Ch1_(1)

February 25, 2025

1

[1]:

```
import pandas as pd
import numpy as np
missdict = {'f1': [1, 2, 3, 4, 5, 6, 7, 8, 9, 10],
            'f2': [10., None, 20., 30., None, 50., 60., 70., 80., 90.],
            'f3': ['A','A', 'A', 'A','B','B','B','B','C','C']}
missdata = pd.DataFrame( missdict )
missdata.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9
Data columns (total 3 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   f1      10 non-null     int64
 1   f2      8 non-null      float64
 2   f3      10 non-null     object
dtypes: float64(1), int64(1), object(1)
memory usage: 368.0+ bytes
```

[2]:

```
missdata.isna().mean()
```

[2]:

```
f1    0.0
f2    0.2
f3    0.0
dtype: float64
```

[3]:

```
tmpdata1 = missdata.dropna()
tmpdata1
```

[3]:

```
   f1    f2 f3
0   1  10.0  A
2   3  20.0  A
3   4  30.0  A
5   6  50.0  B
6   7  60.0  B
```

```
7   8  70.0  B
8   9  80.0  C
9  10  90.0  C
```

```
[4]: tmpdata2 = missdata.dropna( subset=['f3'] )
     tmpdata2
```

```
[4]:    f1    f2 f3
     0   1  10.0  A
     1   2   NaN  A
     2   3  20.0  A
     3   4  30.0  A
     4   5   NaN  B
     5   6  50.0  B
     6   7  60.0  B
     7   8  70.0  B
     8   9  80.0  C
     9  10  90.0  C
```

```
[5]: numdata = missdata.select_dtypes(include=['int64', 'float64'])
     tmpdata3 = numdata.fillna( -999, inplace=False )
     tmpdata3.describe()
```

```
[5]:              f1          f2
     count  10.00000   10.000000
     mean    5.50000 -158.800000
     std     3.02765  443.562297
     min     1.00000 -999.000000
     25%     3.25000   12.500000
     50%     5.50000   40.000000
     75%     7.75000   67.500000
     max    10.00000   90.000000
```

```
[6]: numdata.mean()
```

```
[6]: f1     5.50
     f2    51.25
     dtype: float64
```

```
[7]: tmpdata4 = numdata.fillna( numdata.mean(), inplace=False  )
     tmpdata4
```

```
[7]:    f1     f2
     0   1  10.00
     1   2  51.25
     2   3  20.00
     3   4  30.00
```

```
4    5  51.25
5    6  50.00
6    7  60.00
7    8  70.00
8    9  80.00
9   10  90.00
```

```
[8]: missdata.groupby('f3')['f2'].mean()
```

```
[8]: f3
     A    20.0
     B    60.0
     C    85.0
     Name: f2, dtype: float64
```

```
[9]: missdata.groupby('f3')['f2'].transform('mean')
```

```
[9]: 0    20.0
     1    20.0
     2    20.0
     3    20.0
     4    60.0
     5    60.0
     6    60.0
     7    60.0
     8    85.0
     9    85.0
     Name: f2, dtype: float64
```

```
[10]: tmpdata5 = numdata.copy()
      tmpdata5['f2'].fillna( missdata.groupby('f3')['f2'].transform('mean'),␣
       ↪inplace=True)
      tmpdata5
```

```
[10]:    f1    f2
      0   1  10.0
      1   2  20.0
      2   3  20.0
      3   4  30.0
      4   5  60.0
      5   6  50.0
      6   7  60.0
      7   8  70.0
      8   9  80.0
      9  10  90.0
```

[11]:

```
missdata_tr = missdata.dropna()
x_tr = missdata_tr[['f1']]
y_tr = missdata_tr['f2']

from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit( x_tr, y_tr )

missdata_ts = missdata [ missdata.isnull().any(axis=1) ]
x_ts = missdata_ts[['f1']]

predicted_values = model.predict( x_ts )
tmpdata6 = missdata.copy()
tmpdata6.loc[ tmpdata6['f2'].isnull(), 'f2'] = predicted_values
tmpdata6
```

[11]:

```
   f1         f2 f3
0   1  10.000000  A
1   2  14.191176  A
2   3  20.000000  A
3   4  30.000000  A
4   5  41.985294  B
5   6  50.000000  B
6   7  60.000000  B
7   8  70.000000  B
8   9  80.000000  C
9  10  90.000000  C
```

[12]:

```
missdata_num = missdata.copy()
missdata_num['f3']=missdata_num['f3'].map({'A':1, 'B':2, 'C':3})
```

[13]:

```
missdata_num
```

[13]:

```
   f1    f2  f3
0   1  10.0   1
1   2   NaN   1
2   3  20.0   1
3   4  30.0   1
4   5   NaN   2
5   6  50.0   2
6   7  60.0   2
7   8  70.0   2
8   9  80.0   3
9  10  90.0   3
```

[14]:

```
from sklearn.impute import KNNImputer
imputer = KNNImputer(n_neighbors=2)
```

```
tmpdata7 = imputer.fit_transform(missdata_num)
```

[15]:

```
pd.DataFrame( tmpdata7 )
```

[15]:

```
      0     1    2
0   1.0  10.0  1.0
1   2.0  15.0  1.0
2   3.0  20.0  1.0
3   4.0  30.0  1.0
4   5.0  40.0  2.0
5   6.0  50.0  2.0
6   7.0  60.0  2.0
7   8.0  70.0  2.0
8   9.0  80.0  3.0
9  10.0  90.0  3.0
```

2

[16]:

```
outdict = {'A': [10, 0.02, 0.3, 40, 50, 60, 712, 80, 90, 1003],
        'B': [0.05, 0.00015, 25, 35, 45, 205, 65, 75, 85, 3905]}
outdata = pd.DataFrame( outdict )

Q1 = outdata.quantile(0.25)
Q3 = outdata.quantile(0.75)
IQR = Q3 - Q1
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

((outdata < lower_bound) | (outdata > upper_bound))
```

[16]:

```
       A      B
0  False  False
1  False  False
2  False  False
3  False  False
4  False  False
5  False   True
6   True  False
7  False  False
8  False  False
9   True   True
```

[17]:

```
outliers = ((outdata < lower_bound) | (outdata > upper_bound)).any(axis=1)
outliersdata = outdata[ outliers ]
outliersdata
```

```
[17]:         A       B
      5    60.0   205.0
      6   712.0    65.0
      9  1003.0  3905.0
```

```
[18]: standardizeddata = (outdata - outdata.mean()) / outdata.std()
      standardizeddata
```

```
[18]:           A         B
      0 -0.552206 -0.364647
      1 -0.580536 -0.364688
      2 -0.579741 -0.344154
      3 -0.467047 -0.335940
      4 -0.438661 -0.327727
      5 -0.410274 -0.196309
      6  1.440519 -0.311300
      7 -0.353501 -0.303086
      8 -0.325115 -0.294872
      9  2.266563  2.842723
```

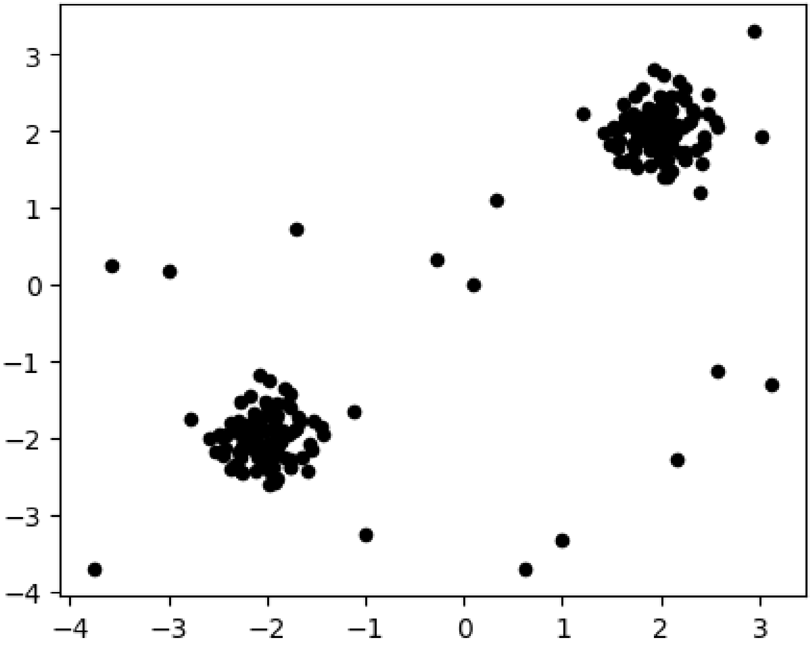
```
[19]: outliers2 = ((standardizeddata < -3) | (standardizeddata > 3)).any(axis=1)
      outliersdata2 = outdata[ outliers2 ]
      outliersdata2
```

```
[19]: Empty DataFrame
      Columns: [A, B]
      Index: []
```

```
[20]: import matplotlib.pyplot as plt
      np.random.seed(42)
      X_inliers = 0.3 * np.random.randn(100, 2)
      X_outliers = np.random.uniform(low=-4, high=4, size=(20, 2))
      X = np.r_[X_inliers + 2, X_inliers - 2, X_outliers]

      plt.figure(figsize=(5, 4))
      plt.scatter(X[:, 0], X[:, 1], color='k', s=20)
```

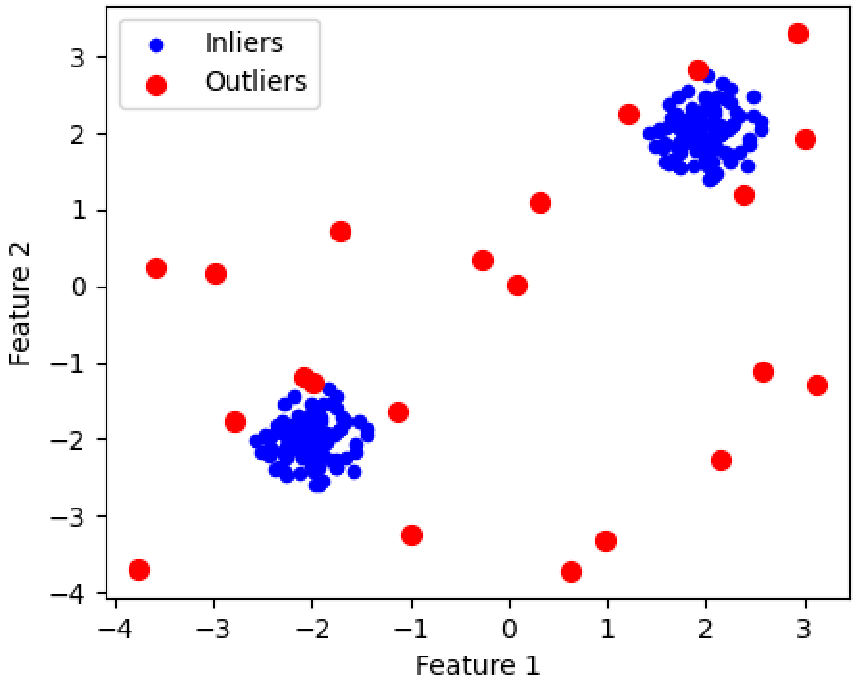
```
[20]: <matplotlib.collections.PathCollection at 0x7b9fd1eb3790>
```



```
[21]: from sklearn.neighbors import LocalOutlierFactor
      clf = LocalOutlierFactor(n_neighbors=20, contamination=0.1)
      y_pred = clf.fit_predict(X) # 1: inlier, -1: outlier
      outlier_mask = y_pred == -1

      plt.figure(figsize=(5, 4))
      plt.scatter(X[:, 0], X[:, 1], color='b', s=20, label='Inliers')
      plt.scatter(X[outlier_mask, 0], X[outlier_mask, 1], color='r', s=50,␣
        ↪label='Outliers')
      plt.xlabel("Feature 1")
      plt.ylabel("Feature 2")
      plt.legend()
```

```
[21]: <matplotlib.legend.Legend at 0x7b9fd1df78e0>
```

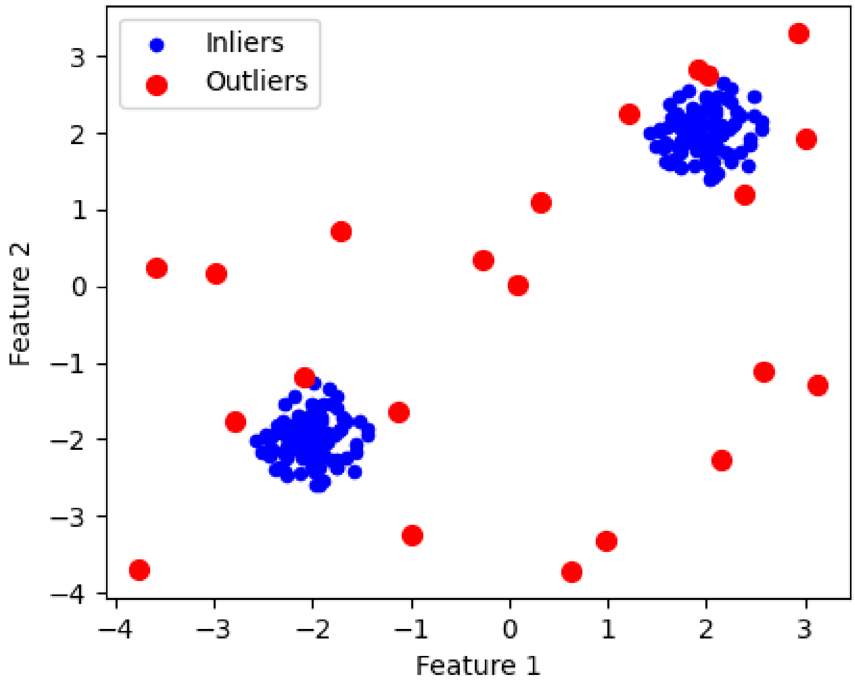


```
[22]: from sklearn.ensemble import IsolationForest
      clf2 = IsolationForest(contamination=0.1)
      # contamination :
      # n_estimators :      (defalut  100)
      # max_features :                 (default  1)

      clf2.fit( X )
      y_pred2 = clf2.predict( X ) # 1: inlier, -1: outlier
      outlier_mask2 = y_pred2 == -1

      plt.figure(figsize=(5, 4))
      plt.scatter(X[:, 0], X[:, 1], color='b', s=20, label='Inliers')
      plt.scatter(X[outlier_mask2, 0], X[outlier_mask2, 1], color='r', s=50,␣
        ↪label='Outliers')
      plt.xlabel("Feature 1")
      plt.ylabel("Feature 2")
      plt.legend()
```

```
[22]: <matplotlib.legend.Legend at 0x7b9fd18bb280>
```



● Inliers
● Outliers
Feature 2
3
2
1
0
−1
−2
−3
−4
−4
−3
−2
−1
0
1
2
3
Feature 1