Team Stage-4

April 26, 2023

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import PolynomialFeatures
from sklearn.metrics import mean_squared_error
```

[2]:
```
# Reading the daywise new cases and deaths in USA.

dayWise = pd.read_csv("../../DATASETS/COVID DATASETS/CovidDayWise.csv")
dayWise.drop(['Unnamed: 0'],axis = 1, inplace = True)
dayWise
```

[2]:

	countyFIPS	County Name	State	StateFIPS	Date	\
0	1001	Autauga County	AL	1	2022-05-30	
1	1003	Baldwin County	AL	1	2022-05-30	
2	1005	Barbour County	AL	1	2022-05-30	
3	1007	Bibb County	AL	1	2022-05-30	
4	1009	Blount County	AL	1	2022-05-30	
…	…	…	…	…	…	
681809	56037	Sweetwater County	WY	56	2023-01-01	
681810	56039	Teton County	WY	56	2023-01-01	
681811	56041	Uinta County	WY	56	2023-01-01	
681812	56043	Washakie County	WY	56	2023-01-01	
681813	56045	Weston County	WY	56	2023-01-01	

	Number of new cases	Number of new Deaths
0	9	0
1	55	1
2	1	0
3	9	0
4	6	0
…	…	…
681809	0	0
681810	0	0
681811	0	0
681812	0	0
681813	0	0

```
[681814 rows x 7 columns]
```

[3]:
```
# Grouping them by Date to find total number of cases in a particular day.

dayWise = dayWise.groupby(['Date'])['Number of new cases','Number of new␣
 ↪Deaths'].sum().reset_index()
dayWise
```

```
C:\Users\venka\AppData\Local\Temp\ipykernel_19256\963740360.py:3: FutureWarning:
Indexing with multiple keys (implicitly converted to a tuple of keys) will be
deprecated, use a list instead.
  dayWise = dayWise.groupby(['Date'])['Number of new cases','Number of new
Deaths'].sum().reset_index()
```

[3]:

	Date	Number of new cases	Number of new Deaths
0	2022-05-30	51206	122
1	2022-05-31	76840	166
2	2022-06-01	158949	483
3	2022-06-02	67209	192
4	2022-06-03	206850	219
..	…	…	…
212	2022-12-28	28200	217
213	2022-12-29	80280	214
214	2022-12-30	107584	1510
215	2022-12-31	214	3
216	2023-01-01	0	0

```
[217 rows x 3 columns]
```

[4]:
```
# Any negative data present in the data is made to zero.

dayWise[dayWise['Number of new cases']<0]=0
dayWise[dayWise['Number of new Deaths']<0]=0
```

[5]:
```
# counting the number of days in the last six months of 2022.

days = []
for i in range(217):
    days.append(i)

days
```

[5]:
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 216]
```

[6]:
```
x = pd.DataFrame({'days': days})

yCases = dayWise['Number of new cases']
yDeaths = dayWise['Number of new Deaths']
```

[7]:
```
# Generating Prediction days for the next 1 week.

predictDays = []
for i in range(len(x), len(x)+7):
    predictDays.append(i)
predictDays = pd.DataFrame({'Future days': predictDays})
predictDays
```

[7]:

	Future days
0	217
1	218
2	219
3	220
4	221
5	222
6	223

1 Linear Regression and Forecasting.

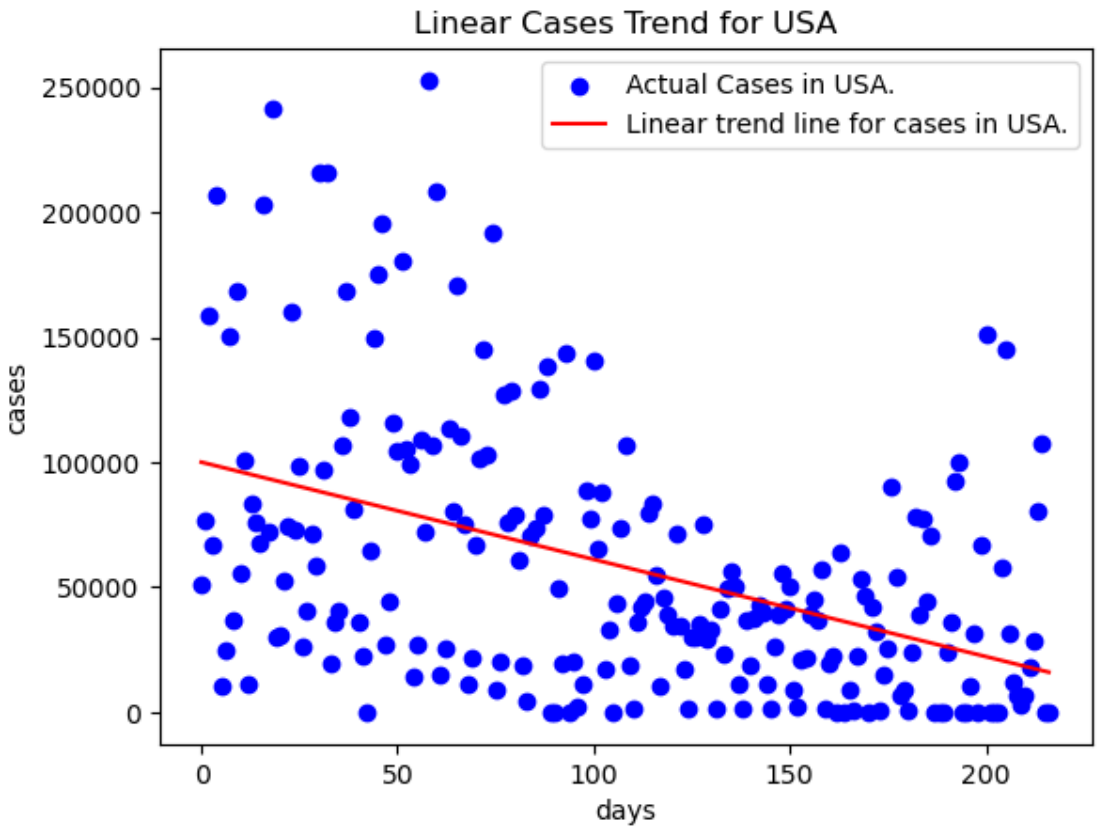
[8]:
```
# Generating a linear model regression for cases in USA.

linearModelCases = LinearRegression()
linearModelCases.fit(x,yCases)
casesTrend = linearModelCases.predict(x)
```

[9]:
```
# Plotting the linear regression for the Number of cases in USA.

plt.title('Linear Cases Trend for USA')
plt.xlabel('days')
plt.ylabel('cases')
plt.scatter(x, yCases, color='blue', label='Actual Cases in USA.')
plt.plot(x, casesTrend, color='red', label='Linear trend line for cases in USA.
  ↪')
plt.legend()
```

[9]:
```
<matplotlib.legend.Legend at 0x2a596050670>
```



[10]:
```
# RMSE error for the actual cases and predicted cases in USA.

rmseCases = mean_squared_error(yCases, casesTrend, squared=False)
rmseCases
```

[10]:
```
48745.96671545787
```

[11]:
```
# Forecasting the number of cases for 1 week ahead.

forecastCases = linearModelCases.predict(predictDays)
forecastCases
```

```
C:\Users\venka\anaconda3\lib\site-packages\sklearn\base.py:493: FutureWarning:
The feature names should match those that were passed during fit. Starting
version 1.2, an error will be raised.
Feature names unseen at fit time:
- Future days
Feature names seen at fit time, yet now missing:
- days

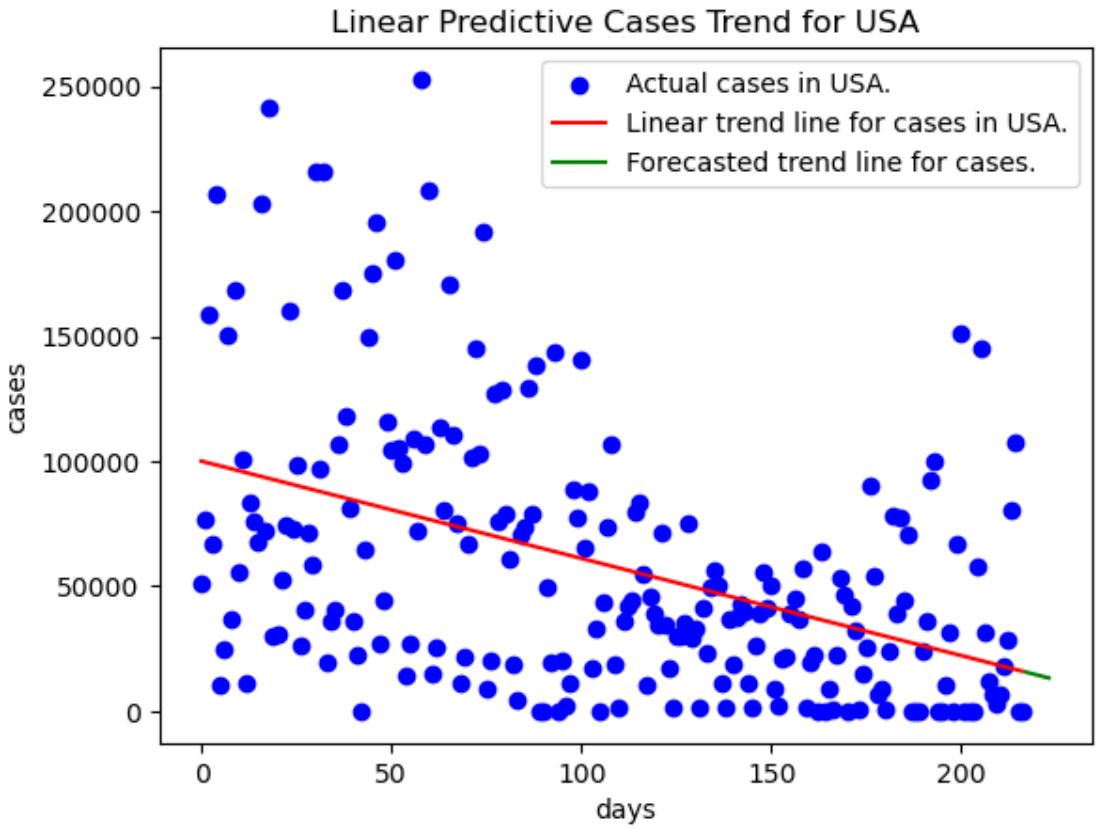
  warnings.warn(message, FutureWarning)
```

[11]:
```
array([15623.63402458, 15234.49575811, 14845.35749165, 14456.21922519,
       14067.08095872, 13677.94269226, 13288.8044258 ])
```

[12]:
```
# Plotting the predicted cases for 1 week ahead.

plt.title('Linear Predictive Cases Trend for USA')
plt.xlabel('days')
plt.ylabel('cases')
plt.scatter(x, yCases, color='blue', label='Actual cases in USA.')
plt.plot(x, casesTrend, color='red', label='Linear trend line for cases in USA.
 ↪')
plt.plot(predictDays['Future days'], forecastCases, color='green',␣
 ↪label='Forecasted trend line for cases.')
plt.legend()
```

[12]:
```
<matplotlib.legend.Legend at 0x2a5960b8c70>
```



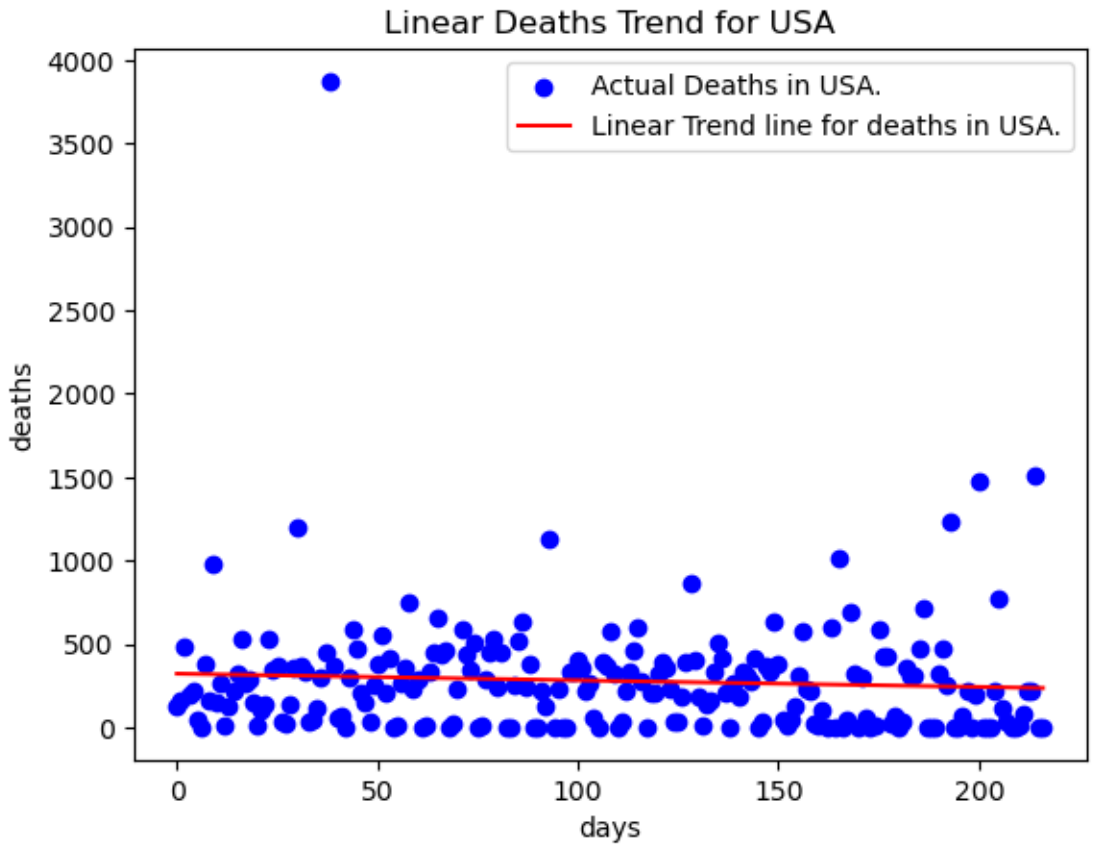
[13]:
```
# Generating the linear model regression for Deaths in USA.

linearModelDeaths = LinearRegression()
linearModelDeaths.fit(x,yDeaths)
deathsTrend = linearModelDeaths.predict(x)
```

[14]:
```
# Plotting the trend line for the number of deaths in USA.

plt.title('Linear Deaths Trend for USA')
plt.xlabel('days')
plt.ylabel('deaths')
plt.scatter(x, yDeaths, color = 'blue', label='Actual Deaths in USA.')
plt.plot(x, deathsTrend, color='red',label='Linear Trend line for deaths in USA.
 ↪' )
plt.legend()
```

[14]: <matplotlib.legend.Legend at 0x2a596114400>



[15]:
```
# RMSE error for actual deaths and predicted deaths for USA.

rmse = mean_squared_error(yDeaths, deathsTrend, squared=False)
rmse
```

[15]: 359.8176853371268

[16]:
```
# Forecating Deaths using linear model for 1 week ahead.

forecastDeaths = linearModelDeaths.predict(predictDays)
forecastDeaths
```

```
C:\Users\venka\anaconda3\lib\site-packages\sklearn\base.py:493: FutureWarning:
The feature names should match those that were passed during fit. Starting
version 1.2, an error will be raised.
Feature names unseen at fit time:
- Future days
Feature names seen at fit time, yet now missing:
- days
```

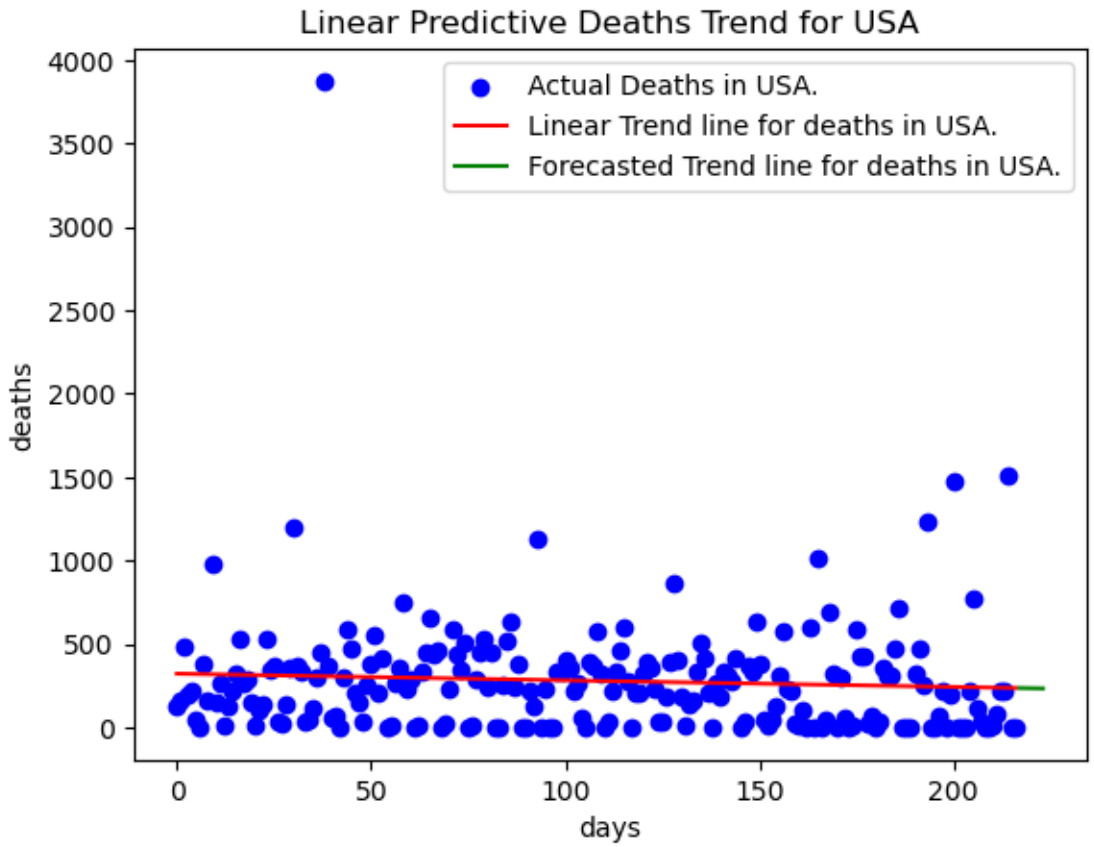
```
  warnings.warn(message, FutureWarning)
```

[16]:
```
array([235.06349206, 234.66661969, 234.26974732, 233.87287495,
       233.47600257, 233.0791302 , 232.68225783])
```

[17]:
```
# Plotting the predictive deaths for 1 week ahead.

plt.title('Linear Predictive Deaths Trend for USA')
plt.xlabel('days')
plt.ylabel('deaths')
plt.scatter(x, yDeaths, color = 'blue', label='Actual Deaths in USA.')
plt.plot(x, deathsTrend, color='red', label='Linear Trend line for deaths in␣
 ↪USA.' )
plt.plot(predictDays['Future days'], forecastDeaths, color='green',␣
 ↪label='Forecasted Trend line for deaths in USA.')
plt.legend()
```

[17]:
```
<matplotlib.legend.Legend at 0x2a5961b7eb0>
```



2 Non Linear Regression and Forecasting.

[18]:
```
# Modelling a non-linear regression of degree 6. I have tried all the degrees␣
 ↪for to know which degree has the optimal fit.
# Degree 6 has the optimal fit for the data.

nonLinear = PolynomialFeatures(degree=6)
days = np.array(days)
days = days.reshape(-1,1)
xPoly = nonLinear.fit_transform(days)
```

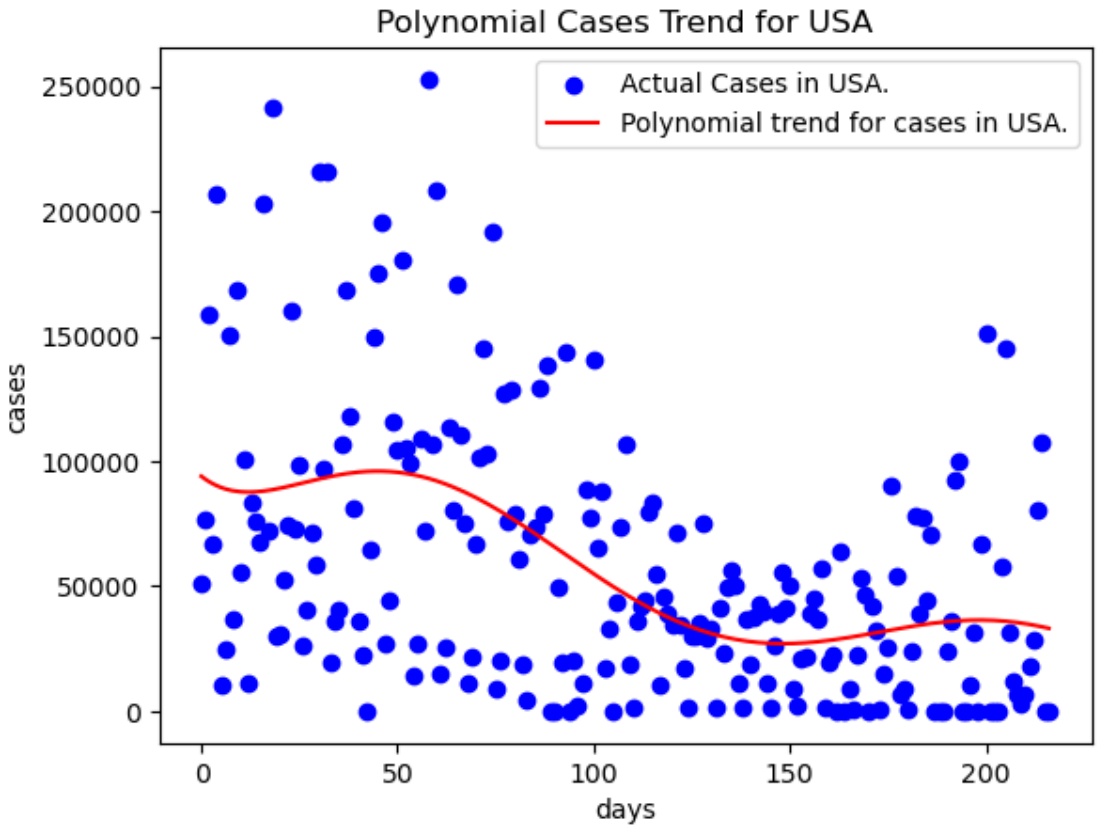
[19]:
```
# Applying linear model on polynomial fit to predict the trend.

linearModelCases.fit(xPoly, yCases)
polyCasesTrend = linearModelCases.predict(xPoly)
```

[20]:
```
# Plotting polynomial trend for number of cases in USA.

plt.title('Polynomial Cases Trend for USA')
plt.xlabel('days')
plt.ylabel('cases')
plt.scatter(x, yCases, color='blue', label='Actual Cases in USA.')
plt.plot(x, polyCasesTrend, color='red', label='Polynomial trend for cases in␣
 ↪USA.')
plt.legend()
```

[20]:
```
<matplotlib.legend.Legend at 0x2a596509880>
```



[21]:
```
# RMSE error for actual cases and polynomial trend for cases in USA.
rmsePolyCases = mean_squared_error(yCases, polyCasesTrend, squared=False)
rmsePolyCases
```

[21]:
```
47310.29431728599
```

[22]:
```
# Forecasting polynomial trend cases for 1 week ahead.

xFuturePoly = nonLinear.fit_transform(predictDays)
futureCasesTrend = linearModelCases.predict(xFuturePoly)
futureCasesTrend
```

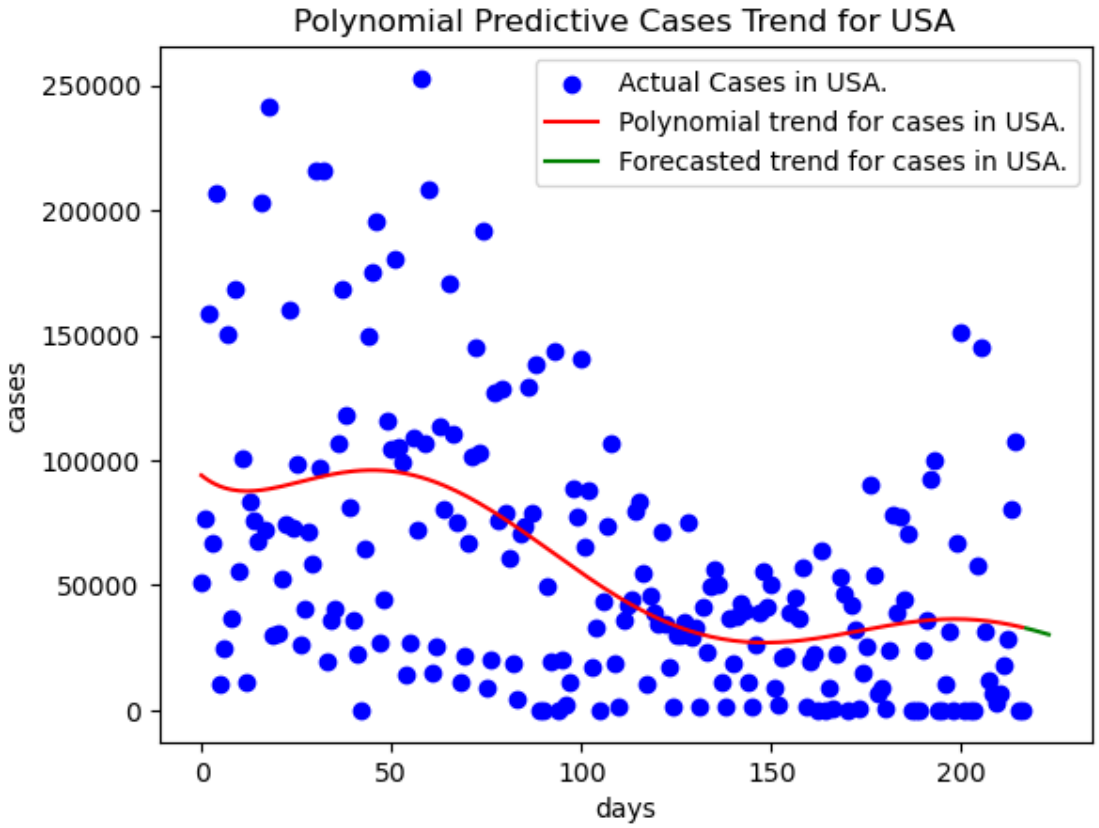
[22]:
```
array([32794.63475286, 32407.64626421, 32006.50459463, 31592.49921074,
       31167.03651018, 30731.64328255, 30287.9702088 ])
```

[23]:
```
# Plotting the forecasted cases for 1 week ahead.

plt.title('Polynomial Predictive Cases Trend for USA')
plt.xlabel('days')
plt.ylabel('cases')
```

```
plt.scatter(x, yCases, color='blue', label='Actual Cases in USA.')
plt.plot(x, polyCasesTrend, color='red', label='Polynomial trend for cases in␣
 ↪USA.')
plt.plot(predictDays['Future days'], futureCasesTrend, color='green',␣
 ↪label='Forecasted trend for cases in USA.')
plt.legend()
```

[23]: <matplotlib.legend.Legend at 0x2a596597f10>



[24]:
```
# Applying linear model on polynomial fit for deaths.

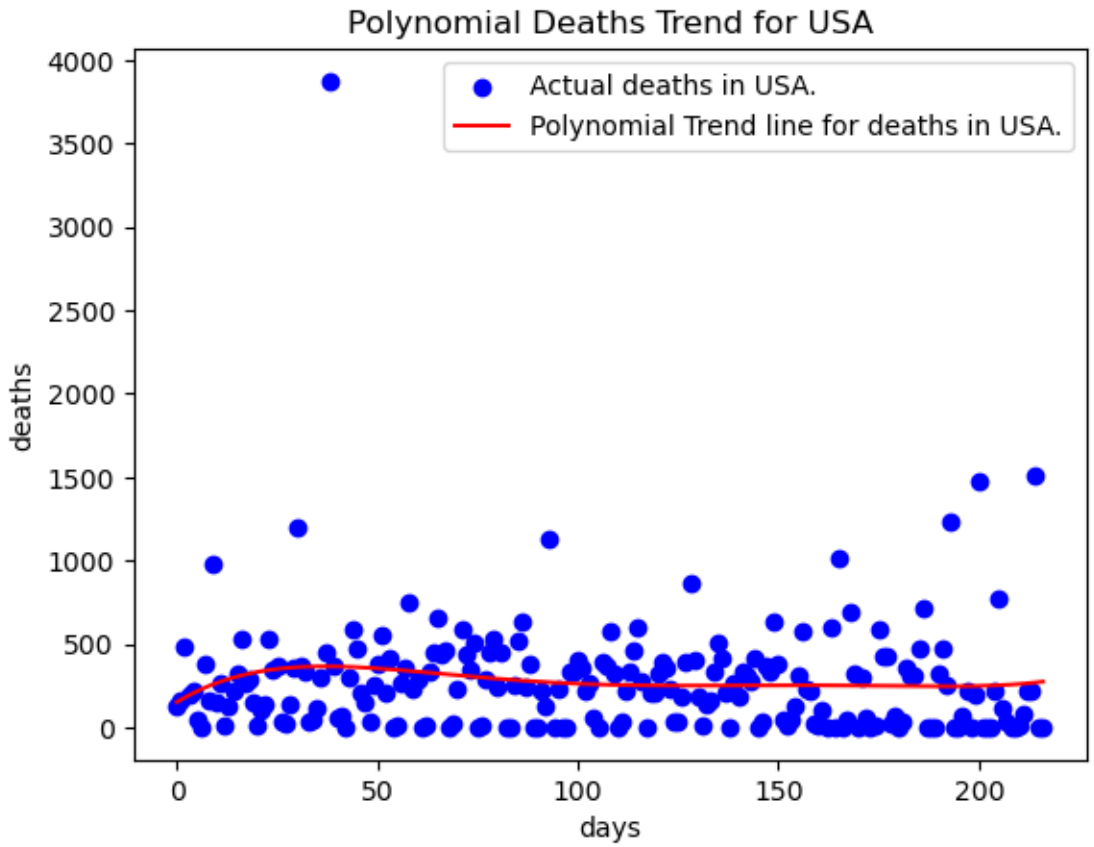
linearModelDeaths.fit(xPoly, yDeaths)
polyDeathsTrend = linearModelDeaths.predict(xPoly)
```

[25]:
```
# Plotting the polynomial deaths trend for USA.

plt.title('Polynomial Deaths Trend for USA')
plt.xlabel('days')
plt.ylabel('deaths')
plt.scatter(x, yDeaths, color='blue', label='Actual deaths in USA.')
```

```
plt.plot(x, polyDeathsTrend, color='red', label='Polynomial Trend line for␣
 ↪deaths in USA.')
plt.legend()
```

[25]: <matplotlib.legend.Legend at 0x2a5965da4f0>



[26]:
```
# RMSE error for actual deaths and polynomial deaths trend for USA.
rmsePolyDeaths = mean_squared_error(yDeaths, polyDeathsTrend, squared=False)
rmsePolyDeaths
```

[26]: 357.9967720870376

[27]:
```
# Forecasting polynomial deaths trend for 1 week ahead.

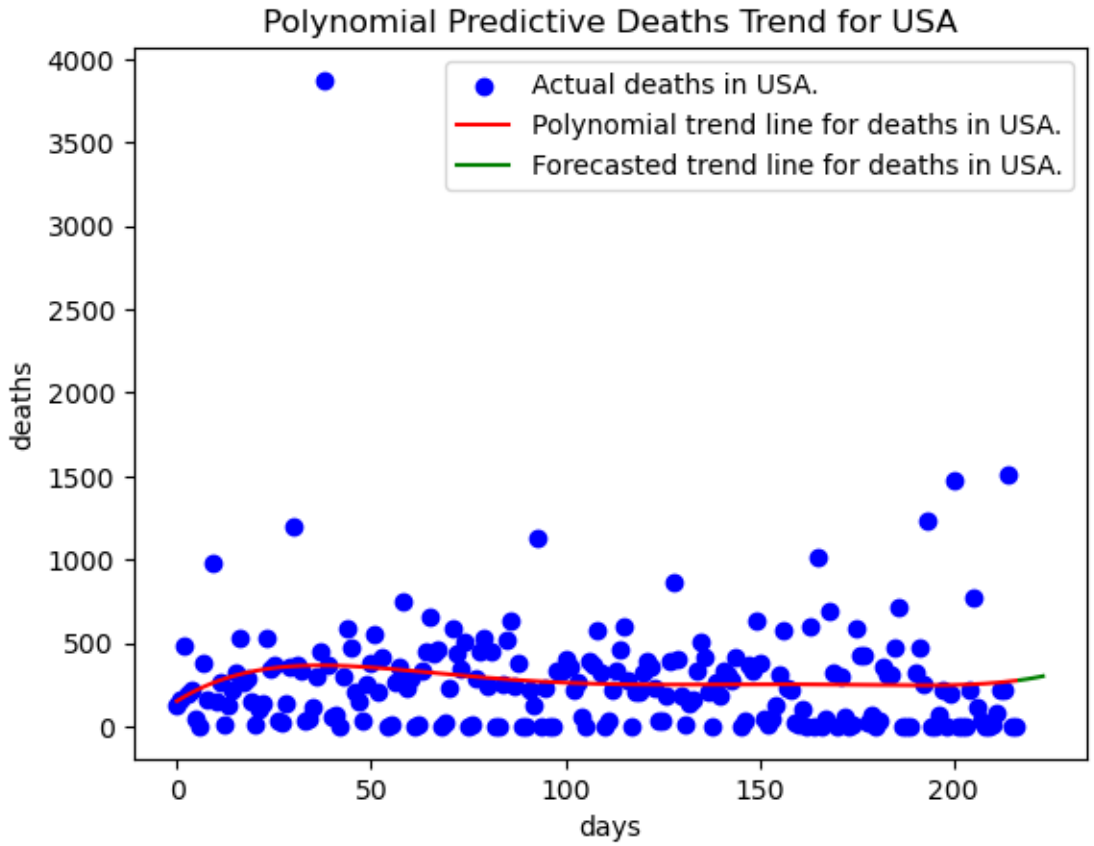
futureDeathsTrend = linearModelDeaths.predict(xFuturePoly)
futureDeathsTrend
```

[27]:
```
array([276.42026785, 279.7810167 , 283.38910978, 287.25588301,
       291.39297829, 295.81234746, 300.52625629])
```

[28]:
```
# Plotting forecasted polynomial deaths trend.

plt.title('Polynomial Predictive Deaths Trend for USA')
plt.xlabel('days')
plt.ylabel('deaths')
plt.scatter(x, yDeaths, color='blue', label='Actual deaths in USA.')
plt.plot(x, polyDeathsTrend, color='red', label='Polynomial trend line for␣
 ↪deaths in USA.')
plt.plot(predictDays['Future days'], futureDeathsTrend, color='green',␣
 ↪label='Forecasted trend line for deaths in USA.')
plt.legend()
```

[28]: <matplotlib.legend.Legend at 0x2a59676b640>



3 Bias versus Variance tradeoff

The bias and variance are the errors in the prediction data. Bias error results in an underfitting of the data that means it misses relation between feature and target. Variance error results in an overfitting curve that means data is very sensitive and results in fluctuations even small variation

of data.

Bias and variance tradeoff is nothing but generating an optimal fitting of the curve for the data. It should not the over fitting and underfitting.

4 Trend compared to other states.

[29]:
```
# Reading the world wide cases and deaths data.

worldWide = pd.read_csv("C:/Users/venka/OneDrive/Documents/GitHub/
 ↪Ferocious5_CS605/DATASETS/COVID DATASETS/owid-covid-data-clean.csv")
worldWide
```

[29]:
```
     iso_code      continent       location        date  new_cases  \
0         IDN           Asia      Indonesia  2020-01-03        0.0
1         IDN           Asia      Indonesia  2020-01-04        0.0
2         IDN           Asia      Indonesia  2020-01-05        0.0
3         IDN           Asia      Indonesia  2020-01-06        0.0
4         IDN           Asia      Indonesia  2020-01-07        0.0
…         …             …             …          …         …
4636      USA  North America  United States  2023-03-04   227828.0
4637      USA  North America  United States  2023-03-05        NaN
4638      USA  North America  United States  2023-03-06        NaN
4639      USA  North America  United States  2023-03-07        NaN
4640      USA  North America  United States  2023-03-08        NaN

      new_deaths   population
0            0.0  275501344.0
1            0.0  275501344.0
2            0.0  275501344.0
3            0.0  275501344.0
4            0.0  275501344.0
…            …            …
4636      2197.0  338289856.0
4637         NaN  338289856.0
4638         NaN  338289856.0
4639         NaN  338289856.0
4640         NaN  338289856.0

[4641 rows x 7 columns]
```

[30]:
```
# Converting the date column to datetype.

worldWide['date'] = pd.to_datetime(worldWide['date'])
worldWide.dtypes
```

[30]:
```
iso_code              object
continent             object
location              object
date          datetime64[ns]
new_cases            float64
new_deaths           float64
population           float64
dtype: object
```

[31]:
```
# Choosing three other countires  to compare the trend with USA.

CasesWorldIDN = worldWide.loc[worldWide['iso_code'] == 'IDN'] #INDONESIA
CasesWorldPAK = worldWide.loc[worldWide['iso_code'] == 'PAK'] #PAKISTHAN
CasesWorldNGA = worldWide.loc[worldWide['iso_code'] == 'NGA'] #NIGERIA
```

[32]:
```
# choosing the start date and end date to keep only last 6 months data.

start_date = '2022-05-30'
end_date = '2023-01-01'
date_range = pd.date_range(start=start_date, end=end_date)

casesWorldNewIDN = CasesWorldIDN[(CasesWorldIDN['date']>= start_date) &␣
 ↪(CasesWorldIDN['date']<= end_date)]
casesWorldNewPAK = CasesWorldPAK[(CasesWorldPAK['date']>= start_date) &␣
 ↪(CasesWorldPAK['date']<= end_date)]
casesWorldNewNGA = CasesWorldNGA[(CasesWorldNGA['date']>= start_date) &␣
 ↪(CasesWorldNGA['date']<= end_date)]
```

[33]:
```
# Indonesia country data.

casesWorldNewIDN
```

[33]:

	iso_code	continent	location	date	new_cases	new_deaths	\
878	IDN	Asia	Indonesia	2022-05-30	218.0	12.0	
879	IDN	Asia	Indonesia	2022-05-31	340.0	5.0	
880	IDN	Asia	Indonesia	2022-06-01	368.0	3.0	
881	IDN	Asia	Indonesia	2022-06-02	304.0	6.0	
882	IDN	Asia	Indonesia	2022-06-03	372.0	4.0	
…	…	…	…	…	…	…	
1090	IDN	Asia	Indonesia	2022-12-28	695.0	14.0	
1091	IDN	Asia	Indonesia	2022-12-29	685.0	9.0	
1092	IDN	Asia	Indonesia	2022-12-30	552.0	10.0	
1093	IDN	Asia	Indonesia	2022-12-31	488.0	19.0	
1094	IDN	Asia	Indonesia	2023-01-01	366.0	7.0	

	population
878	275501344.0

```
879   275501344.0
880   275501344.0
881   275501344.0
882   275501344.0
…            …
1090  275501344.0
1091  275501344.0
1092  275501344.0
1093  275501344.0
1094  275501344.0

[217 rows x 7 columns]
```

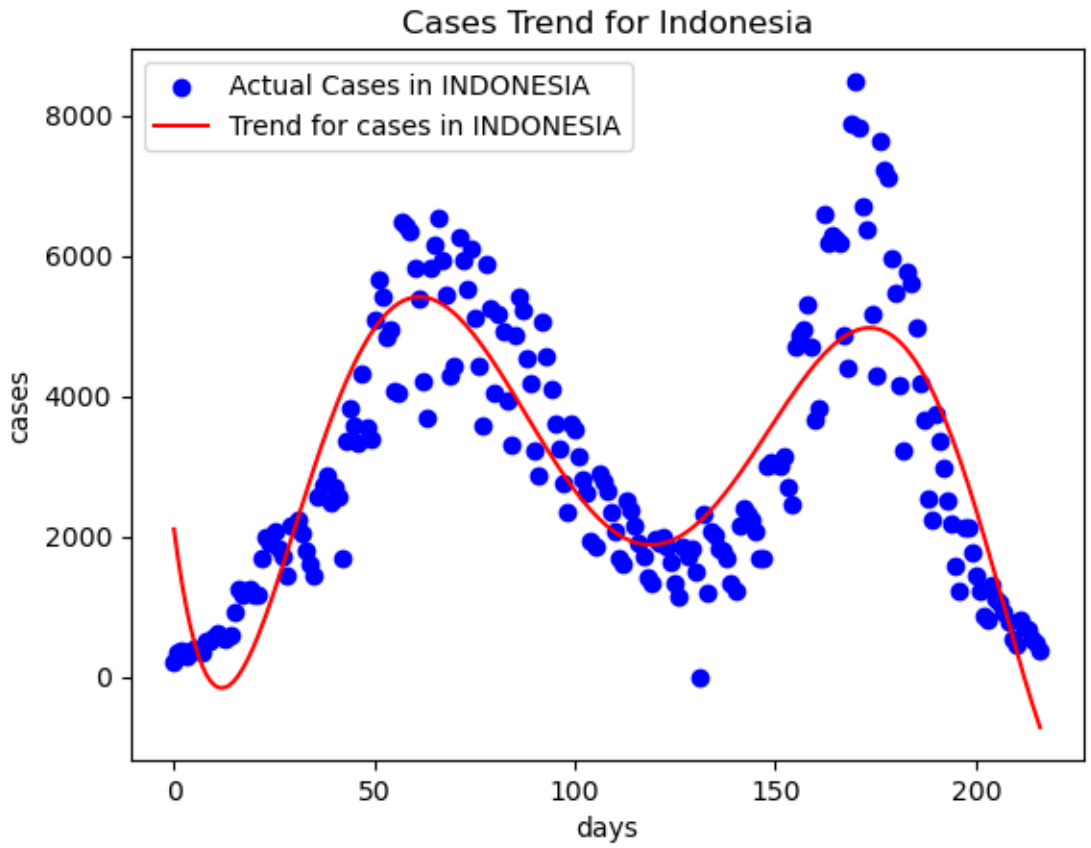
[34]:
```
# Generating the polynomial trend and forecast 1 week ahead.

linearModelCases.fit(xPoly, casesWorldNewIDN['new_cases'])
polyCasesTrendIDN = linearModelCases.predict(xPoly)
```

[35]:
```
# Ploting the polynomial trend for cases in INDONESIA.

plt.title('Cases Trend for Indonesia')
plt.xlabel('days')
plt.ylabel('cases')
plt.scatter(x, casesWorldNewIDN['new_cases'], color='blue', label='Actual Cases␣
 ↪in INDONESIA')
plt.plot(x, polyCasesTrendIDN, color='red', label='Trend for cases in␣
 ↪INDONESIA')
plt.legend()
```

[35]:
```
<matplotlib.legend.Legend at 0x2a5967eb340>
```



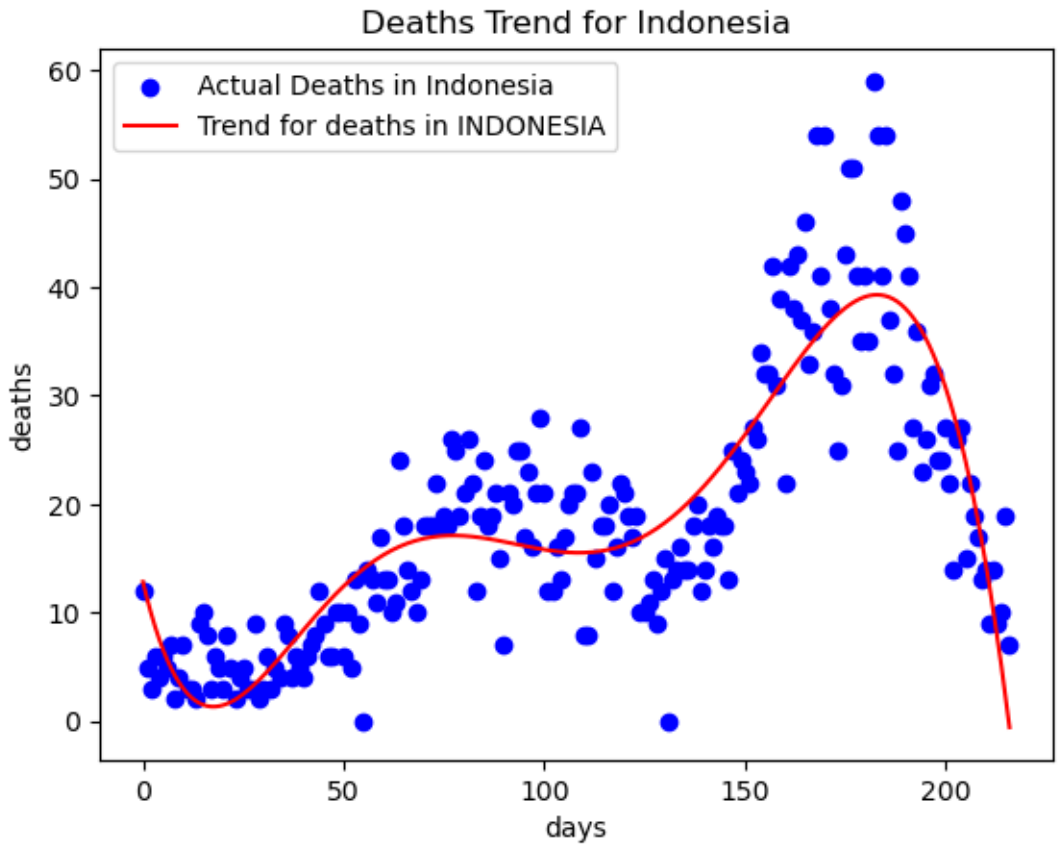
[36]:
```
#Generating the polynomial trend for deaths in INDONESIA.

linearModelDeaths.fit(xPoly, casesWorldNewIDN['new_deaths'])
polyDeathsTrendIDN = linearModelDeaths.predict(xPoly)
```

[37]:
```
# Ploting the polynomial trend for deaths in INDONESIA.

plt.title('Deaths Trend for Indonesia')
plt.xlabel('days')
plt.ylabel('deaths')
plt.scatter(x, casesWorldNewIDN['new_deaths'], color='blue', label='Actual␣
 ↪Deaths in Indonesia')
plt.plot(x, polyDeathsTrendIDN, color='red', label='Trend for deaths in␣
 ↪INDONESIA')
plt.legend()
```

[37]:
```
<matplotlib.legend.Legend at 0x2a59684cd60>
```



[38]:
```
# Data of PAKISTHAN.

casesWorldNewPAK
```

[38]:

	iso_code	continent	location	date	new_cases	new_deaths	population
3198	PAK	Asia	Pakistan	2022-05-30	50.0	0.0	235824864.0
3199	PAK	Asia	Pakistan	2022-05-31	48.0	0.0	235824864.0
3200	PAK	Asia	Pakistan	2022-06-01	54.0	0.0	
3201	PAK	Asia	Pakistan	2022-06-02	66.0	0.0	
3202	PAK	Asia	Pakistan	2022-06-03	67.0	0.0	
…	…	…	…	…	…	…	
3410	PAK	Asia	Pakistan	2022-12-28	0.0	0.0	
3411	PAK	Asia	Pakistan	2022-12-29	0.0	0.0	
3412	PAK	Asia	Pakistan	2022-12-30	0.0	0.0	
3413	PAK	Asia	Pakistan	2022-12-31	0.0	0.0	
3414	PAK	Asia	Pakistan	2023-01-01	0.0	0.0	

```
3200  235824864.0
3201  235824864.0
3202  235824864.0
…            …
3410  235824864.0
3411  235824864.0
3412  235824864.0
3413  235824864.0
3414  235824864.0

[217 rows x 7 columns]
```

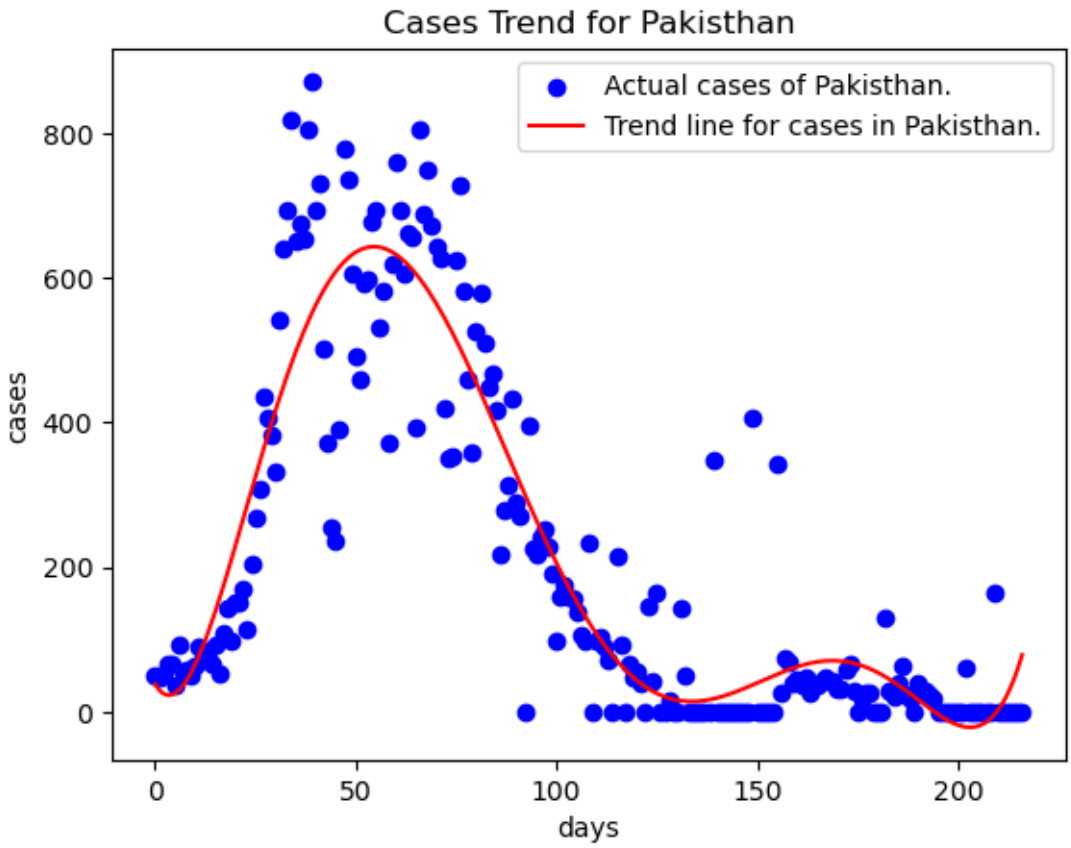
[39]:
```
# Generating trend for cases in PAKISTHAN.

linearModelCases.fit(xPoly, casesWorldNewPAK['new_cases'])
polyCasesTrendPAK = linearModelCases.predict(xPoly)
```

[40]:
```
# Plotting cases trend for PAKISTHAN.

plt.title('Cases Trend for Pakisthan')
plt.xlabel('days')
plt.ylabel('cases')
plt.scatter(x, casesWorldNewPAK['new_cases'], color='blue', label='Actual cases␣
 ↪of Pakisthan.')
plt.plot(x, polyCasesTrendPAK, color='red', label='Trend line for cases in␣
 ↪Pakisthan.')
plt.legend()
```

[40]:
```
<matplotlib.legend.Legend at 0x2a596c6c130>
```



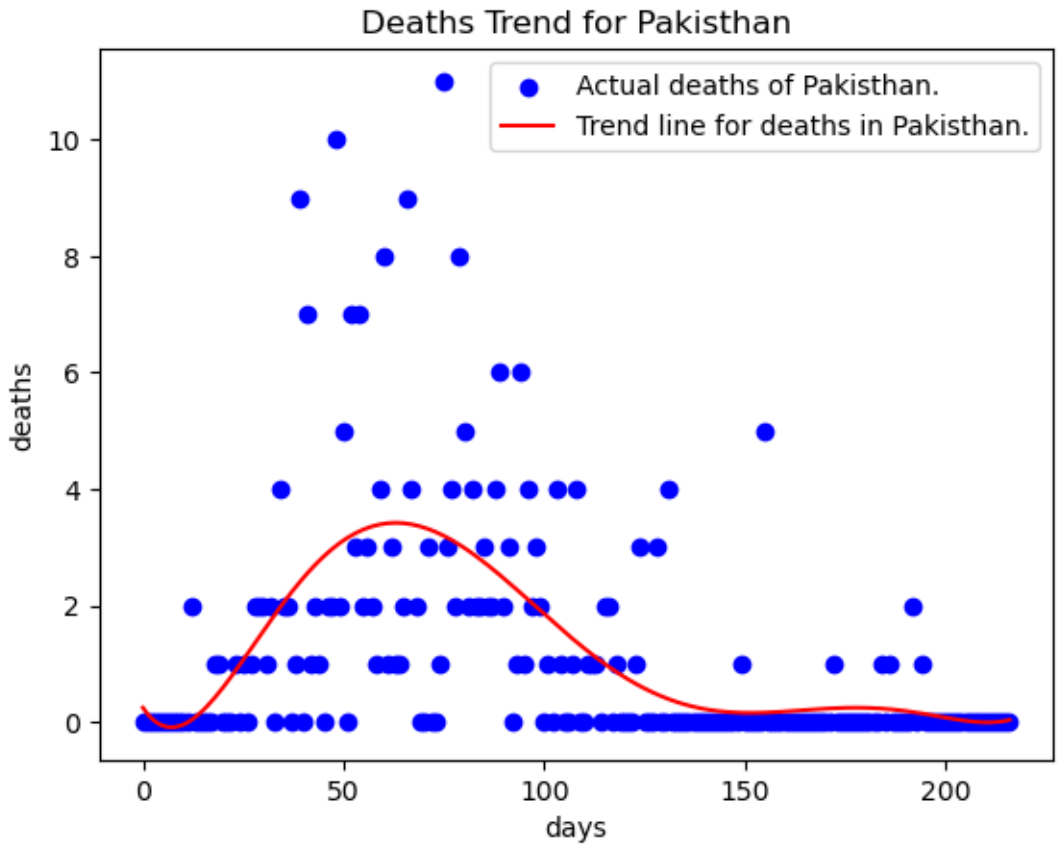
[41]:
```
# Generating trend for deaths in PAKISTHAN.

linearModelDeaths.fit(xPoly, casesWorldNewPAK['new_deaths'])
polyDeathsTrendPAK = linearModelDeaths.predict(xPoly)
```

[42]:
```
# Plotting deaths trend for PAKISTHAN.

plt.title('Deaths Trend for Pakisthan')
plt.xlabel('days')
plt.ylabel('deaths')
plt.scatter(x, casesWorldNewPAK['new_deaths'], color='blue', label='Actual␣
 ↪deaths of Pakisthan.')
plt.plot(x, polyDeathsTrendPAK, color='red', label='Trend line for deaths in␣
 ↪Pakisthan.')
plt.legend()
```

[42]: <matplotlib.legend.Legend at 0x2a5960cc3a0>



[43]:
```
# Data for Nigeria.

casesWorldNewNGA
```

[43]:
```
     iso_code continent location       date  new_cases  new_deaths  \
2038      NGA    Africa  Nigeria 2022-05-30       51.0         0.0
2039      NGA    Africa  Nigeria 2022-05-31        0.0         0.0
2040      NGA    Africa  Nigeria 2022-06-01        0.0         0.0
2041      NGA    Africa  Nigeria 2022-06-02       34.0         0.0
2042      NGA    Africa  Nigeria 2022-06-03        0.0         0.0
…         …      …       …       …          …         …           …
2250      NGA    Africa  Nigeria 2022-12-28        0.0         0.0
2251      NGA    Africa  Nigeria 2022-12-29        0.0         0.0
2252      NGA    Africa  Nigeria 2022-12-30        0.0         0.0
2253      NGA    Africa  Nigeria 2022-12-31       35.0         0.0
2254      NGA    Africa  Nigeria 2023-01-01        0.0         0.0

       population
2038  218541216.0
2039  218541216.0
```

```
2040  218541216.0
2041  218541216.0
2042  218541216.0
…            …
2250  218541216.0
2251  218541216.0
2252  218541216.0
2253  218541216.0
2254  218541216.0

[217 rows x 7 columns]
```

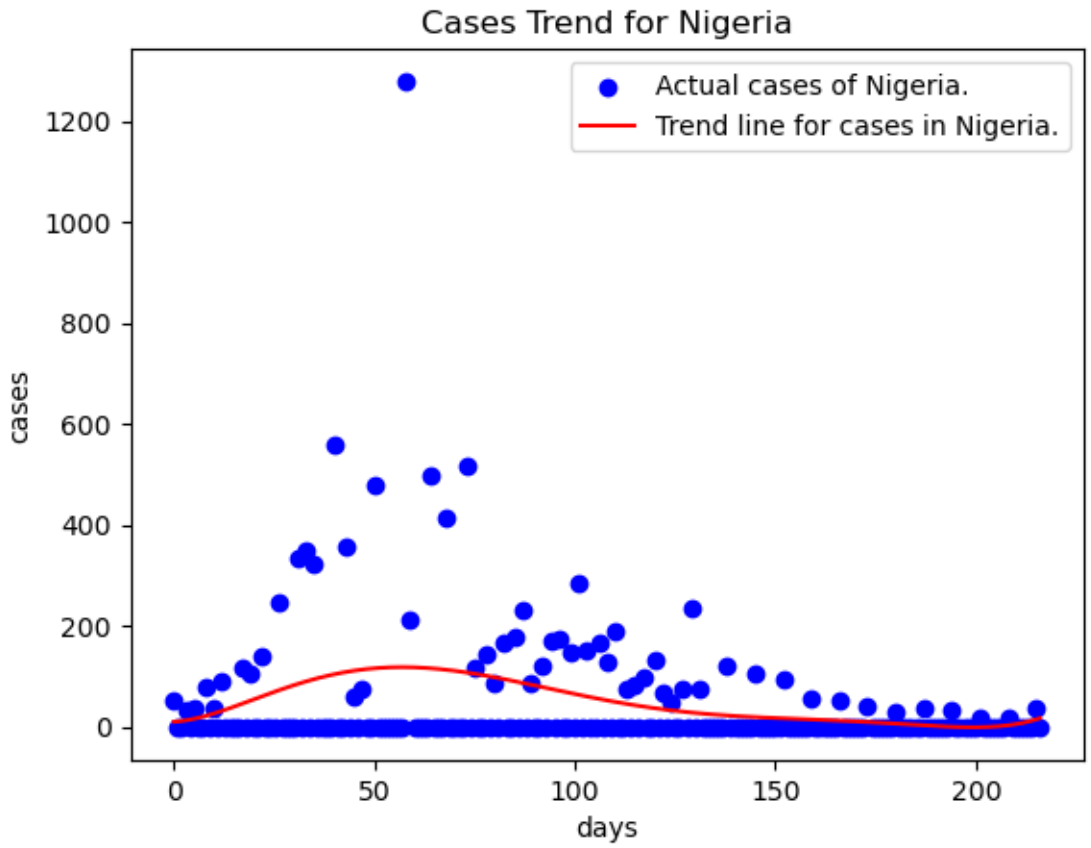
[44]:
```
# Generating trend for cases in NIGERIA.

linearModelCases.fit(xPoly, casesWorldNewNGA['new_cases'])
polyCasesTrendNGA = linearModelCases.predict(xPoly)
```

[45]:
```
# Plotting cases trend for NIGERIA.

plt.title('Cases Trend for Nigeria')
plt.xlabel('days')
plt.ylabel('cases')
plt.scatter(x, casesWorldNewNGA['new_cases'], color='blue', label='Actual cases␣
 ↪of Nigeria.')
plt.plot(x, polyCasesTrendNGA, color='red', label='Trend line for cases in␣
 ↪Nigeria.')
plt.legend()
```

[45]:
```
<matplotlib.legend.Legend at 0x2a596d2d220>
```



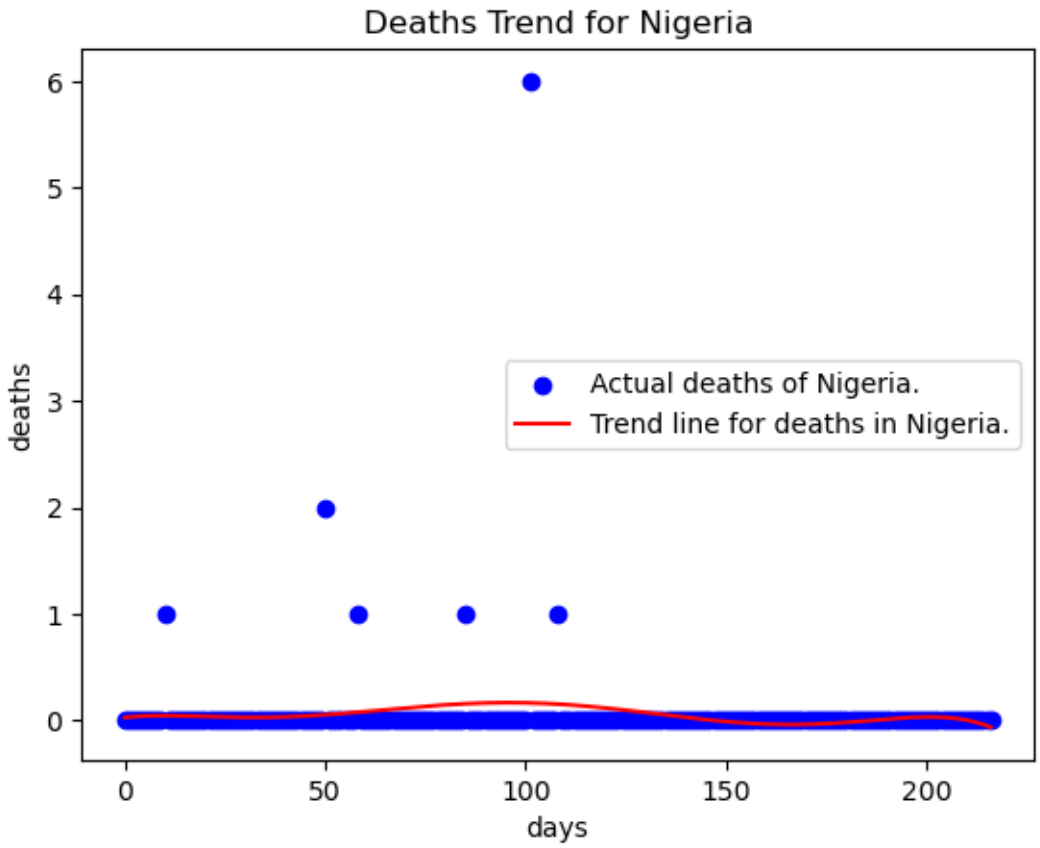
[46]:
```
# Generating trend for deaths in NIGERIA.

linearModelDeaths.fit(xPoly, casesWorldNewNGA['new_deaths'])
polyDeathsTrendNGA = linearModelDeaths.predict(xPoly)
```

[47]:
```
# Plotting deaths trend for NIGERIA.

plt.title('Deaths Trend for Nigeria')
plt.xlabel('days')
plt.ylabel('deaths')
plt.scatter(x, casesWorldNewNGA['new_deaths'], color='blue', label='Actual␣
 ↪deaths of Nigeria.')
plt.plot(x, polyDeathsTrendNGA, color='red', label='Trend line for deaths in␣
 ↪Nigeria.')
plt.legend()
```

[47]:
```
<matplotlib.legend.Legend at 0x2a5970cd130>
```



5 Comparision of other states with USA.

When compared to other nations USA has the highest number of cases per each day where as Nigeria has lowest number of cases on each day. At the end of last six months of 2022, Nigeria covid cases are almost equal to 0, where as USA has thousands of covid cases even at the end. Pakisthan covid cases has declined after 100 days and reported less than 100 cases for the next hundred days. Cases of Indonesia is very fluctuating that cases sharply declined between 100 to 150 days and then rapidly increased after 150 days and reported alomost 0 cases after 200th day.

Nigeria has the lowest number of deaths on each day where as USA has the highest number of deaths on each day. Pakisthan has its maximum deaths between 50 to 100 days and Indonesia has its highest number of deaths on each day between 150 to 200 days. Overall USA has witnessed maximum number of deaths on each day for the last 6 months of 2022.

6 References:

1) https://scikit-learn.org/stable/modules/generated/sklearn.preprocessing.PolynomialFeatures.html

2)https://scikitlearn.org/stable/modules/generated/sklearn.preprocessing.PolynomialFeatures.html#sklearn.prep

3) https://scikit-learn.org/stable/modules/generated/sklearn.linear_model.LinearRegression.html

4) https://scikit-learn.org/stable/modules/generated/sklearn.linear_model.LinearRegression.html#sklearn.lin

5) https://scikit-learn.org/stable/modules/generated/sklearn.metrics.mean_squared_error.html

[ ]: