KDD - Experiment 04

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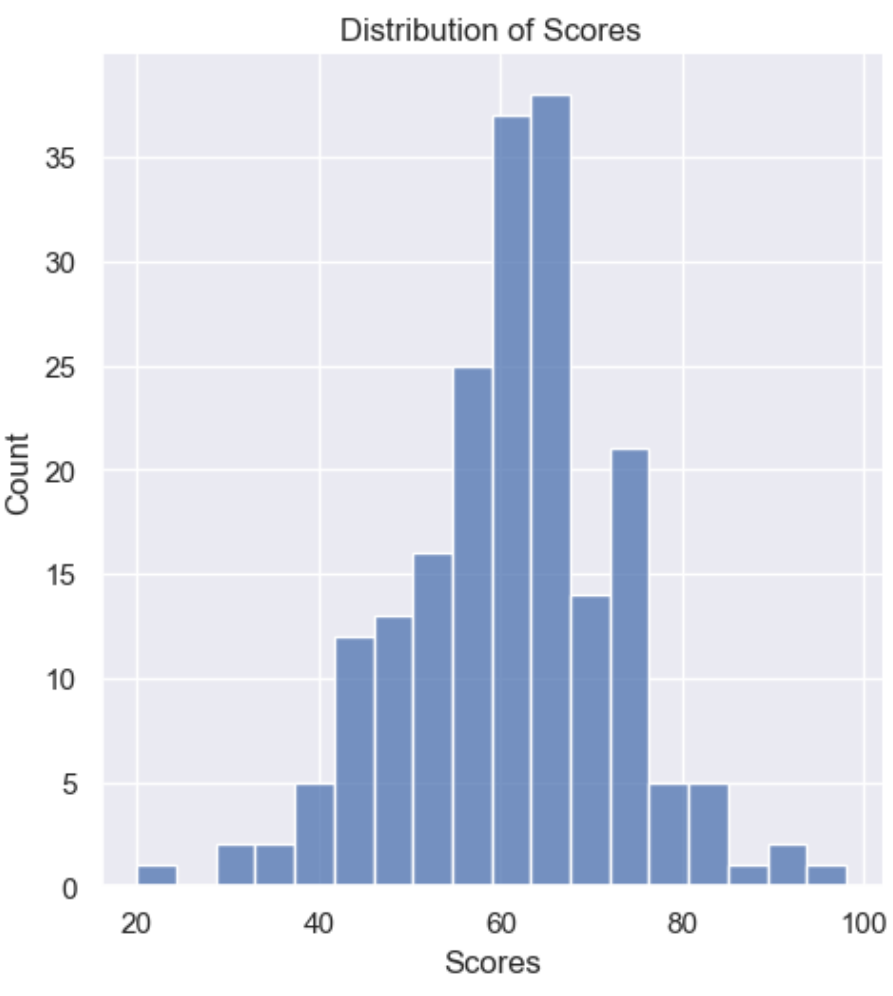
Detecting outliers using standard deviation :

In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
```

In [2]:
```
def generate_scores(mean=60,std_dev=12,num_samples=200):
    np.random.seed(27)
    scores = np.random.normal(loc=mean,scale=std_dev,size=num_samples)
    scores = np.round(scores, decimals=0)
    return scores
scores_data = generate_scores()
```

In [3]:
```
sns.set_theme()
sns.displot(data=scores_data).set(title="Distribution of Scores", xlabel="Scores")
```

Out[3]:
```
<seaborn.axisgrid.FacetGrid at 0x1bf638de5e0>
```



In [4]:
```
df_scores = pd.DataFrame(scores_data,columns=['score'])
```

In [5]:
```
df_scores.mean()
```

Out[5]:
```
score    61.005
dtype: float64
```

In [6]:
```
df_scores.std()
```

Out[6]:
```
score    11.854434
dtype: float64
```

In [7]:
```
lower_limit = df_scores.mean() - 3*df_scores.std()
upper_limit = df_scores.mean() + 3*df_scores.std()
print(lower_limit)
print(upper_limit)
```

```
score    25.441697
dtype: float64
score    96.568303
dtype: float64
```

In [8]:
```
df_scores_filtered = df_scores[(df_scores[['score']]>lower_limit) & (df_scores[['score']]<upper_limit)]
df_scores_filtered
```

Out[8]:

	score
0	75.0
1	56.0
2	67.0
3	65.0
4	63.0
...	...
195	76.0
196	67.0
197	74.0
198	NaN
199	53.0

200 rows × 1 columns

Detecting outliers using Z-score :

In [9]:

```
def detect_outliers(scores):
    z_scores = (scores - np.mean(scores)) / np.std(scores)
    outliers = np.abs(z_scores) > 3
    return outliers
```

In [10]:

```
scores = generate_scores()
outliers = detect_outliers(scores)
print(outliers)
```

```
[False False False False False False False False False False False False
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 False False False False False False  True False]
```

In [11]:

```
df_scores['z_score']=(df_scores['score'] - df_scores['score'].mean())/df_scores['score'].std()
df_scores.head()
```

Out[11]:

	score	z_score
0	75.0	1.180571
1	56.0	-0.422205
2	67.0	0.505718
3	65.0	0.337005
4	63.0	0.168291

In [12]:

```
df_scores_filtered= df_scores[(df_scores['z_score']>-3) & (df_scores['z_score']<3)]
print(df_scores_filtered)
```

```
     score   z_score
0     75.0  1.180571
1     56.0 -0.422205
2     67.0  0.505718
3     65.0  0.337005
4     63.0  0.168291
..     ...       ...
194   42.0 -1.603198
195   76.0  1.264928
196   67.0  0.505718
197   74.0  1.096214
199   53.0 -0.675275

[198 rows x 2 columns]
```

Detect Outliers Using the Interquartile Range (IQR) :

In [13]:

```
sns.boxplot(data=scores_data).set(title="Box Plot of Scores")
```

Out[13]:

```
[Text(0.5, 1.0, 'Box Plot of Scores')]
```

In [14]:

```
df_scores.describe()
```

Out[14]:

	score	z_score
count	200.000000	2.000000e+02
mean	61.005000	-1.787459e-16
std	11.854434	1.000000e+00
min	20.000000	-3.459043e+00
25%	54.000000	-5.909181e-01
50%	62.000000	8.393484e-02
75%	67.000000	5.057179e-01
max	98.000000	3.120773e+00

In [15]:
```
IQR = 67-54
lower_limit = 54 - 1.5*IQR
upper_limit = 67 + 1.5*IQR
print(upper_limit)
print(lower_limit)
```

```
86.5
34.5
```

In [16]:
```
df_scores_filtered = df_scores[(df_scores['score']>lower_limit) & (df_scores['score']<upper_limit)]
print(df_scores_filtered)
```

```
     score   z_score
0     75.0  1.180571
1     56.0 -0.422205
2     67.0  0.505718
3     65.0  0.337005
4     63.0  0.168291
..     ...       ...
194   42.0 -1.603198
195   76.0  1.264928
196   67.0  0.505718
197   74.0  1.096214
199   53.0 -0.675275

[192 rows x 2 columns]
```

In [17]:
```
q25,q75 = np.percentile(a = df_scores,q=[25,75])
IQR = q75 - q25
print(IQR)
```

```
61.91606516404945
```

Detect Outliers Using Percentile :

In [18]:
```
lower_limit, upper_limit = np.percentile(a=df_scores,q=[0.5,99.5])
print(upper_limit)
print(lower_limit)
```

```
90.005
-2.6998335925602515
```

In [19]:
```
df_scores_filtered = df_scores[(df_scores['score']>lower_limit) & (df_scores['score']<upper_limit)]
print(df_scores_filtered)
```

```
     score   z_score
0     75.0  1.180571
1     56.0 -0.422205
2     67.0  0.505718
3     65.0  0.337005
4     63.0  0.168291
..     ...       ...
194   42.0 -1.603198
195   76.0  1.264928
196   67.0  0.505718
197   74.0  1.096214
199   53.0 -0.675275

[198 rows x 2 columns]
```

Conclusion:

> In conclusion, the choice of outlier detection and handling method depends on the nature of the data and the statistical assumptions being made. While standard deviation and z-score methods are commonly used for normally distributed data, the IQR method is more robust and suitable for non-normal data. It is important to carefully consider the properties of the data and the goals of the analysis when deciding which method to use.