

```
In [1]: import pandas as pd
import matplotlib.pyplot as plt
```

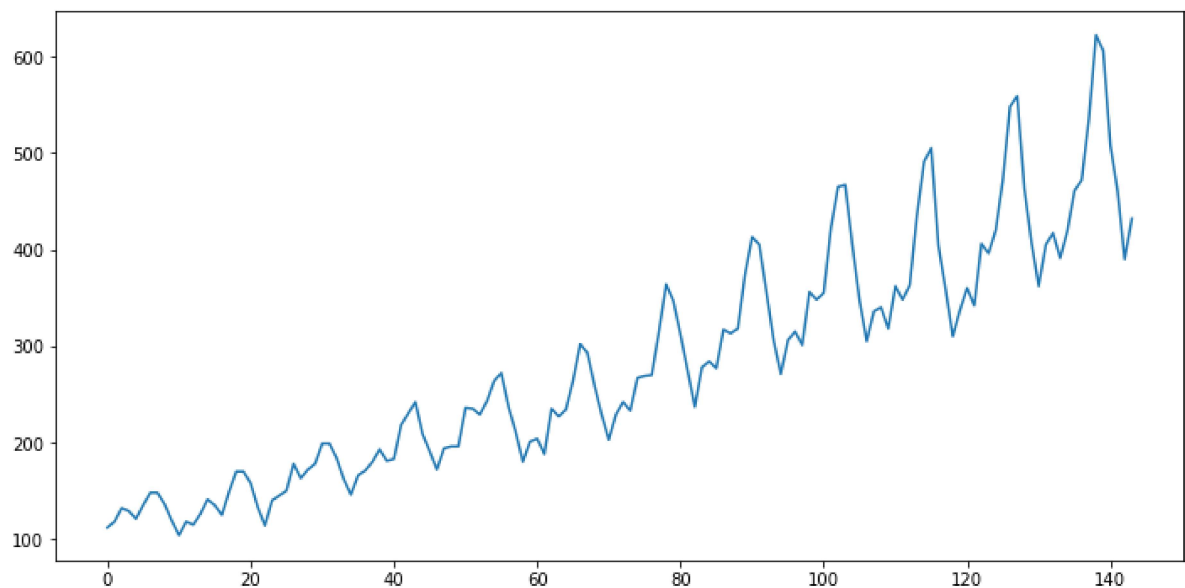
```
In [2]: data = pd.read_csv('datasets/AirPassengers.csv')
data.head()
```

Out[2]:

	Month	#Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121

```
In [3]: plt.rcParams.update({'figure.figsize':(12,6)})
data['#Passengers'].plot()
```

Out[3]: <AxesSubplot:>



Moving Averages

- Simple Moving Average(SMA)
- Cumulative Moving Average(CMA)
- Exponential Moving Average(EMA)

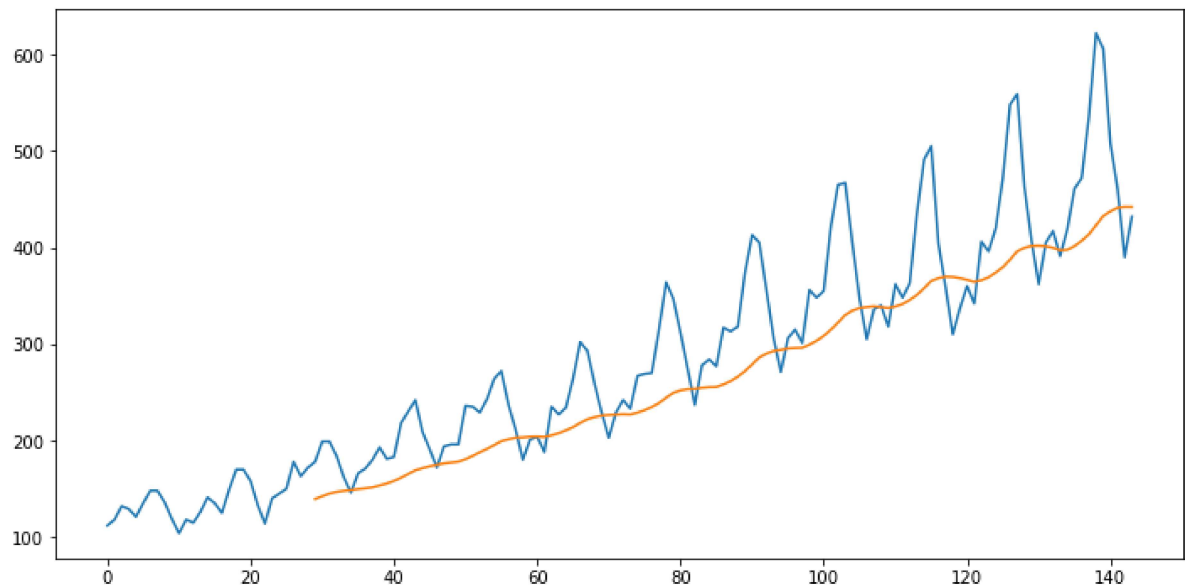
SMA

$$SMA_t = \frac{x_t + x_{t-1} + x_{t-2} + \dots + x_{t-n}}{n}$$

```
In [7]: data['SMA_30']=data['#Passengers'].rolling(window = 30).mean()
```

```
In [9]: data['#Passengers'].plot()
data['SMA_30'].dropna().plot()
```

Out[9]: <AxesSubplot:>



Conclusion #Passengers Columns has Uptrend/Increasing Trend(Pattern)

CMA

$$CMA_t = \frac{x_1 + x_2 + \dots + x_n}{n}$$

```
In [10]: data['CMA'] = data['#Passengers'].expanding().mean()
```

In [12]: data

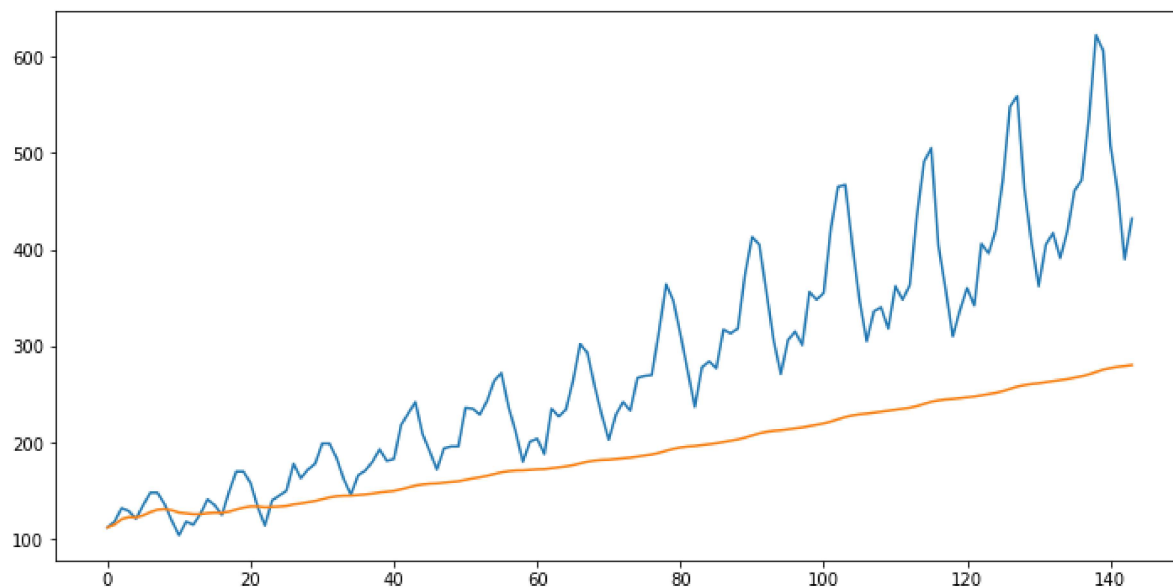
Out[12]:

	Month	#Passengers	SMA_30	CMA
0	1949-01	112	NaN	112.000000
1	1949-02	118	NaN	115.000000
2	1949-03	132	NaN	120.666667
3	1949-04	129	NaN	122.750000
4	1949-05	121	NaN	122.400000
...
139	1960-08	606	432.566667	275.514286
140	1960-09	508	437.433333	277.163121
141	1960-10	461	441.200000	278.457746
142	1960-11	390	442.100000	279.237762
143	1960-12	432	442.000000	280.298611

144 rows × 4 columns

In [15]: data['#Passengers'].plot()
data['CMA'].plot()

Out[15]: <AxesSubplot:>



EMA/EWMA

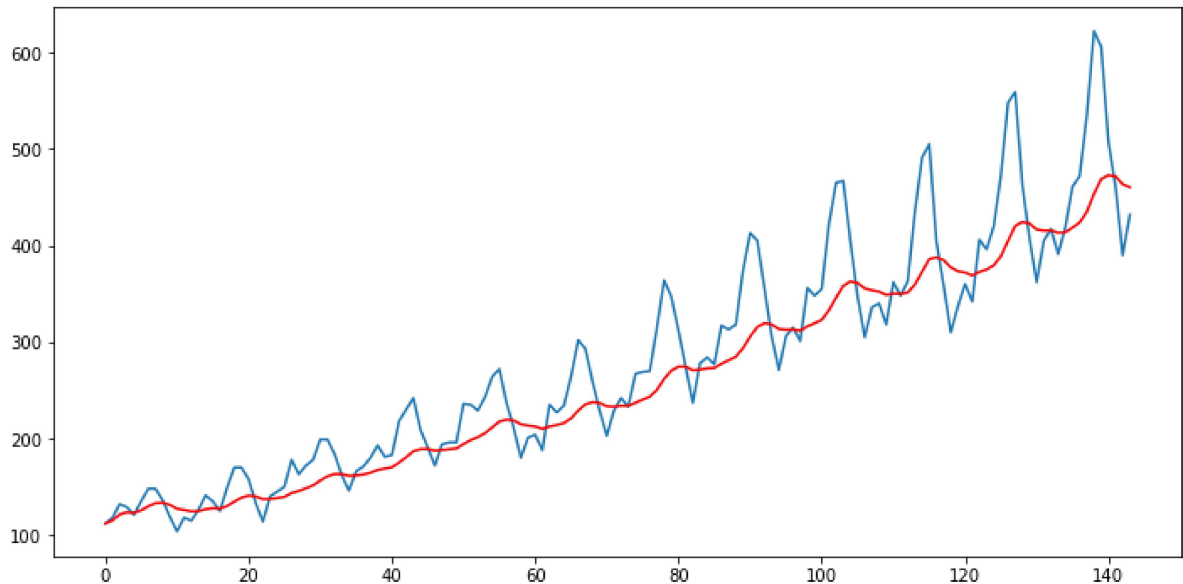
$$EMA_t = \alpha * x_t + (1 - \alpha) * EMA_{t-1}$$

alpha is smooting factor

```
In [19]: data['EMA_0.1']=data['#Passengers'].ewm(alpha=0.1).mean()
```

```
In [20]: data['#Passengers'].plot()  
data['EMA_0.1'].plot(color = 'r')
```

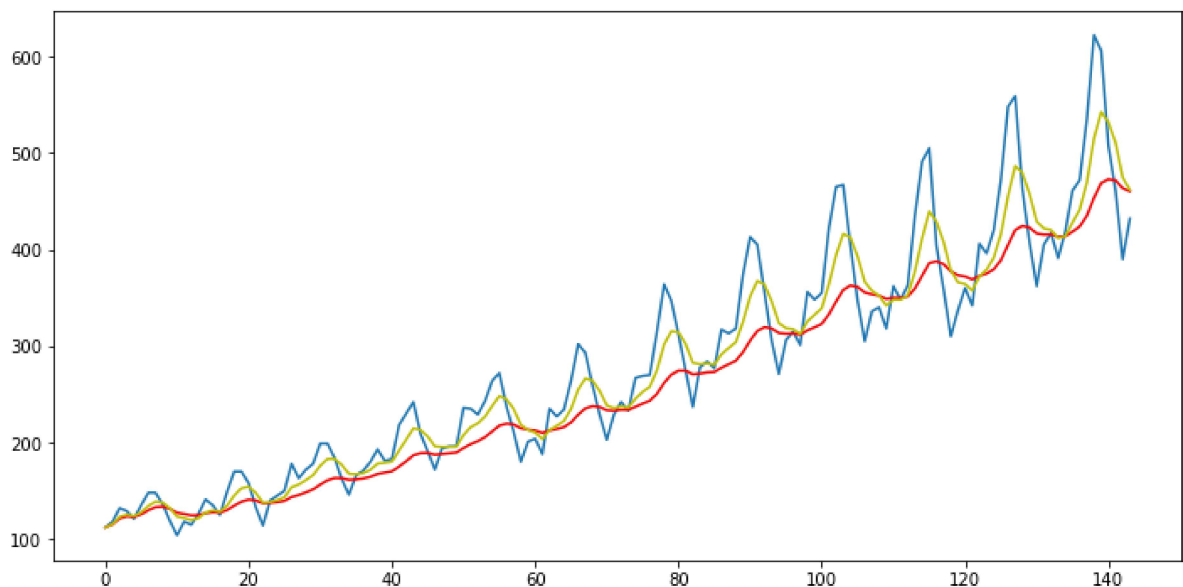
Out[20]: <AxesSubplot:>



```
In [22]: data['EMA_0.3']=data['#Passengers'].ewm(alpha=0.3).mean()
```

```
In [23]: data['#Passengers'].plot()  
data['EMA_0.1'].plot(color = 'r')  
data['EMA_0.3'].plot(color = 'y')
```

Out[23]: <AxesSubplot:>



In []: