Chapter 6

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1 Hands-On Data Preprocessing in Python

Learn how to effectively prepare data for successful data analytics

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2 Chapter 6: Prediction

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

2.1 Predictive models

2.1.1 Forecasting

Example of using forecasting to predict future

[2]:
```
msu_df = pd.read_csv('MSU applications.csv')
msu_df.set_index('Year',drop=True,inplace=True)
```

[3]:
```
msu_df
```

[3]:

Year	P_Football_Performance	SMAn2	N_Applications
2006	0.273	5778.0	5778
2007	0.273	5778.0	5140
2008	0.250	5459.0	6141
2009	0.615	5640.5	7429
2010	0.333	6785.0	7839
2011	0.417	7634.0	9300
2012	0.692	8569.5	9864
2013	0.538	9582.0	10449
2014	0.615	10156.5	11117
2015	0.538	10783.0	10766
2016	0.769	10941.5	12701
2017	0.692	11733.5	13930
2018	0.462	13315.5	13817
2019	0.692	13873.5	17363

```
2020                    0.615  15590.0            18269
2021                    0.462  17816.0            16127
```

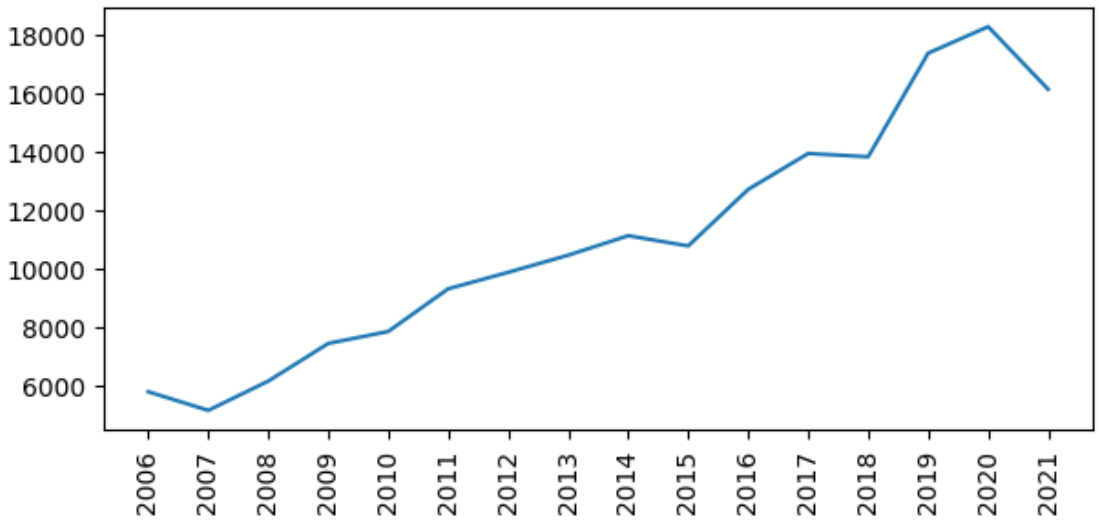
[4]:
```
application_df = pd.DataFrame(msu_df.N_Applications)
```

[5]:
```
application_df.transpose()
```

[5]:
```
Year            2006  2007  2008  2009  2010  2011  2012   2013   2014   2015  \
N_Applications  5778  5140  6141  7429  7839  9300  9864  10449  11117  10766

Year             2016   2017   2018   2019   2020   2021
N_Applications  12701  13930  13817  17363  18269  16127
```

[6]:
```
plt.figure(figsize=(7,3))
plt.plot(application_df)
plt.xticks(application_df.index,rotation=90)
plt.show()
```



[7]:
```
application_df.loc[2017:2021].mean()
```

[7]:
```
N_Applications    15901.2
dtype: float64
```

[8]:
```
average_df = pd.DataFrame(application_df.loc[2017:2021])
average_df['N_Applications'] = 15901.2
average_df.loc[2022] = 15901.2
```

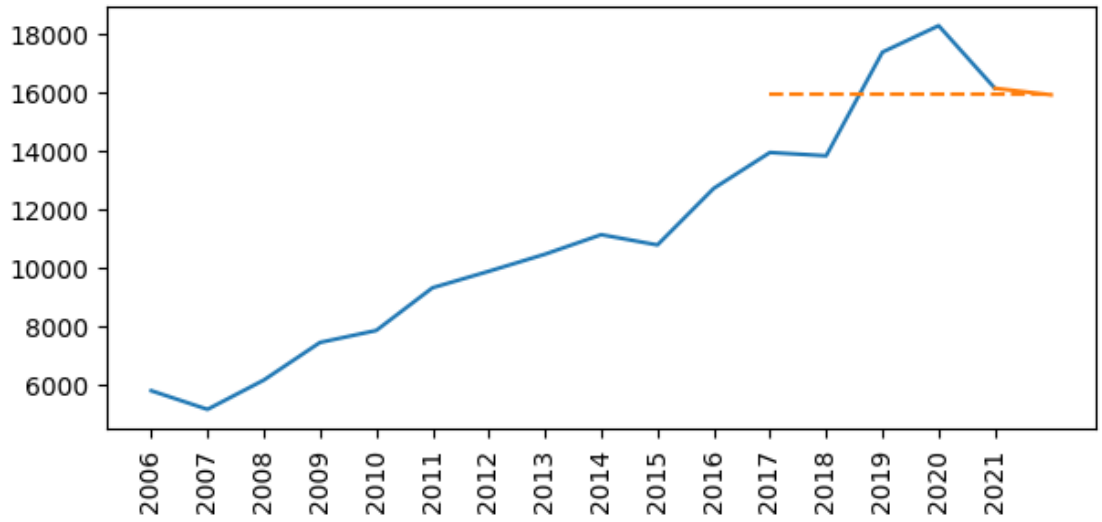
[10]:
```
predict_df = pd.DataFrame(application_df.loc[2021]).transpose()
predict_df.loc[2022] = 15901.2
```

```
predict_df
```

[10]:

	N_Applications
2021	16127.0
2022	15901.2

[11]:
```
plt.figure(figsize=(7,3))
plt.plot(application_df)
plt.plot(average_df,linestyle='--',c='C1')
plt.plot(predict_df,c='C1')
plt.xticks(application_df.index,rotation=90)
plt.show()
```



2.2 Regression Analysis

2.2.1 Example of designing regression analysis to predict future values

2.3 Linear Regression

[12]:
```
import pandas as pd
msu_df = pd.read_csv('MSU applications.csv')
msu_df.set_index('Year',drop=True,inplace=True)
msu_df
```

[12]:

Year	P_Football_Performance	SMAn2	N_Applications
2006	0.273	5778.0	5778
2007	0.273	5778.0	5140
2008	0.250	5459.0	6141
2009	0.615	5640.5	7429

2010	0.333	6785.0	7839
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2018	0.462	13315.5	13817
2019	0.692	13873.5	17363
2020	0.615	15590.0	18269
2021	0.462	17816.0	16127

[14]:
```
from sklearn.linear_model import LinearRegression

X = ['P_Football_Performance','SMAn2']
y = 'N_Applications'

data_X = msu_df[X]
data_y = msu_df[y]

lm = LinearRegression()
lm.fit(data_X, data_y)

print('intercept (b0) ', lm.intercept_)
coef_names = ['b1','b2']
print(pd.DataFrame({'Predictor': data_X.columns,
                    'coefficient Name':coef_names,
                    'coefficient Value': lm.coef_}))
```

```
intercept (b0)  -890.7106225983407
               Predictor coefficient Name  coefficient Value
0  P_Football_Performance               b1        5544.961933
1                  SMAn2               b2           0.907032
```

How to use the trained equation for prediction

[15]:
```
newData = pd.DataFrame({'P_Football_Performance':0.364,'SMAn2':17198},
                       index=[2022])
newData
```

[15]:

	P_Football_Performance	SMAn2
2022	0.364	17198

[16]:
```
lm.predict(newData)
```

[16]:
```
array([16726.78787061])
```

2.4 Multi-Layered Perceptron (MLP)

[17]:
```
from sklearn.neural_network import MLPRegressor

X = ['P_Football_Performance','SMAn2']
y = 'N_Applications'

data_X = msu_df[X]
data_y = msu_df[y]

mlp = MLPRegressor(hidden_layer_sizes=6, max_iter=10000)
mlp.fit(data_X, data_y)

mlp.predict(newData)
```

[17]:
```
array([18822.22578833])
```