1010,   8135,   1010, 16773,
          1010,   3493,   1998,   2062,   1012,   2061,   8040, 16093, 28331,   1010,
          2331, 14020,   1010, 26489,   6292, 24069,   1998, 22824, 10540,   2024,
          2196,   2521,   2185,   1012,   1045,   2052,   2360,   1996,   2364,   5574,
          1997,   1996,   2265,   2003,   2349,   2000,   1996,   2755,   2008,   2009,
          3632,   2073,   2060,   3065,   2876,   1005,   1056,   8108,   1012,   5293,
          3492,   4620,   4993,   2005,   7731,   9501,   1010,   5293, 11084,   1010,
          5293,   7472, 11472,   2987,   1005,   1056,   6752,   2105,   1012,   1996,
          2034,   2792,   1045,   2412,   2387,   4930,   2033,   2004,   2061, 11808,
          2009,   2001, 16524,   1010,   1045,   2481,   1005,   1056,   2360,   1045,
          2001,   3201,   2005,   2009,   1010,   2021,   2004,   1045,   3427,   2062,
          1010,   1045,   2764,   1037,   5510,   2005, 11472,   1010,   1998,   2288,
         17730,   2000,   1996,   2152,   3798,   1997,   8425,   4808,   1012,   2025,
          2074,   4808,   1010,   2021, 21321,   1006, 15274,   4932,   2040,   1005,
          2222,   2022,   2853,   2041,   2005,   1037, 15519,   1010, 13187,   2040,
          1005,   2222,   3102,   2006,   2344,   1998,   2131,   2185,   2007,   2009,
          1010,   2092,   5450,   2098,   1010,   2690,   2465, 13187,   2108,   2357,
          2046,   3827,   7743,   2229,   2349,   2000,   2037,   3768,   1997,   2395,
          4813,   2030,   3827,   3325,   1007,   3666, 11472,   1010,   2017,   2089,
          2468,   6625,   2007,   2054,   2003,   8796, 10523,   1012,   2008,   2015,
          2065,   2017,   2064,   2131,   1999,   3543,   2007,   2115,   9904,   2217,
          1012,    102,      0,      0,      0,      0,      0,      0,      0,      0,
             0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
             0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
             0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
             0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
```

```
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0,      0,      0,      0,      0,      0,      0,      0,      0,
    0,      0]])
```

- for this is result they're padding in a tokenize, padding is not impact of meaning but impact on model (since model processed unimportant value)

solution 1 to handle padding : sliding window, its like you just have 512 word to read, instead of forgetting everything you remember 50 word before tuning.

In [19]:
```python
token_review_ch=tokenizer(
    review,
    truncation=True, #if token excedd number of token
    max_length=512, #maximum tokeno
    stride=50, #keep 50 token from previous chunk,
    return_overflowing_tokens=True,
    return_tensors="pt"


)
print(token_review_ch['input_ids'])
```

```
tensor([[  101,  2028,  1997,  1996,  2060, 15814,  2038,  3855,  2008,  2044,
          3666,  2074,  1015, 11472,  2792,  2017,  1005,  2222,  2022, 13322,
          1012,  2027,  2024,  2157,  1010,  2004,  2023,  2003,  3599,  2054,
          3047,  2007,  2033,  1012,  1996,  2034,  2518,  2008,  4930,  2033,
          2055, 11472,  2001,  2049, 24083,  1998,  4895, 10258,  2378,  8450,
          5019,  1997,  4808,  1010,  2029,  2275,  1999,  2157,  2013,  1996,
          2773,  2175,  1012,  3404,  2033,  1010,  2023,  2003,  2025,  1037,
          2265,  2005,  1996,  8143, 18627,  2030,  5199,  3593,  1012,  2023,
          2265,  8005,  2053, 17957,  2007, 12362,  2000,  5850,  1010,  3348,
          2030,  4808,  1012,  2049,  2003, 13076,  1010,  1999,  1996,  4438,
          2224,  1997,  1996,  2773,  1012,  2009,  2003,  2170, 11472,  2004,
          2008,  2003,  1996,  8367,  2445,  2000,  1996, 17411,  4555,  3036,
          2110,  7279,  4221, 12380,  2854,  1012,  2009,  7679,  3701,  2006,
         14110,  2103,  1010,  2019,  6388,  2930,  1997,  1996,  3827,  2073,
          2035,  1996,  4442,  2031,  3221, 21430,  1998,  2227, 20546,  2015,
          1010,  2061,  9394,  2003,  2025,  2152,  2006,  1996, 11376,  1012,
          7861,  2103,  2003,  2188,  2000,  2116, 26030,  2015,  1010,  7486,
          1010, 18542, 10230,  1010,  7402,  2015,  1010,  8135,  1010, 16773,
          1010,  3493,  1998,  2062,  1012,  2061,  8040, 16093, 28331,  1010,
          2331, 14020,  1010, 26489,  6292, 24069,  1998, 22824, 10540,  2024,
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