During this week two different belt tension predictor models have been trained and deployed to predict belt tension using real-time data coming from FASTory. The architecture of these two models is similar but each model different normalization range for data normalization. Model\_1 uses the data’s minimum and maximum values to normalize the data between 0 and 1, on the other hand Model\_2 uses the customize minimum and maximum values to normalize the data. The customized data normalization range for model is selected in way that predictor model robustly handles the outliers during real-time prediction. Following table shows the real-time prediction results from both models. I tested the models for 1500 plus real-time data sample to predict belt tension class and I was changing belt tension during real time prediction and these results are pretty good.

# Prediction Results for Belt Tension 75%-85% (Class-2)

Table : Prediction for 75-85% Belt Tension (Class-2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **T\_Class** | **Power (W)** | **Load\_Combination** | **Active\_Zone** | **M1\_Pred** | **M2\_Pred** | **Time** |
| 2 | 235.945 | 2 | 0100 | 2 | 2 | 04/22/2021, 13:30:29 |
| 2 | 236.113 | 2 | 0100 | 2 | 2 | 04/22/2021, 13:30:30 |
| 2 | 236.113 | 2 | 0100 | 2 | 2 | 04/22/2021, 13:30:31 |
| 2 | 236.23 | 2 | 0100 | 2 | 2 | 04/22/2021, 13:30:32 |
| 2 | 236.23 | 2 | 0100 | 2 | 2 | 04/22/2021, 13:30:33 |
| 2 | 237.16 | 4 | 0010 | 2 | 2 | 04/22/2021, 13:32:49 |
| 2 | 237.16 | 4 | 0010 | 2 | 2 | 04/22/2021, 13:32:50 |
| 2 | 237.143 | 4 | 0010 | 2 | 2 | 04/22/2021, 13:32:51 |
| 2 | 237.143 | 4 | 0010 | 2 | 2 | 04/22/2021, 13:32:52 |
| 2 | 237.173 | 4 | 0010 | 2 | 2 | 04/22/2021, 13:32:53 |
| 2 | 237.481 | 8 | 0001 | 2 | 2 | 04/22/2021, 13:33:50 |
| 2 | 237.203 | 8 | 0001 | 2 | 2 | 04/22/2021, 13:33:51 |
| 2 | 237.203 | 8 | 0001 | 2 | 2 | 04/22/2021, 13:33:52 |
| 2 | 236.856 | 8 | 0001 | 2 | 2 | 04/22/2021, 13:33:53 |
| 2 | 236.856 | 8 | 0001 | 2 | 2 | 04/22/2021, 13:33:54 |
| 2 | 233.321 | 9 | 1001 | 2 | 2 | 04/22/2021, 13:37:42 |
| 2 | 233.413 | 9 | 1001 | 2 | 2 | 04/22/2021, 13:37:43 |
| 2 | 233.413 | 9 | 1001 | 2 | 2 | 04/22/2021, 13:37:44 |
| 2 | 233.386 | 9 | 1001 | 2 | 2 | 04/22/2021, 13:37:45 |
| 2 | 233.386 | 9 | 1001 | 2 | 2 | 04/22/2021, 13:37:46 |
| 2 | 234.75 | 10 | 0101 | 2 | 2 | 04/22/2021, 13:42:37 |
| 2 | 234.75 | 10 | 0101 | 2 | 2 | 04/22/2021, 13:42:38 |
| 2 | 234.881 | 10 | 0101 | 2 | 2 | 04/22/2021, 13:42:39 |
| 2 | 234.881 | 10 | 0101 | 2 | 2 | 04/22/2021, 13:42:40 |
| 2 | 235.085 | 10 | 0101 | 2 | 2 | 04/22/2021, 13:42:41 |
| 2 | 236.62 | 12 | 0011 | 2 | 2 | 04/22/2021, 13:43:22 |
| 2 | 236.62 | 12 | 0011 | 2 | 2 | 04/22/2021, 13:43:23 |
| 2 | 236.684 | 12 | 0011 | 2 | 2 | 04/22/2021, 13:43:24 |
| 2 | 236.684 | 12 | 0011 | 2 | 2 | 04/22/2021, 13:43:25 |
| 2 | 237.733 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:44:52 |
| 2 | 237.733 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:44:53 |
| 2 | 238.072 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:44:54 |
| 2 | 238.072 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:44:55 |
| 2 | 244.243 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:46:43 |
| 2 | 244.243 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:46:44 |
| 2 | 244.497 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:46:45 |
| 2 | 244.497 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:46:46 |
| 2 | 244.53 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:46:47 |
| 2 | 244.165 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:47:45 |
| 2 | 244.134 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:47:46 |
| 2 | 244.134 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:47:47 |
| 2 | 244.112 | 14 | 0111 | 2 | 2 | 04/22/2021, 13:47:48 |
| 2 | 243.037 | 11 | 1101 | 2 | 2 | 04/22/2021, 13:49:17 |
| 2 | 242.81 | 11 | 1101 | 2 | 2 | 04/22/2021, 13:49:18 |
| 2 | 242.81 | 11 | 1101 | 2 | 2 | 04/22/2021, 13:49:19 |
| 2 | 242.609 | 11 | 1101 | 2 | 2 | 04/22/2021, 13:49:20 |
| 2 | 243.188 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:51:01 |
| 2 | 243.188 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:51:02 |
| 2 | 243.184 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:51:03 |
| 2 | 243.184 | 13 | 1011 | 2 | 2 | 04/22/2021, 13:51:04 |
| 2 | 247.165 | 15 | 1111 | 2 | 2 | 04/22/2021, 13:53:26 |
| 2 | 247.281 | 15 | 1111 | 2 | 2 | 04/22/2021, 13:53:27 |
| 2 | 247.281 | 15 | 1111 | 2 | 2 | 04/22/2021, 13:53:28 |
| 2 | 247.379 | 15 | 1111 | 2 | 2 | 04/22/2021, 13:53:29 |

Table : Mis predictions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **T\_Class** | **Power (W)** | **Load\_Combination** | **Active\_Zone** | **M1\_Pred** | **M2\_Pred** | **Time** |
| 2 | 232.6 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:23 |
| 2 | 232.6 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:24 |
| 2 | 232.554 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:25 |
| 2 | 232.554 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:26 |
| 2 | 232.52 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:27 |
| 2 | 234.269 | 1 | 1000 | 1 | 1 | 04/22/2021, 13:29:27 |
| 2 | 234.269 | 1 | 1000 | 1 | 1 | 04/22/2021, 13:29:28 |
| 2 | 234.389 | 1 | 1000 | 1 | 1 | 04/22/2021, 13:29:29 |
| 2 | 234.389 | 1 | 1000 | 1 | 1 | 04/22/2021, 13:29:30 |
| 2 | 234.486 | 1 | 1000 | 1 | 1 | 04/22/2021, 13:29:31 |

# Prediction Results for Belt Tension 0%-70% (Class-1)

Table :Prediction Results for Belt Tension Class-1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **T\_Class** | **Power (W)** | **Load\_Combination** | **Active\_Zone** | **M1\_Pred** | **M2\_Pred** | **Time** |
| 1 | 229.855 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:56:55 |
| 1 | 229.931 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:56:56 |
| 1 | 229.931 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:56:57 |
| 1 | 229.926 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:56:58 |
| 1 | 229.926 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:56:59 |
| 1 | 229.846 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:57:00 |
| 1 | 230.124 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:59:12 |
| 1 | 230.124 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:59:13 |
| 1 | 230.085 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:59:14 |
| 1 | 230.085 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:59:15 |

# Prediction Results for Belt Tension >85% (Class-3)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **T\_Class** | **Power (W)** | **Load\_Combination** | **Active\_Zone** | **M1\_Pred** | **M2\_Pred** | **Time** |
| 3 | 252.693 | 0 | 0000 | 3 | 2 | 04/22/2021, 13:59:41 |
| 3 | 252.693 | 0 | 0000 | 3 | 2 | 04/22/2021, 13:59:42 |
| 3 | 252.812 | 0 | 0000 | 3 | 2 | 04/22/2021, 13:59:43 |
| 3 | 255.921 | 1 | 1000 | 3 | 2 | 04/22/2021, 14:02:39 |
| 3 | 255.959 | 1 | 1000 | 3 | 2 | 04/22/2021, 14:02:40 |
| 3 | 255.959 | 1 | 1000 | 3 | 2 | 04/22/2021, 14:02:41 |
| 3 | 256.048 | 2 | 0100 | 3 | 2 | 04/22/2021, 14:02:42 |
| 3 | 256.048 | 2 | 0100 | 3 | 2 | 04/22/2021, 14:02:43 |
| 3 | 256.082 | 2 | 0100 | 3 | 2 | 04/22/2021, 14:02:44 |
| 3 | 256.082 | 2 | 0100 | 3 | 2 | 04/22/2021, 14:02:45 |
| 3 | 257.533 | 2 | 0100 | 3 | 3 | 04/22/2021, 14:02:54 |
| 3 | 257.533 | 2 | 0100 | 3 | 3 | 04/22/2021, 14:02:55 |
| 3 | 257.72 | 2 | 0100 | 3 | 3 | 04/22/2021, 14:02:56 |
| 3 | 257.72 | 2 | 0100 | 3 | 3 | 04/22/2021, 14:02:57 |
| 3 | 258.19 | 4 | 0010 | 3 | 3 | 04/22/2021, 14:04:54 |
| 3 | 258.19 | 4 | 0010 | 3 | 3 | 04/22/2021, 14:04:55 |
| 3 | 258.186 | 4 | 0010 | 3 | 3 | 04/22/2021, 14:04:56 |
| 3 | 256.834 | 8 | 0001 | 3 | 3 | 04/22/2021, 14:06:27 |
| 3 | 256.834 | 8 | 0001 | 3 | 3 | 04/22/2021, 14:06:28 |
| 3 | 256.501 | 8 | 0001 | 3 | 3 | 04/22/2021, 14:06:29 |
| 3 | 279.917 | 9 | 1001 | 3 | 3 | 04/22/2021, 14:08:02 |
| 3 | 280.485 | 9 | 1001 | 3 | 3 | 04/22/2021, 14:08:03 |
| 3 | 280.485 | 9 | 1001 | 3 | 3 | 04/22/2021, 14:08:04 |
| 3 | 278.889 | 10 | 0101 | 3 | 3 | 04/22/2021, 14:08:45 |
| 3 | 279.053 | 10 | 0101 | 3 | 3 | 04/22/2021, 14:08:46 |
| 3 | 279.053 | 10 | 0101 | 3 | 3 | 04/22/2021, 14:08:47 |
| 3 | 280.309 | 12 | 0011 | 3 | 3 | 04/22/2021, 14:10:21 |
| 3 | 280.309 | 12 | 0011 | 3 | 3 | 04/22/2021, 14:10:22 |
| 3 | 280.242 | 12 | 0011 | 3 | 3 | 04/22/2021, 14:10:23 |
| 3 | 287.266 | 13 | 1011 | 3 | 3 | 04/22/2021, 14:11:53 |
| 3 | 287.266 | 13 | 1011 | 3 | 3 | 04/22/2021, 14:11:54 |
| 3 | 287.151 | 13 | 1011 | 3 | 3 | 04/22/2021, 14:11:55 |
| 3 | 282.805 | 14 | 0111 | 3 | 3 | 04/22/2021, 14:13:02 |
| 3 | 282.805 | 14 | 0111 | 3 | 3 | 04/22/2021, 14:13:03 |
| 3 | 282.608 | 14 | 0111 | 3 | 3 | 04/22/2021, 14:13:04 |
| 3 | 284.764 | 15 | 1111 | 3 | 3 | 04/22/2021, 14:14:57 |
| 3 | 284.764 | 15 | 1111 | 3 | 3 | 04/22/2021, 14:14:58 |
| 3 | 286.667 | 15 | 1111 | 3 | 3 | 04/22/2021, 14:14:59 |
| 3 | 286.667 | 15 | 1111 | 3 | 3 | 04/22/2021, 14:15:00 |
| 3 | 288.67 | 11 | 1101 | 3 | 3 | 04/22/2021, 14:15:01 |
| 3 | 288.67 | 11 | 1101 | 3 | 3 | 04/22/2021, 14:15:02 |
| 3 | 289.755 | 11 | 1101 | 3 | 3 | 04/22/2021, 14:15:03 |
| 3 | 289.755 | 11 | 1101 | 3 | 3 | 04/22/2021, 14:15:04 |
| 3 | 298.46 | 7 | 1110 | 3 | 3 | 04/22/2021, 14:18:43 |
| 3 | 298.24 | 7 | 1110 | 3 | 3 | 04/22/2021, 14:18:44 |
| 3 | 298.24 | 7 | 1110 | 3 | 3 | 04/22/2021, 14:18:45 |

mismatch

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **T\_Class** | **Power (W)** | **Load\_Combination** | **Active\_Zone** | **M1\_Pred** | **M2\_Pred** | **Time** |
| 2 | 232.6 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:23 |
| 2 | 232.6 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:24 |
| 2 | 232.554 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:25 |
| 2 | 232.554 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:26 |
| 2 | 232.52 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:27 |
| 2 | 232.52 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:28 |
| 2 | 232.562 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:29 |
| 2 | 232.562 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:30 |
| 2 | 232.597 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:31 |
| 2 | 232.597 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:32 |
| 2 | 232.625 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:33 |
| 2 | 232.625 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:34 |
| 2 | 232.655 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:35 |
| 2 | 232.655 | 0 | 0000 | 1 | 1 | 04/22/2021, 13:28:36 |