**Outlier Detection Results**

**SVM**

SVM model used on ‘speed\_7578.csv’

Chart

Description automatically generated

**Results**

Accuracy: 89.1%

Recall: 84.6%

Precision: 37.9%

f1 score: 52.4%

SVM model used on ‘nyc\_taxi.csv’

Chart

Description automatically generated

**Results**

Accuracy: 88.0%

Recall: 90.0%

Precision: 10.5%

f1 score: 18.8%

SVM model used on ‘Twitter\_volume\_UPS.csv’

Chart, scatter chart

Description automatically generated

**Results**

Accuracy: 88.7%

Recall: 99.0%

Precision: 24.4%

f1 score: 39.2%

SVM model used on ‘machine\_temperature\_system\_failure.csv’.

A picture containing text, pencil

Description automatically generated

**Results**

Accuracy: 88.6%

Recall: 97.7%

Precision: 22.2%

f1 score: 36.2%

SVM model used on ‘ec2\_cpu\_utilization\_fe7f93.csv’.

Chart

Description automatically generated

**Results**

Accuracy: 89.1%

Recall: 80.0%

Precision: 15.7%

f1 score: 26.2%

**Evaluation of SVM**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data set | Accuracy (%) | Recall (%) | Precision (%) | F1 (%) |
| speed\_7578.csv | 89.1 | 84.6 | 37.9 | 52.4 |
| nyc\_taxi | 88.0 | 90.0 | 10.5 | 18.8 |
| Twitter\_volume\_UPS | 88.7 | 99.0 | 24.4 | 39.2 |
| machine\_temperature\_system\_failure | 88.6 | 97.2 | 22.2 | 36.2 |
| ec2\_cpu\_utilization\_fe7f93 | 89.1 | 80.0 | 15.7 | 26.2 |
| Average | 88.7 | 90.2 | 22.1 | 34.6 |

**IForest**

IForest model used on ‘speed\_7578.csv’

Chart, line chart

Description automatically generated

**Results**

Accuracy: 89.8%

Recall: 93.8%

Precision: 51.7%

f1 score: 66.7%

IForest model used on ‘nyc\_taxi.csv’

Chart, bar chart

Description automatically generated

**Results**

Accuracy: 89.5%

Recall: 97.2%

Precision: 40.9%

f1 score: 57.5%

IForest model used on ‘Twitter\_volume\_UPS.csv’

Chart, scatter chart

Description automatically generated

**Results**

Accuracy: 88.5%

Recall: 97.5%

Precision: 19.5%

f1 score: 32.5%

IForest model used on ‘machine\_temperature\_system\_failure.csv’.

Shape

Description automatically generated with medium confidence

**Results**

Accuracy: 87.9%

Recall: 93.5%

Precision: 7.6%

f1 score: 14.0%

IForest model used on ‘ec2\_cpu\_utilization\_fe7f93.csv’.

Chart, bar chart

Description automatically generated

**Results**

Accuracy: 88.5%

Recall: 91.7%

Precision: 21.8%

f1 score: 35.2%

**Evaluation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data set | Accuracy (%) | Recall (%) | Precision (%) | F1 (%) |
| speed\_7578.csv | 89.8 | 93.8 | 51.7 | 66.7 |
| nyc\_taxi | 89.5 | 97.2 | 40.9 | 57.5 |
| Twitter\_volume\_UPS | 88.5 | 97.5 | 19.5 | 32.5 |
| machine\_temperature\_system\_failure | 87.9 | 93.5 | 7.6 | 14.0 |
| ec2\_cpu\_utilization\_fe7f93 | 88.5 | 91.7 | 21.8 | 35.2 |
| Average | 88.8 | 94.8 | 28.3 | 41.2 |

**LOF**

LOF model used on ‘speed\_7578.csv’

Chart

Description automatically generated with low confidence

**Results**

Accuracy: 85.0%

Recall: 33.3%

Precision: 3.5%

f1 score: 6.3%

LOF model used on ‘nyc\_taxi.csv’

Chart, bar chart

Description automatically generated

**Results**

Accuracy: 89.1%

Recall: 95.5%

Precision: 32.6%

f1 score: 48.6%

LOF model used on ‘Twitter\_volume\_UPS.csv’

Chart

Description automatically generated

**Results**

Accuracy: 86.3%

Recall: 96.4%

Precision: 13.4%

f1 score: 23.5%

LOF model used on ‘machine\_temperature\_system\_failure.csv’.

Shape

Description automatically generated

**Results**

Accuracy: 88.2%

Recall: 96.3%

Precision: 13.7%

f1 score: 24.0%

LOF model used on ‘ec2\_cpu\_utilization\_fe7f93.csv’.

Chart

Description automatically generated

**Results**

Accuracy: 86.0%

Recall: 91.3%

Precision: 10.4%

f1 score: 18.7%

**Evaluation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data set | Accuracy (%) | Recall (%) | Precision (%) | F1 (%) |
| speed\_7578.csv | 85.0 | 33.3 | 3.5 | 6.3 |
| nyc\_taxi | 89.1 | 95.5 | 32.6 | 48.6 |
| Twitter\_volume\_UPS | 86.3 | 96.4 | 13.4 | 23.5 |
| machine\_temperature\_system\_failure | 88.2 | 96.3 | 13.7 | 24.0 |
| ec2\_cpu\_utilization\_fe7f93 | 86.0 | 91.3 | 10.4 | 18.7 |
| Average | 86.9 | 82.3 | 14.72 | 24.2 |

**Histogram based Outlier Detection**

Histogram model used on ‘speed\_7578.csv’

Chart

Description automatically generated

**Results**

Accuracy: 84.8%

Recall: 0.0%

Precision: 0.0%

f1 score: 0.0%

Histogram model used on ‘nyc\_taxi.csv’

A picture containing text, writing implement, pencil

Description automatically generated

**Results**

Accuracy: 86.2%

Recall: 92.4%

Precision: 11.9%

f1 score: 21.0%

Histogram model used on ‘Twitter\_volume\_UPS.csv’

Chart, histogram

Description automatically generated

**Results**

Accuracy: 85.1%

Recall: 0.0%

Precision: 0.0%

f1 score: 0.0%

Histogram model used on ‘machine\_temperature\_system\_failure.csv’.

Graphical user interface

Description automatically generated with medium confidence

**Results**

Accuracy: 90.5%

Recall: 99.7%

Precision: 54.8%

f1 score: 70.7%

Histogram model used on ‘ec2\_cpu\_utilization\_fe7f93.csv’.

Chart, bar chart

Description automatically generated

**Results**

Accuracy: 85.1%

Recall: 0.0%

Precision: 0.0%

f1 score: 0.0%

**Evaluation of Histogram**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data set | Accuracy (%) | Recall (%) | Precision (%) | F1 (%) |
| speed\_7578.csv | 84.8 | 0.0 | 0.0 | 0.0 |
| nyc\_taxi | 86.2 | 92.4 | 11.9 | 21.0 |
| Twitter\_volume\_UPS | 85.1 | 0.0 | 0.0 | 0.0 |
| machine\_temperature\_system\_failure | 90.5 | 99.7 | 54.8 | 70.1 |
| ec2\_cpu\_utilization\_fe7f93 | 85.1 | 0.0 | 0.0 | 0.0 |
| Average | 86.3 | 38.4 | 13.3 | 18.2 |

**KNN based Outlier Detection**

KNN model used on ‘speed\_7578.csv’

Chart

Description automatically generated

**Results**

Accuracy: 88.6%

Recall: 90.0%

Precision: 37.5%

f1 score: 52.9%

KNN model used on ‘nyc\_taxi.csv’

Chart

Description automatically generated

**Results**

Accuracy: 87.8%

Recall: 98.6%

Precision: 28.0%

f1 score: 43.6%

KNN model used on ‘Twitter\_volume\_UPS.csv’

Chart, scatter chart

Description automatically generated

**Results**

Accuracy: 87.1%

Recall: 100.0%

Precision: 19.1%

f1 score: 32.1%

KNN model used on ‘machine\_temperature\_system\_failure.csv’.

Graphical user interface

Description automatically generated

**Results**

Accuracy: 90.1%

Recall: 99.8%

Precision: 51.0%

f1 score: 67.5%

KNN model used on ‘ec2\_cpu\_utilization\_fe7f93.csv’.

Chart, scatter chart

Description automatically generated

**Results**

Accuracy: 86.4%

Recall: 93.8%

Precision: 14.9%

f1 score: 25.6%

**Evaluation of KNN**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data set | Accuracy (%) | Recall (%) | Precision (%) | F1 (%) |
| speed\_7578.csv | 88.6 | 90.0 | 37.5 | 52.9 |
| nyc\_taxi | 87.8 | 98.6 | 28.0 | 43.6 |
| Twitter\_volume\_UPS | 87.1 | 100.0 | 19.1 | 32.1 |
| machine\_temperature\_system\_failure | 90.1 | 99.8 | 51.0 | 67.5 |
| ec2\_cpu\_utilization\_fe7f93 | 86.4 | 93.8 | 14.9 | 25.6 |
| Average | 88.0 | 96.4 | 30.1 | 44.3 |

**Overall Comparison**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | Average Accuracy (%) | Average Recall (%) | Average Precision (%) | Average F1 (%) |
| SVM | 88.7 | 90.2 | 22.1 | 34.6 |
| IForest | 88.8 | 94.7 | 28.3 | 41.2 |
| LOF | 86.9 | 82.6 | 14.7 | 24.2 |
| Histogram | 86.3 | 38.4 | 13.3 | 18.2 |
| KNN | 88.0 | 96.4 | 30.1 | 44.3 |

**Moving Average based Outlier Detection**

**Manual threshold value (20)**

**Manual Interval (10)**

Chart

Description automatically generated

Accuracy: 91.6%

Recall: 96.3%

Precision: 83.9%

f1 score: 89.7%

**Moving Median based Outlier Detection**

**Manual threshold value (20)**

**Manual Interval (10)**

Chart

Description automatically generated

Accuracy: 91.3%

Recall: 95.8%

Precision: 82.1%

f1 score: 88.5%

**Moving Average based Outlier Detection**

**Automatically Calculated Threshold (34)**

**Manual Interval (10)**

Chart

Description automatically generated

Accuracy: 90.7%

Recall: 91.7%

Precision: 100.0%

f1 score: 95.7%

**Moving Median based Outlier Detection**

**Automatically Calculated Threshold (25)**

**Manual Interval (10)**

Chart

Description automatically generated

Accuracy: 91.5%

Recall: 95.5%

Precision: 95.5%

f1 score: 95.5%

**Unoptimized Ensemble of Average and Median**

Chart

Description automatically generated

Accuracy: 89.7%

Recall: 66.7%

Precision: 50.0%

f1 score: 57.1%

**Optimised Ensemble**

Chart

Description automatically generated

Accuracy: 89.8%

Recall: 25.0%

Precision: 100.0%

f1 score: 40.0%

**Evaluation of Optimised Moving Average**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data set | Accuracy (%) | Recall (%) | Precision (%) | F1 (%) |
| speed\_7578.csv | 90.7 | 91.7 | 100.0 | 95.7 |
| nyc\_taxi | 10.2 | 100.0 | 10.0 | 18.3 |
| Twitter\_volume\_UPS | 89.7 | 89.7 | 25.0 | 29.1 |
| machine\_temperature\_system\_failure | 90.0 | 78.6 | 84.6 | 81.5 |
| ec2\_cpu\_utilization\_fe7f93 | 89.9 | 50.0 | 25.0 | 33.3 |
| Average | 74.1 | 82 | 48.9 | 51.6 |

**Evaluation of Optimised Moving Median**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data set | Accuracy (%) | Recall (%) | Precision (%) | F1 (%) |
| speed\_7578.csv | 91.5 | 95.5 | 95.5 | 95.5 |
| nyc\_taxi | 11.8 | 100.0 | 10.0 | 18.2 |
| Twitter\_volume\_UPS | 89.0 | 96.2 | 24.4 | 38.9 |
| machine\_temperature\_system\_failure | 90.0 | 70.0 | 100.0 | 82.4 |
| ec2\_cpu\_utilization\_fe7f93 | 89.7 | 60.0 | 18.8 | 28.6 |
| Average | 74.4 | 84.3 | 49.7 | 52.7 |