For running the TFM simulation, the data from S412 as input to the TFM model, then test on S414 and S419. For the EKF model, Using the output from TFM model, then using the data from S420 to update the estimation the results by EKF model. Testing on S414 and S419. The time length of simulation is two weeks. The unit for speed is miles/h. The unit for flow is veh/h. The precision results as below:

Table 1 Station 414 without error

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 3.931 | 3.546 | 618.60 | 15.478 | 4.008 | 3.512 | 346.2 | 8.224 |

Table 4 Station 414 with error

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 4.16 | 4.23 | 1038.43 | 48.82 | 6.98 | 5.85 | 918.32 | 46.13 |
|  |  |  |  |  |  |  |  |

Table 3 Station 419 without error

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | R  MSE | MAPE |
| 4.916 | 4.767 | 1154.04 | 37.483 | 3.339 | 3.315 | 690 | 18.977 |
|  |  |  |  |  |  |  |  |

Table 4 Station 419 with error

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 5.14 | 5.28 | 1501.11 | 72.95 | 4.08 | 4.15 | 1258.93 | 63.79 |
|  |  |  |  |  |  |  |  |

(Training set: S412, S420; Testing set: S414.)-One day without error

Input: time of day, Distance. The unit for speed is miles/h. The unit for flow is veh/5-min.

S414

Flow

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 96.08 | 31.35 |
| RF | 14.20 | 4.29 |
| ANN | 104.54 | 51.44 |
| XGB | 15.96 | 4.71 |
| GBDT | 14.13 | 4.97 |

Speed

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 2.63 | 2.83 |
| RF | 2.07 | 2.51 |
| ANN | 3.65 | 3.73 |
| XGB | 3.90 | 4.34 |
| GBDT | 2.16 | 2.53 |

S419

Flow

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 87.96 | 38.72 |
| RF | 51.44 | 15.05 |
| ANN | 104.00 | 62.78 |
| XGB | 51.29 | 15.44 |
| GBDT | 52.56 | 15.48 |

Speed

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 5.65 | 5.48 |
| RF | 3.02 | 2.99 |
| ANN | 5.51 | 6.89 |
| XGB | 2.73 | 3.28 |
| GBDT | 3.14 | 3.04 |

(Training set: S412, S420; Testing set: S414.)-One day with error

Input: time of day, Distance. The unit for speed is miles/h. The unit for flow is veh/5-min.

S414

Flow

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 104.41 | 36.82 |
| RF | 18.67 | 6.48 |
| ANN | 126.35 | 58.43 |
| XGB | 16.05 | 3.50 |
| GBDT | 29.37 | 10.31 |

Speed

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 3.52 | 4.16 |
| RF | 2.32 | 2.71 |
| ANN | 3.71 | 4.33 |
| XGB | 3.91 | 4.21 |
| GBDT | 2.29 | 2.67 |

S419

Flow

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 102.15 | 43.88 |
| RF | 52.91 | 15.48 |
| ANN | 119.67 | 68.16 |
| XGB | 51.24 | 12.53 |
| GBDT | 58.70 | 18.87 |

Speed

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 5.85 | 6.32 |
| RF | 3.31 | 3.30 |
| ANN | 6.43 | 7.26 |
| XGB | 2.73 | 3.15 |
| GBDT | 3.29 | 3.26 |

**Sample rate with error**

**Sample rate 0.178**

The unit for speed is miles/h. The unit for flow is veh/h

Table Station 414

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 5.08 | 4.88 | 1263.95  105.32 | 27.02 | 7.64 | 7.40 | 1070.33 | 23.60 |

Table Station 419

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 5.67 | 5.35 | 1713.66  142.80 | 34.55 | 6.28 | 6.46 | 1431.77  119.31 | 29.99 |

(Training set: S412, S420; Testing set: S414 &414.)-One day without error

Input: time of day, Distance. The unit for speed is miles/h. The unit for flow is veh/5-min.

S414 & 419

Flow

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 111.26 | 58.92 |
| RF | 98.70 | 56.38 |
| ANN | 108.04 | 63.52 |
| XGB | 98.61 | 56.97 |
| GBDT | 97.03 | 56.61 |

Speed

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 5.32 | 5.78 |
| RF | 5.09 | 5.95 |
| ANN | 4.74 | 4.79 |
| XGB | 5.23 | 5.87 |
| GBDT | 5.06 | 5.90 |

**Sample rate 0.357**

The unit for speed is miles/h. The unit for flow is veh/h

Table Station 414

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 5.23 | 5.00 | 1263.95 | 27.02 | 7.75 | 7.67 | 1003.47 | 22.59 |

Table Station 419

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 5.65 | 5.36 | 1713.66  142.80 | 34.55 | 5.87 | 6.33 | 1370.91  114.24 | 29.56 |

(Training set: S412, S420; Testing set: S414 &414.)-One day without error

Input: time of day, Distance. The unit for speed is miles/h. The unit for flow is veh/5-min.

S414 & 419

Flow

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 112.94 | 61.59 |
| RF | 95.55 | 51.77 |
| ANN | 144.19 | 95.45 |
| XGB | 98.09 | 53.40 |
| GBDT | 95.40 | 52.21 |

Speed

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 5.38 | 5.72 |
| RF | 4.63 | 5.53 |
| ANN | 6.71 | 8.12 |
| XGB | 5.20 | 6.17 |
| GBDT | 4.62 | 5.54 |

**Sample rate 0.714**

The unit for speed is miles/h. The unit for flow is veh/h

Station 414

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 4.73 | 4.58 | 1113.54 | 23.20 | 7.64 | 7.40 | 957.83 | 22.29 |

Station 419

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TFM | | | | EKF | | | |
| Speed | | Flow | | Speed | | Flow | |
| RMSE | MAPE | RMSE | MAPE | RMSE | MAPE | RMSE | MAPE |
| 5.29 | 4.98 | 1588.11  132.34 | 31.35 | 6.28 | 6.46 | 1311.91  109.32 | 28.54 |

(Training set: S412, S420; Testing set: S414 &414.)-One day without error

Input: time of day, Distance. The unit for speed is miles/h. The unit for flow is veh/5-min.

S414 & 419

Flow

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 108.02 | 63.28 |
| RF | 88.81 | 55.52 |
| ANN | 128.50 | 95.97 |
| XGB | 92.50 | 52.09 |
| GBDT | 87.98 | 52.80 |

Speed

|  |  |  |
| --- | --- | --- |
| Model | RMSE | MAPE |
| SVM | 5.22 | 5.53 |
| RF | 4.24 | 5.24 |
| ANN | 4.70 | 4.91 |
| XGB | 4.94 | 5.91 |
| GBDT | 4.27 | 5.23 |