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DDA LAB Report -5

Task : Time Series Forecasting

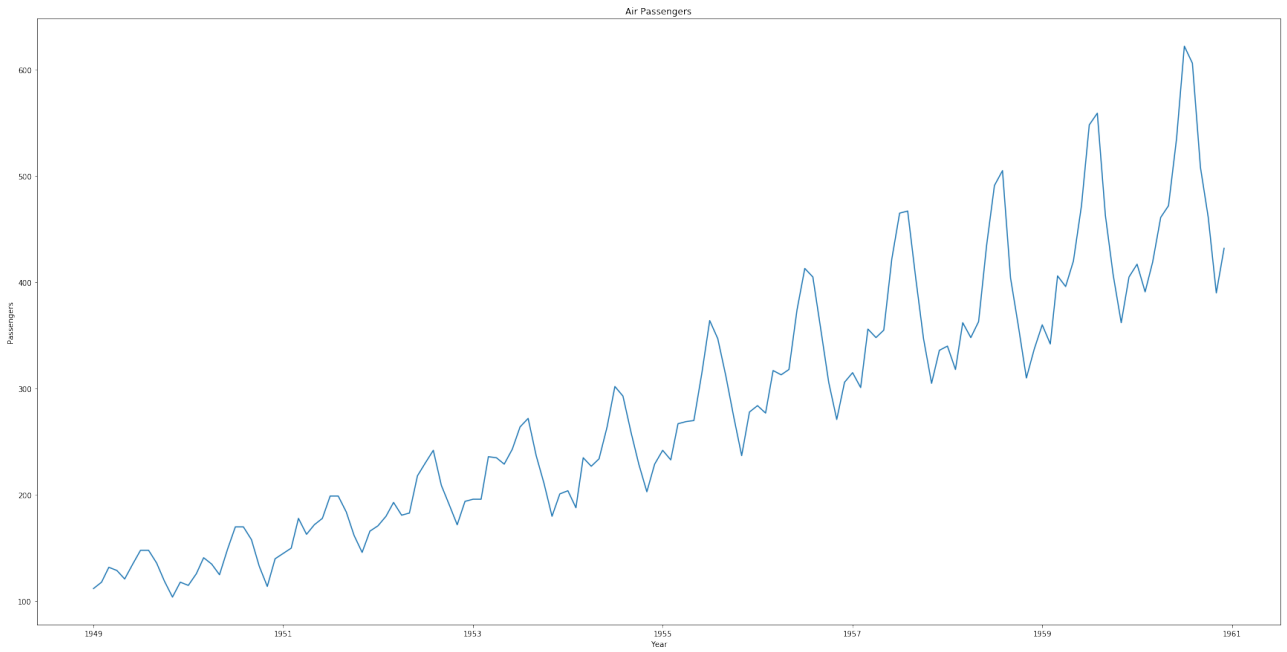
Data : Air Passengers Data set and Melbourne Data set

Exercise 1A: **Stationary and Arima**

A time series is said to be stationary if doesn't have any seasonality or trend. We can check this in many ways. One of the ways to perform DF test. If we get the p-value less that 0.5 then the series is stationary else it is not.
And calculating the mean after diving the data set. If there is a big change in the means then it is not stationary else it is stationary.

Basing these two assumptions the task is solved.

First the Air Passengers Data set is loaded. The time series is plotted. The plot obtained is



The mean is calculated on 2 halves and then the DF test is performed the result is

```
Mean of first part of data: 182.902777778
Mean of second part of data 377.694444444
Standard deviation of first part of data: 47.371803534
Standard deviation of second part of data 85.8368347002
Test Statistic                  0.815369
p-value                         0.991880
#Lags Used                     13.000000
Number of Observations Used    130.000000
Critical Value (1%)             -3.481682
Critical Value (5%)             -2.884042
Critical Value (10%)            -2.578770
```

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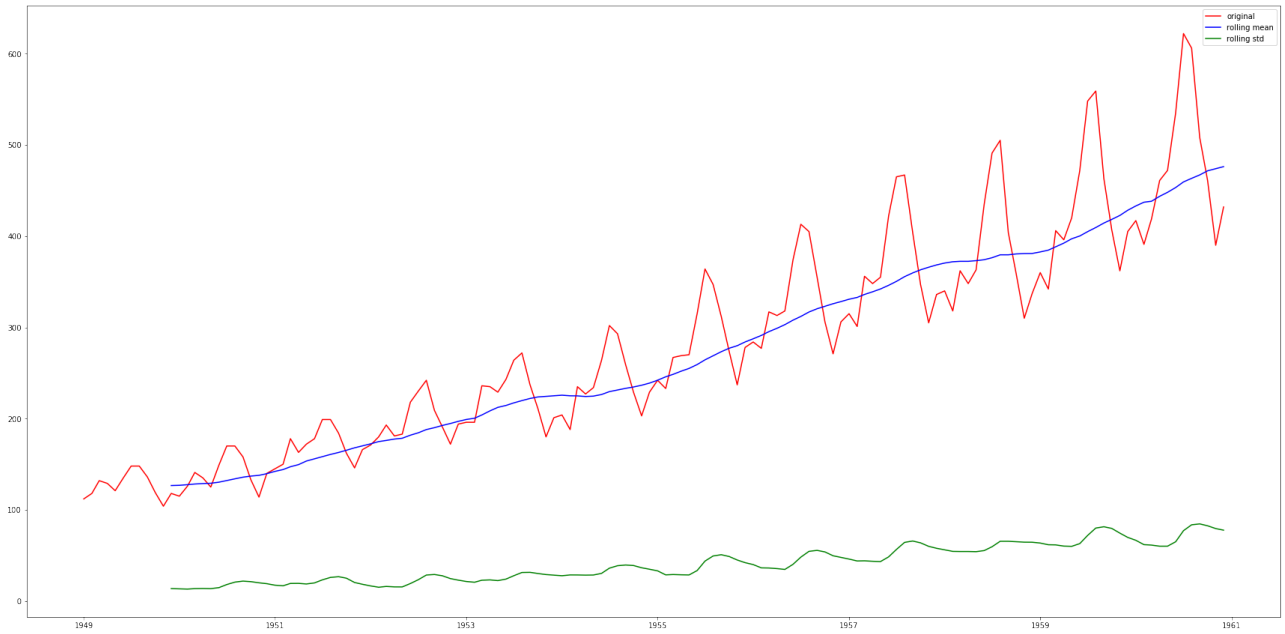
The plot is made with the rolling mean and the standard deviation. The plot is obtained like this



If we observe the plot and the test results we can say that the series is not stationary. To make it statinary we have to remove the trend and seasonality . After making the series stationary the DF test results are

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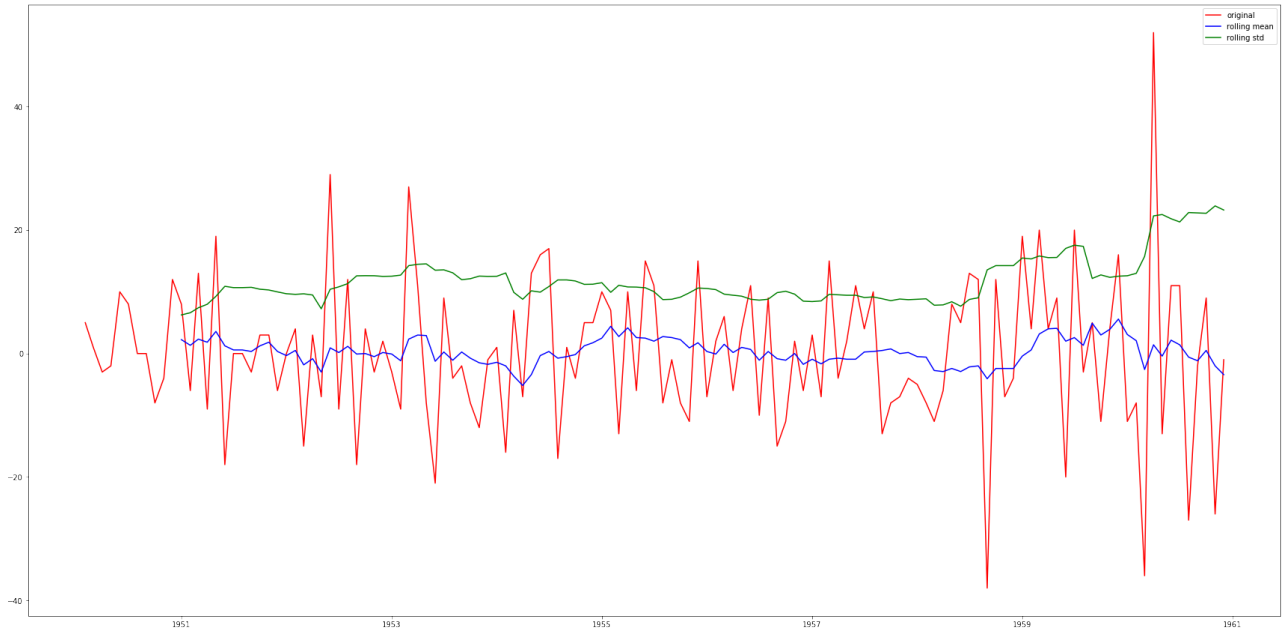
```
Mean of first part of data: 0.738461538462
Mean of second part of data -0.363636363636
Standard deviation of first part of data: 10.4267067197
Standard deviation of second part of data 13.895318989
Test Statistic                -1.559562e+01
p-value                        1.856512e-28
#Lags Used                     0.000000e+00
Number of Observations Used    1.300000e+02
Critical Value (1%)           -3.481682e+00
Critical Value (5%)           -2.884042e+00
Critical Value (10%)          -2.578770e+00
```

If we observe the P-value it is below 0.5. So we can say that the series is stationary now. The plot obtained after making the series staitonary is



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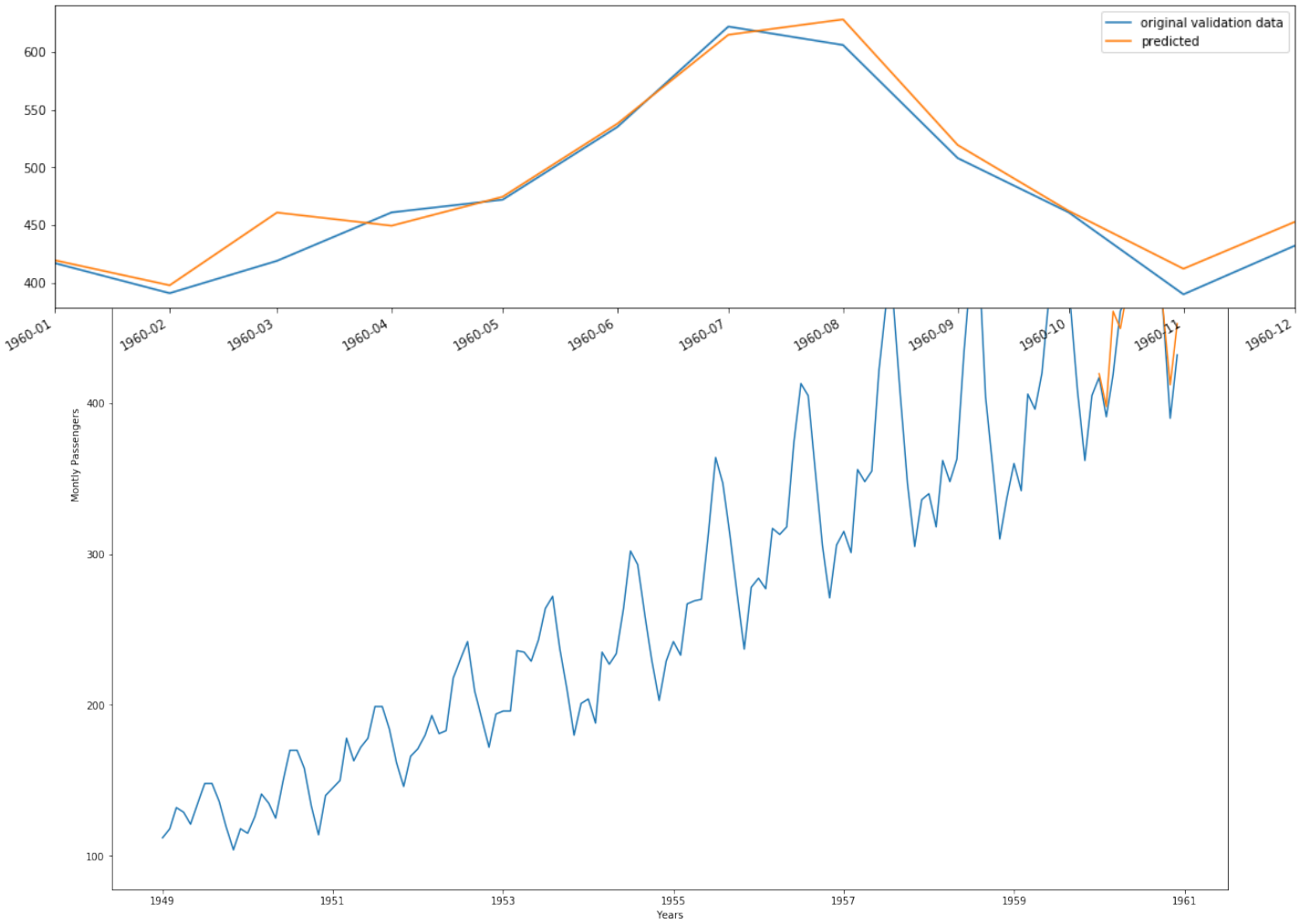
Since the Air Passenger has seasonality **SARIMAX** is used. For the parameters a grid search is made and the best parameters are used for training the model and then the forecast is made and the rmse is calculated. A graph is plotted for the forecasted data and the original data.



The RMSE is calculated for forecasts and it is `17.187245320475341`.

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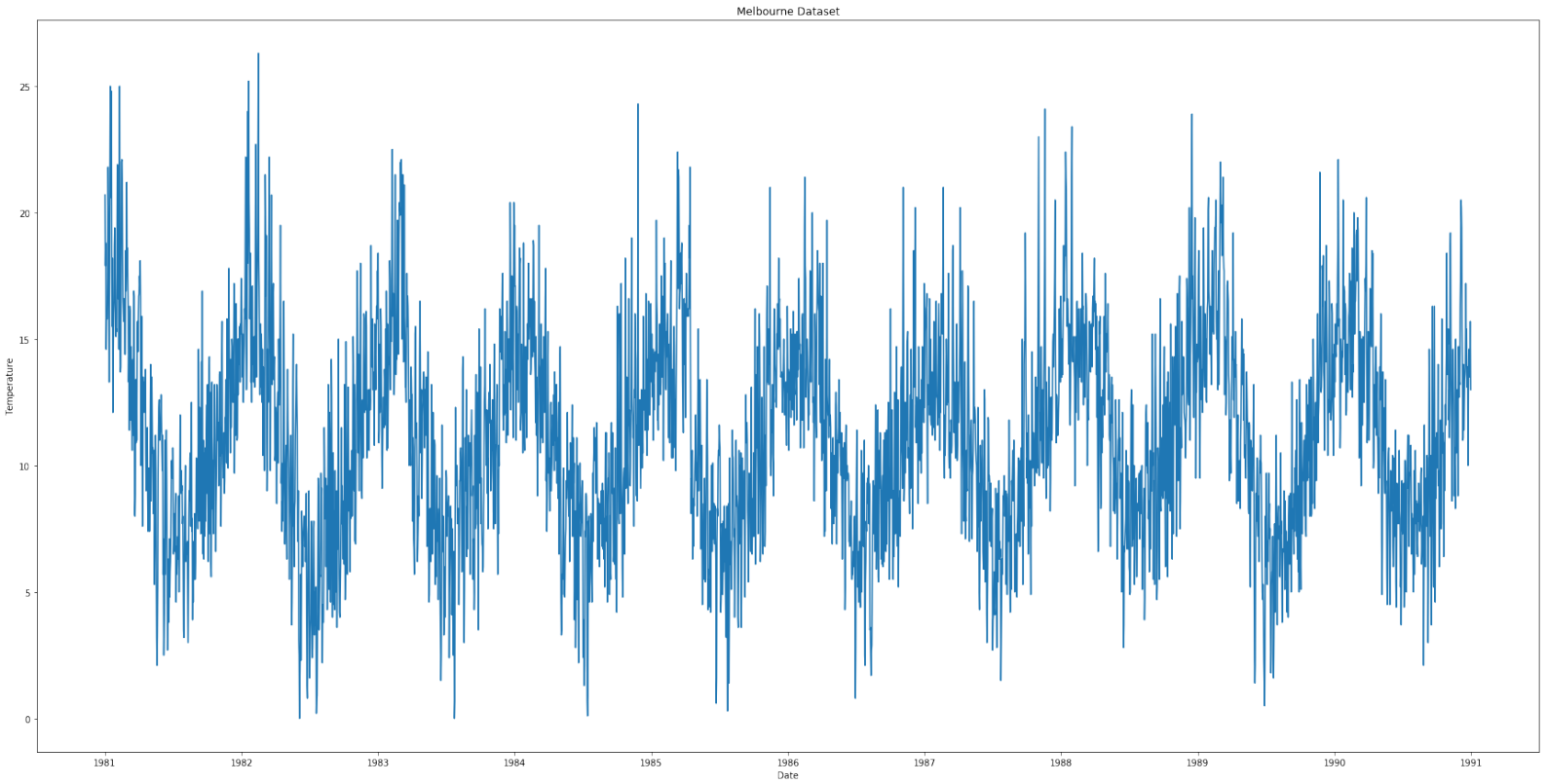
Melbourne Data set

The other data set which is given for the task is melbourne data set. First the data set is plotted.



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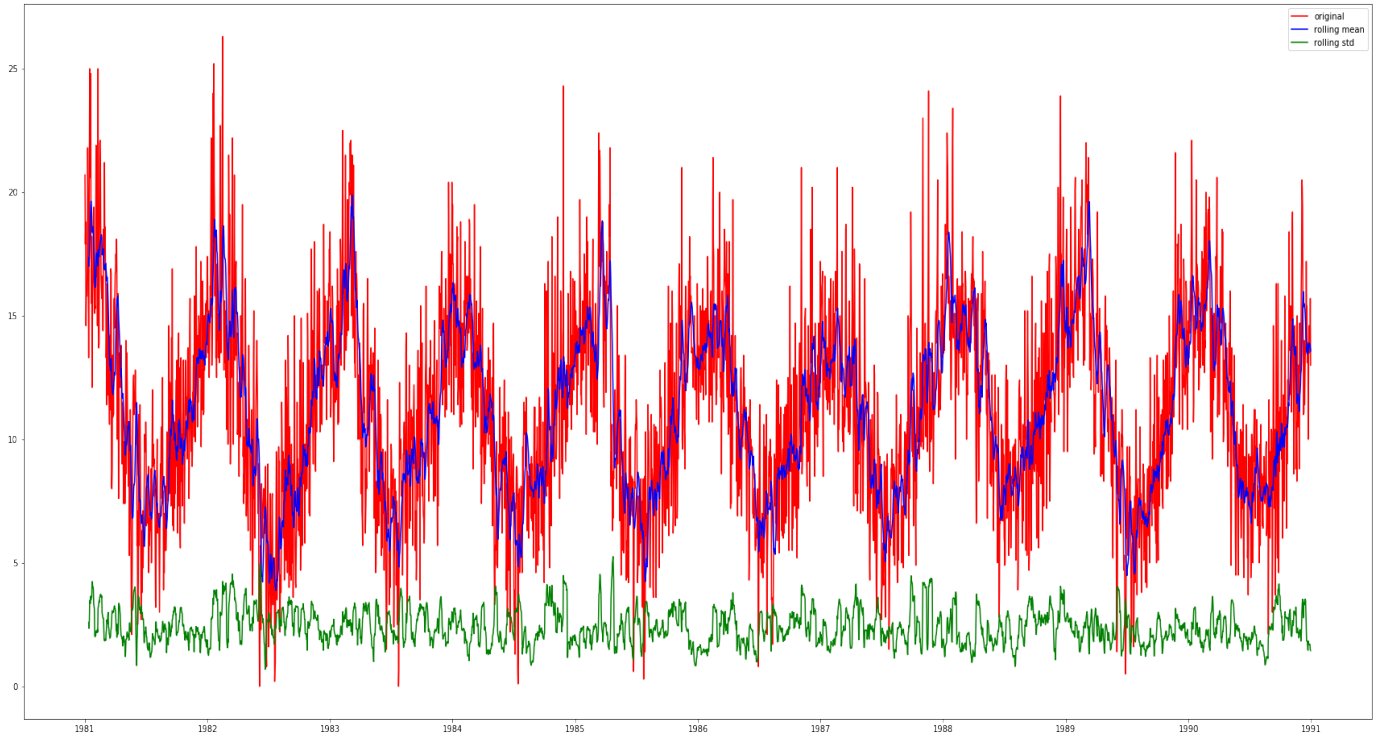
The plot after plotting the mean and the standard deviation is



The results for the DF test are given below

```
Mean of first part of data: 11.0435068493
Mean of second part of data 11.312
Standard deviation of first part of data: 4.26155194293
Standard deviation of second part of data 3.86700884016
Test Statistic                  -4.444805
p-value                          0.000247
#Lags Used                      20.000000
Number of Observations Used    3629.000000
Critical Value (1%)              -3.432153
Critical Value (5%)              -2.862337
Critical Value (10%)             -2.567194
```

If we observe the p-value it is less than 0.5 and the difference in the means are less when compared. So the given time series is stationary and we can apply ARIMA for forecasting.

The parameters for the ARIMA are found by grid search and then the parameters are used for training the model and then the model is used to make the forecasts and then the RMSE is calculated and the plots are made for the forcasted data.

The RMSE obtained is `3.69205616048`

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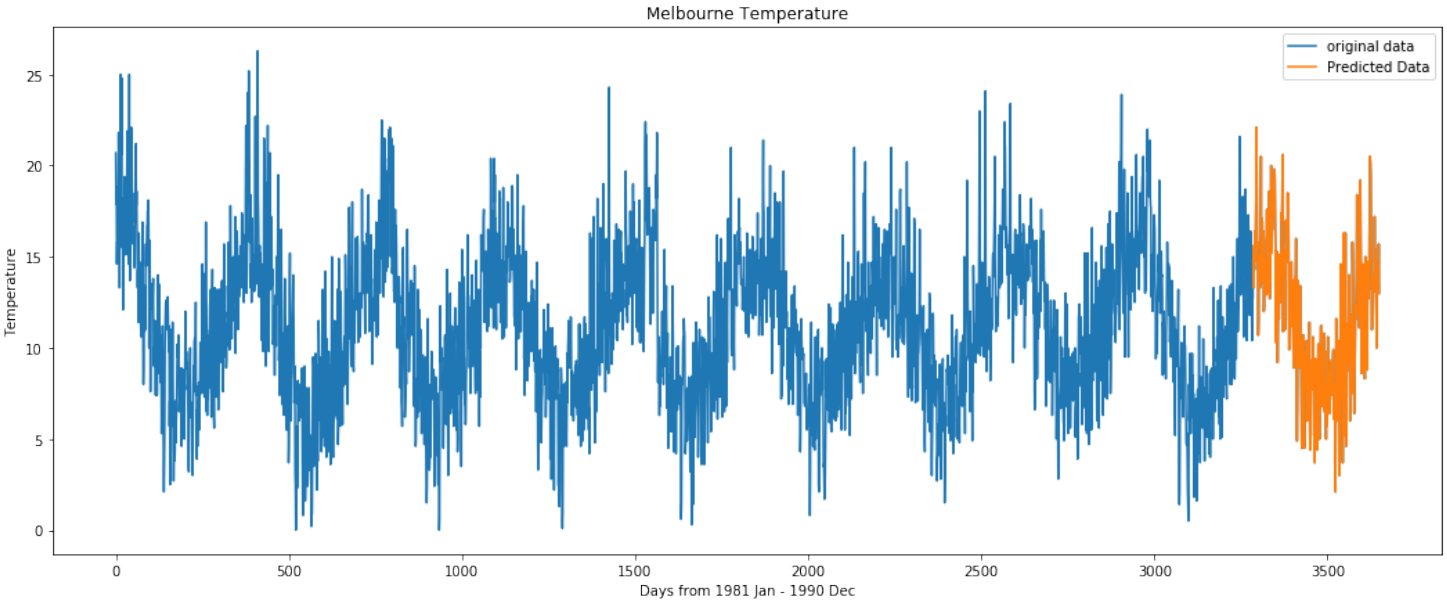

Task 2: Tensor Flow

Exercise : Logistic Regression on the Olivetti faces data set

1. The **olivetti faces** data set is a data set that contains a set of face images taken between April 1992 and April 1994 at AT&T Laboratories Cambridge.
2. The data set has ten different images of each of 40 distinct subjects. The image is quantized to 256 grey levels and stored as unsigned 8 bit integers, the loader will convert these to floating point values on the interval [0,1].
3. The target has 0-39 indicating identity of person.
4. The data set consists of 400 rows with 4096 features.
5. The 3D data set consists of 400*64*64 is converted into 400*4096 and the targets are encoded by using Label binarizer which is provided by sklearn package.
6. The data is split into train and test with 90 and 10 percentage.
7. The train data is used for training the model.
8. By using the tensor flow place holders the weights and the biases are defined . Then cross entropy is used as the cost function for the model and the accuracy is also defined for the model. All these are done by the tensor flow variables.
9. The tensor board variables is defined with the tensor.summary.scalar. And the graphs as well.
10. When the session is initiated and till it finishes the following process occurs the training data is divided into batches of size 100 and fed to the tensorflow model and the logistic regression is implemented on the batch.
11. The cost is calculated for each epoch and the accuracy for the training set is calculated at the end. The cost is plotted and at the end the test accuracy is also calculated.
12. Once the program is run the tensor board is initiated and the graphs are observed.

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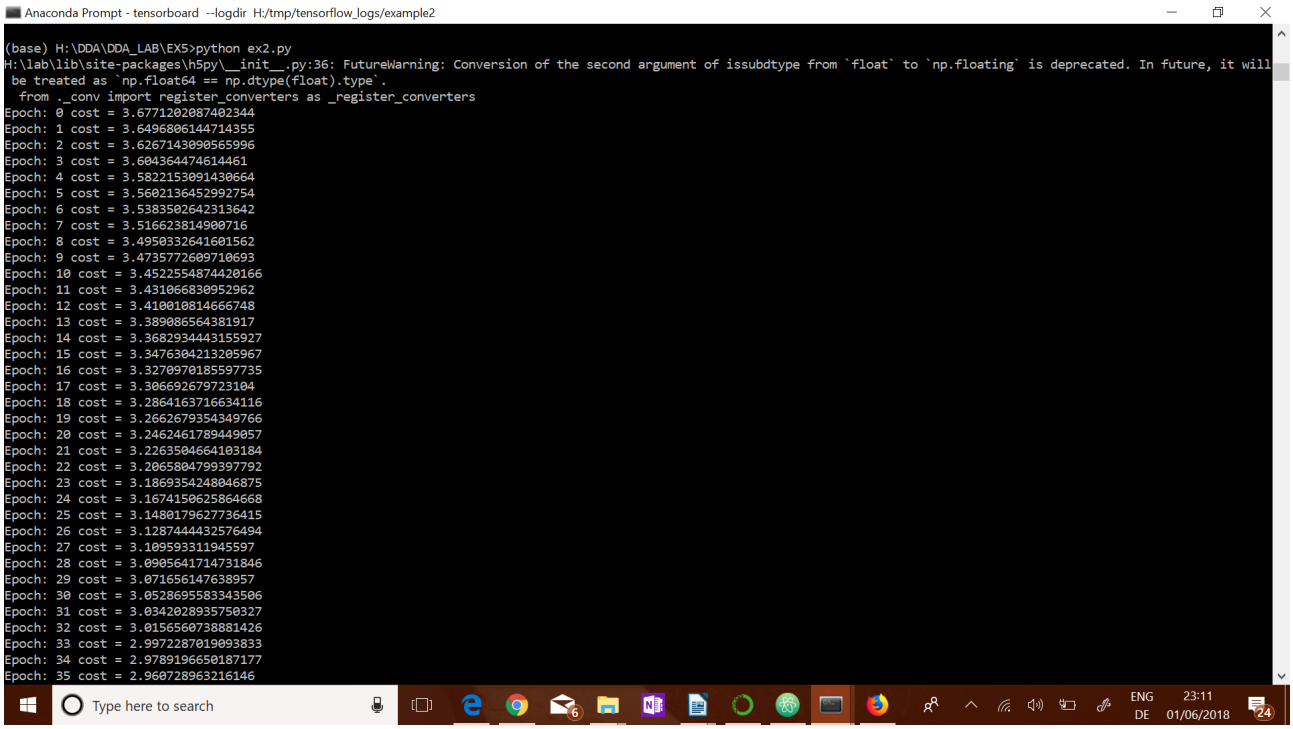

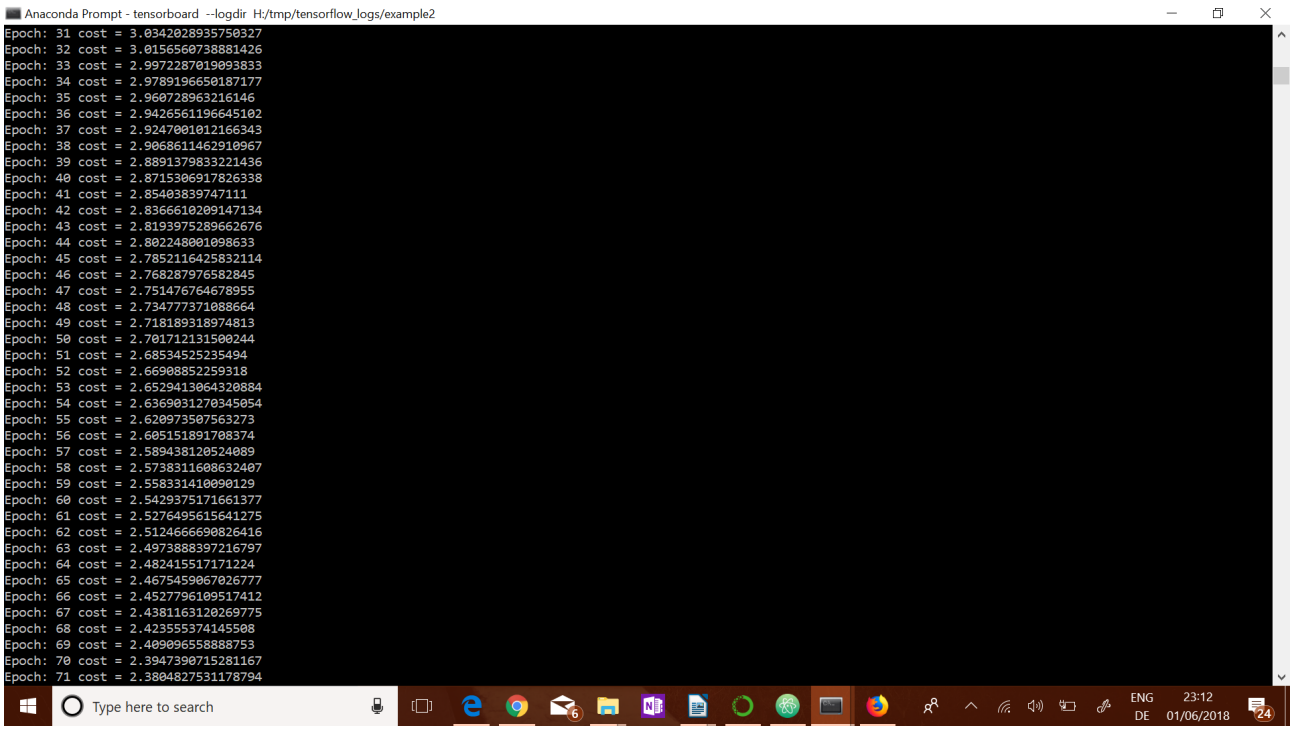

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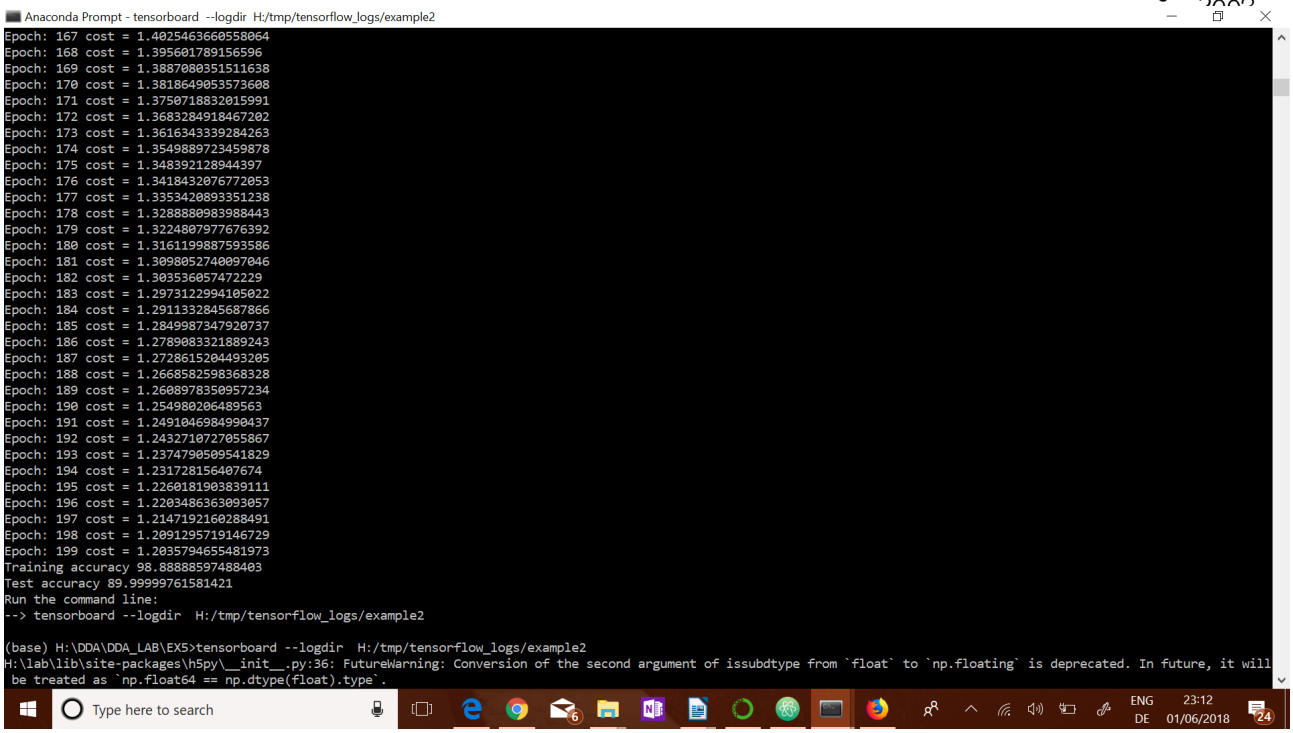

Learning Rate=0.01
Training Epochs=200
Batch size=100

The training accuracy obtained is 98.8 %
The test accuracy obtained is 89.9 %

After deploying the tensor board and deploying it we can see it by
Run the command line:
$tensorboard --logdir= /tmp/tensorflow_logs/example1.6/
Then open http://sunny:6006 into your web browser

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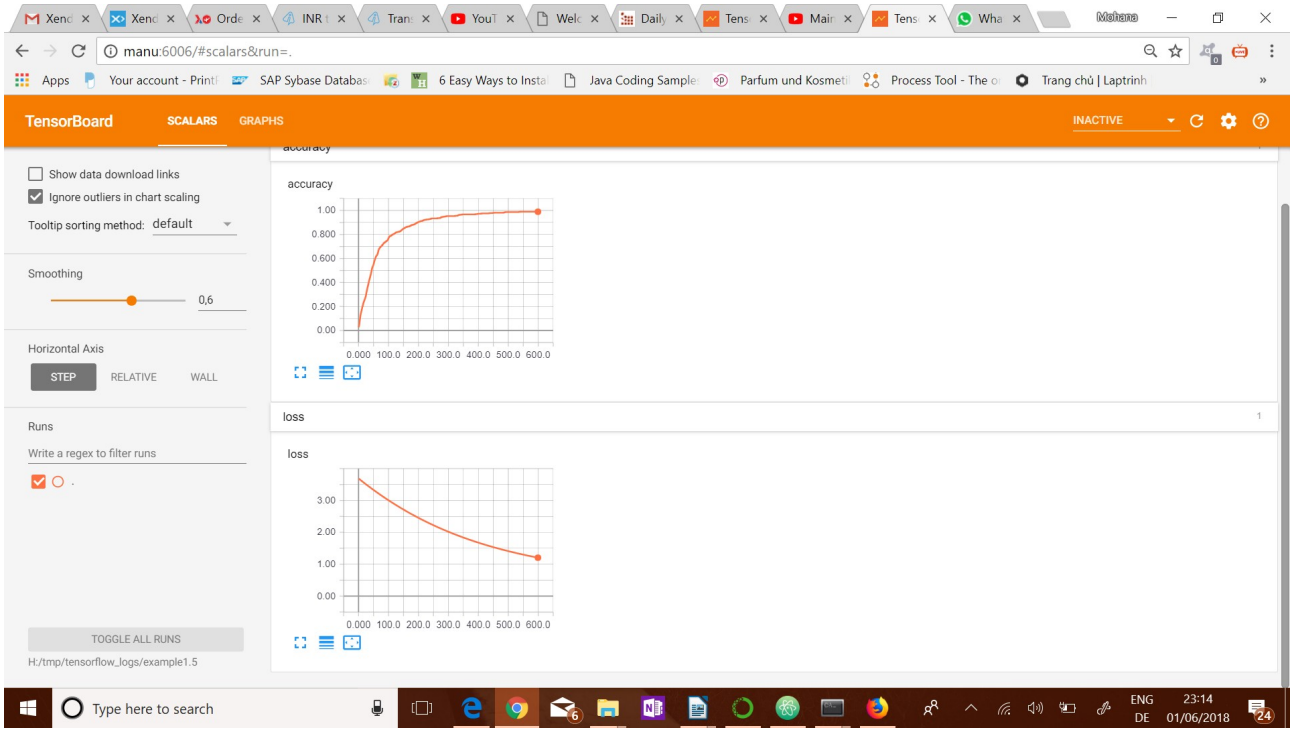
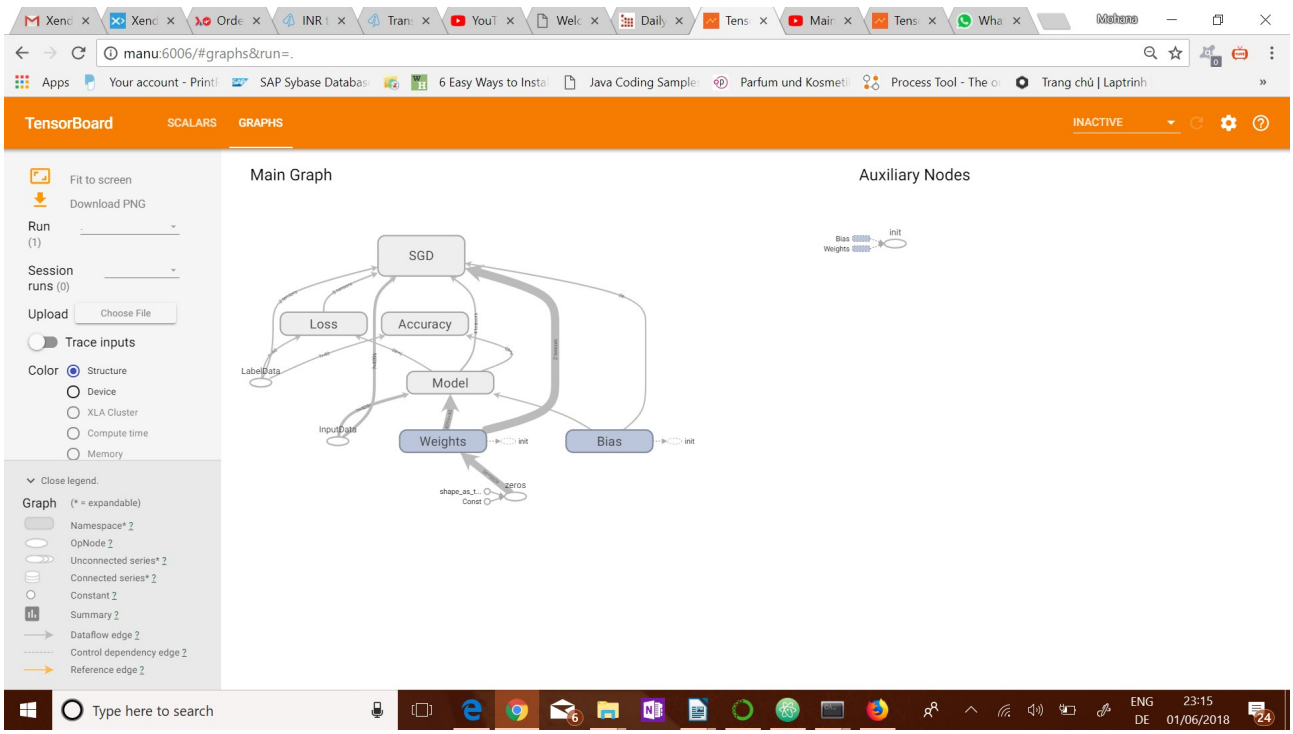
Scalars



Graph



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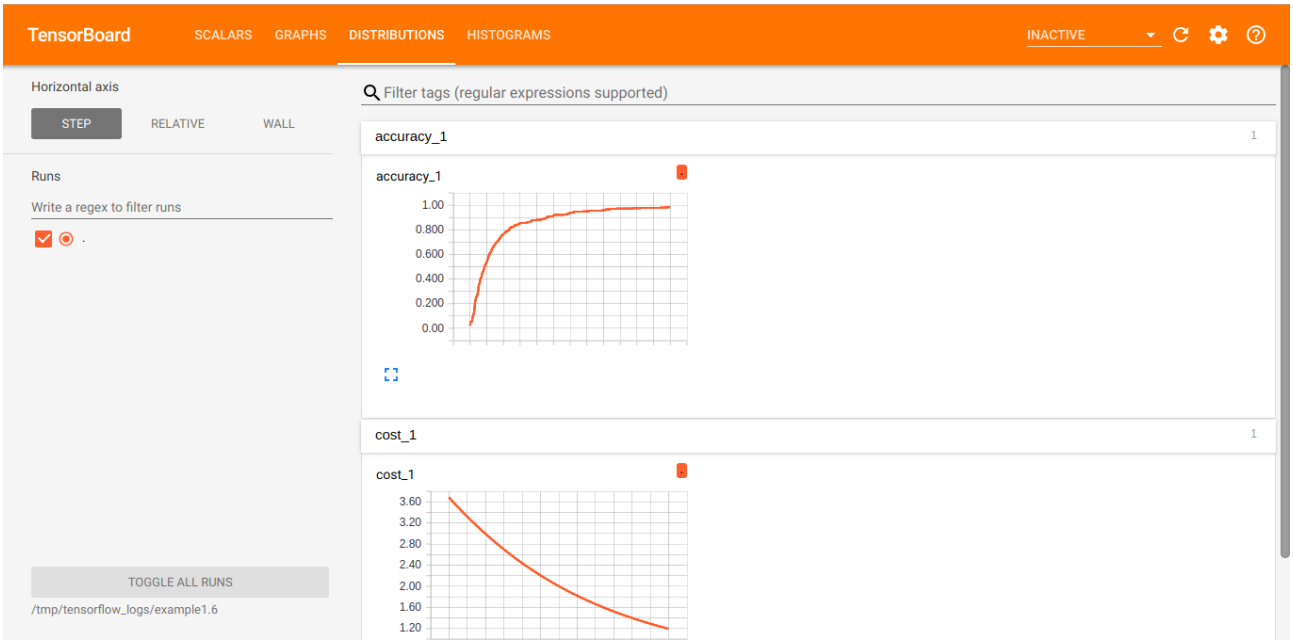
Distributions



Histogram