Credential's

Name : Mayank Anand

Registration Number : 2141001045

In [47]:
```python
# importing libraries

import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
```

Exploratory data analysis (EDA)

In [48]:
```python
# to load the dataset

df = pd.read_csv("Training Dataset.csv")
```

In [49]:
```python
# to view the first few data's of the dataframe

df.head()
```

Out[49]:

	timestamp	value	is_anomaly	predicted
0	1425008573	42	False	44.072500
1	1425008873	41	False	50.709390
2	1425009173	41	False	81.405120
3	1425009473	61	False	39.950367
4	1425009773	44	False	35.350160

In [50]:
```python
# to view the last few data's of the dataframe

df.tail()
```

Out[50]:

	timestamp	value	is_anomaly	predicted
15825	1429756073	44	False	53.624115
15826	1429756373	45	False	59.752296
15827	1429756673	48	False	52.147630
15828	1429756973	26	False	58.007545
15829	1429757273	38	False	59.144700

In [51]:
```python
# to display about the total number of rows and columns in the dataset

df.shape
```

Out[51]:
```
(15830, 4)
```

In [52]:
```python
# to get info of dataframe

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15830 entries, 0 to 15829
Data columns (total 4 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   timestamp   15830 non-null  int64
 1   value       15830 non-null  int64
 2   is_anomaly  15830 non-null  bool
 3   predicted   15830 non-null  float64
dtypes: bool(1), float64(1), int64(2)
memory usage: 386.6 KB
```

In [53]:
```python
# to get statistical information about the dataset

df.describe()
```

Out[53]:

	timestamp	value	predicted
count	1.583000e+04	15830.000000	15830.000000
mean	1.427383e+09	85.572205	71.870715
std	1.370962e+06	321.760918	92.450520
min	1.425009e+09	0.000000	-281.389070
25%	1.426196e+09	29.000000	32.919171
50%	1.427383e+09	47.000000	49.771124
75%	1.428570e+09	76.000000	75.948052
max	1.429757e+09	13479.000000	2716.127200

In [54]:
```python
# to get to know the columns name

df.columns
```

Out[54]:
```
Index(['timestamp', 'value', 'is_anomaly', 'predicted'], dtype='object')
```

In [55]:
```python
# to count how many value are anamoly and not

count=df['is_anomaly'].value_counts()
count
```

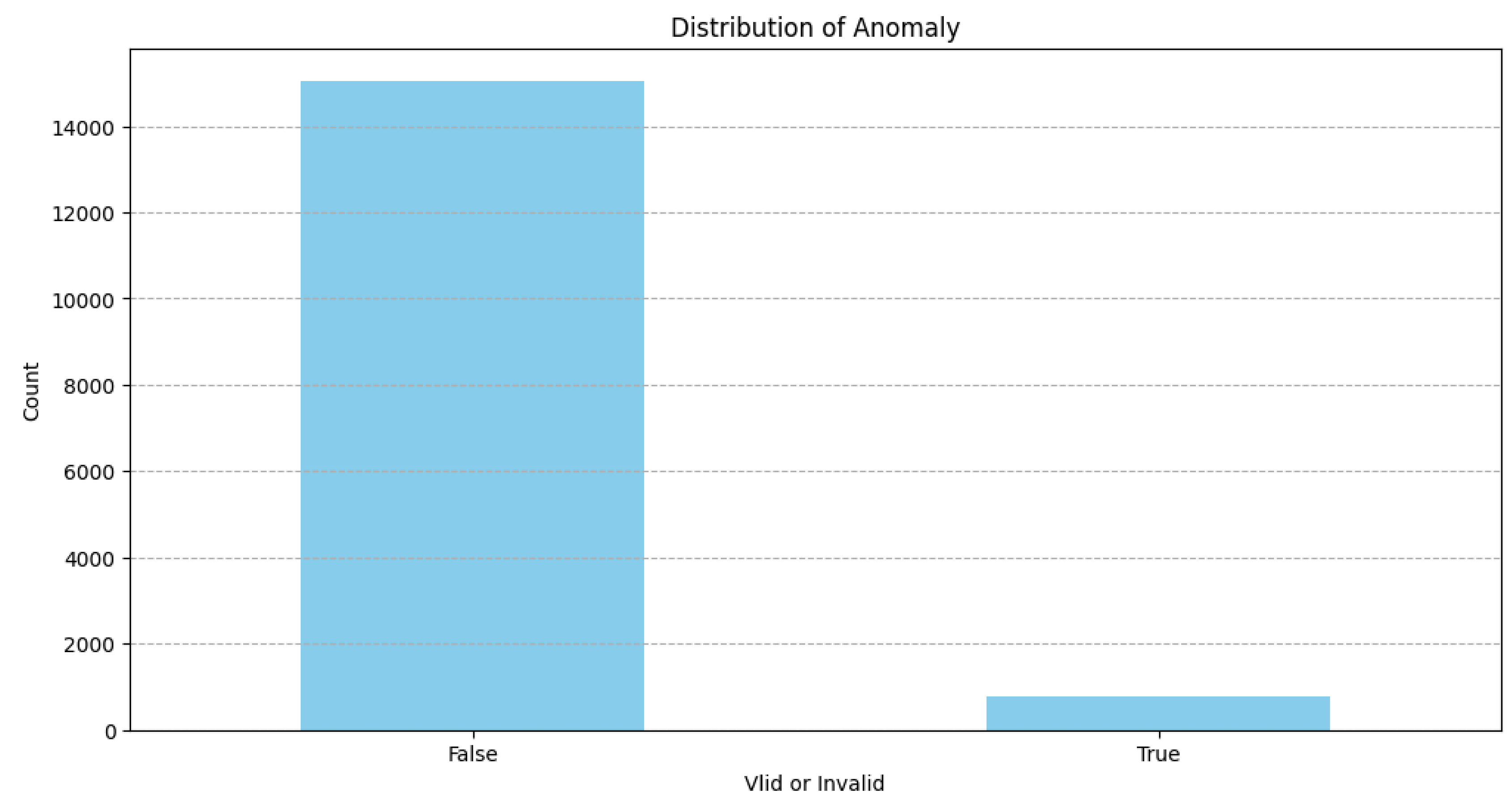
Out[55]:
```
False    15054
True       776
Name: is_anomaly, dtype: int64
```

In [56]:
```python
# to know the datatypes of the columns

df.dtypes
```

Out[56]:
```
timestamp       int64
value           int64
is_anomaly       bool
predicted     float64
dtype: object
```

Data Visualization

In [57]:
```python
# Plotting the bar chart

plt.figure(figsize=(12, 6))
count.plot(kind='bar', color='skyblue')
plt.title('Distribution of Anomaly')
plt.xlabel('Vlid or Invalid')
plt.ylabel('Count')
plt.xticks(rotation=0)
plt.grid(axis='y', linestyle='--')
plt.show()
```



Handling Missing Values and Data Cleaning

In [58]:
```python
df.isnull().sum()
```

Out[58]:
```
timestamp     0
value         0
is_anomaly    0
predicted     0
dtype: int64
```

In [59]:
```python
# Importing label encoder
from sklearn import preprocessing

# Creating label encoder object
label_encoder = preprocessing.LabelEncoder()
```

In [60]:
```python
# Converting the Anomaly column to Numerical

df1=df.copy()
df1['is_anomaly']= label_encoder.fit_transform(df1['is_anomaly'])
```

In [61]:
```python
df1.dtypes
```

Out[61]:
```
timestamp       int64
value           int64
is_anomaly      int64
predicted     float64
dtype: object
```

Preprocessing for Model Building

In [62]:
```python
# Features on which we will trian our model
X = df1[['timestamp', 'value','predicted']]

# The value to be predicted
y = df1['is_anomaly']
```

In [63]:
```python
X.head()
```

Out[63]:

	timestamp	value	predicted
0	1425008573	42	44.072500
1	1425008873	41	50.709390
2	1425009173	41	81.405120
3	1425009473	61	39.950367
4	1425009773	44	35.350160

In [64]:
```python
y.head()
```

Out[64]:
```
0    0
1    0
2    0
3    0
4    0
Name: is_anomaly, dtype: int64
```

In [65]:
```python
# Importing librareis for splitting the dataframe

from sklearn.model_selection import train_test_split
```

In [66]:
```python
# Splitting the dataframe

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

In [67]:
```python
# to know the shape of training set

X_train.shape
```

Out[67]:
```
(12664, 3)
```

In [68]:
```python
# to know the shape of training set

y_train.shape
```

Out[68]:
```
(12664,)
```

In [69]:
```python
# to know the shape of testing set

X_test.shape
```

Out[69]:
```
(3166, 3)
```

In [70]:
```python
# to know the shape of testing set

y_test.shape
```

Out[70]:
```
(3166,)
```

Model Development

In [71]:
```python
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB
from sklearn.linear_model import LogisticRegression

# List of classifiers
classifiers = {
    "KNeighborsClassifier": KNeighborsClassifier(n_neighbors=20),
    "DecisionTreeClassifier": DecisionTreeClassifier(),
    "RandomForestClassifier": RandomForestClassifier(n_estimators=100),
    "SVC": SVC(kernel='rbf', probability=True),
    "GaussianNB": GaussianNB(),
    "LogisticRegression": LogisticRegression(max_iter=200)
}

# Dictionary to store the performance of each model
performance = {}

# Train and evaluate each classifier
for name, clf in classifiers.items():
    clf.fit(X_train, y_train)
    y_pred = clf.predict(X_test)

    performance[name] = {
        "Accuracy": accuracy_score(y_test, y_pred),
        "Precision": precision_score(y_test, y_pred, average='weighted'),
        "Recall": recall_score(y_test, y_pred, average='weighted'),
        "F1 Score": f1_score(y_test, y_pred, average='weighted')
    }

# Display performance
for model, metrics in performance.items():
    print(f"{model}:\nAccuracy: {metrics['Accuracy']:.4f}, Precision: {metrics['Precision']:.4f}, Recall: {metrics['Recall']:.4f}, F1 Score: {metrics['F1 Score
```

```
KNeighborsClassifier:
Accuracy: 0.9485, Precision: 0.9448, Recall: 0.9485, F1 Score: 0.9258

DecisionTreeClassifier:
Accuracy: 0.9630, Precision: 0.9616, Recall: 0.9630, F1 Score: 0.9622

RandomForestClassifier:
Accuracy: 0.9719, Precision: 0.9697, Recall: 0.9719, F1 Score: 0.9700

SVC:
Accuracy: 0.9466, Precision: 0.8961, Recall: 0.9466, F1 Score: 0.9207

GaussianNB:
Accuracy: 0.9479, Precision: 0.9375, Recall: 0.9479, F1 Score: 0.9408

LogisticRegression:
Accuracy: 0.9466, Precision: 0.8961, Recall: 0.9466, F1 Score: 0.9207
```

```
c:\users\lenovo\appdata\local\programs\python\python39\lib\site-packages\sklearn\metrics\_classification.py:1334: UndefinedMetricWarning: Precision is ill-def
ined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
c:\users\lenovo\appdata\local\programs\python\python39\lib\site-packages\sklearn\metrics\_classification.py:1334: UndefinedMetricWarning: Precision is ill-def
ined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```