### Parameter combinations used for the experiment

default\_params  
  
params\_one = { "random\_state": 33, "activation": "relu", "hidden\_layer\_sizes": (12, 24, 48, 96), "learning\_rate\_init": 0.001, "batch\_size": 20 }  
  
params\_two = { "random\_state": 33, "activation": "relu", "hidden\_layer\_sizes": (12, 24, 48, 96), "learning\_rate\_init": 0.001, "batch\_size": 50 }

### Other Model 1

This model was intended to test the performance of the model on the given dataset without applying any feature engineering or transformation techniques. This is to understand the impact of some of the hyper params on the basic model.

**Features used:** All features of the given data set were used. **Data split:** 70% of data is used for training, with 10% of validation and 20% for testing. **Evaluation metrics:** RMSE and MAE scores were used to evaluate the performance of the model. **Observations:**

| **Model Params** | **Train** **(rmse)** | **Validate** **(rmse)** | **Test** **(rmse)** | **Evaluate** **(rmse)** |
| --- | --- | --- | --- | --- |
| default\_params | 0.010235990698238237 | 0.01048744262284605 | 0.009904215868987822 | 0.010028905979234757 |
| params\_one | 0.006932223912952257 | 0.006729120103675562 | 0.006602403372255023 | 0.006681047017901092 |
| params\_two | 0.007888354736637352 | 0.007768264985211542 | 0.007381068902074671 | 0.007521259696380296 |

### Other Model 2

This model was intended to test the performance of the model, after feature engineering and standardisation.

**Features used:** The candle positions and robot positions were used to calculate the euclidean distance between each candle and robot, which were used along with collision and orientation of robot.  
**Data split:** 70% of data is used for training, with 10% of validation and 20% for testing. **Evaluation metrics:** RMSE and MAE scores were used to evaluate the performance of the model. **Observations:**

| **Model Params** | **Train** **(rmse)** | **Validate** **(rmse)** | **Test** **(rmse)** | **Evaluate** **(rmse)** |
| --- | --- | --- | --- | --- |
| default\_params | 0.005878661190833931 | 0.005844193387682432 | 0.006093833720059899 | 0.0059242788541034415 |
| params\_one | 0.0049782769073360225 | 0.005092708145074442 | 0.0052295245170103765 | 0.005039975722926263 |
| params\_two | 0.004997878889105543 | 0.005126282787313408 | 0.0052903190521238 | 0.005069214445085569 |

### Other Model 3

This model evaluates the model after addition of more features and uses standardisation and transformation techniques.

**Features used:** The candle positions and robot positions were used to calculate the distance of each robot with the candles along the x and y axis seperately, which were used along with collision and orientation of robot.

**Data split:** 70% of data is used for training, with 10% of validation and 20% for testing.

**Evaluation metrics:** RMSE and MAE scores were used to evaluate the performance of the model.

**Observations:**

| **Model Params** | **Train** **(rmse)** | **Validate** **(rmse)** | **Test** **(rmse)** | **Evaluate** **(rmse)** |
| --- | --- | --- | --- | --- |
| default\_params | 0.0068574568517373235 | 0.007020733591741029 | 0.007275347894259288 | 0.00695737272582952 |
| params\_one | 0.006120345806405142 | 0.006308155320899452 | 0.006538339639785879 | 0.006222735763526444 |
| params\_two | 0.006276799679741773 | 0.006518804555387753 | 0.006686550020099288 | 0.006382960851495031 |

### Final Model

This model evaluates the model after addition of more features and uses standardisation and transformation techniques.

**Features used:** Distance between robot and candles, both horizontal and vertical distances as well as Euclidean distances, along with collision and orientation is used.

**Data split:** 70% of data is used for training, with 10% of validation and 20% for testing.

**Evaluation metrics:** RMSE and MAE scores were used to evaluate the performance of the model.

**Observations:**

| **Model Params** | **Train** **(rmse)** | **Validate** **(rmse)** | **Test** **(rmse)** | **Evaluate** **(rmse)** |
| --- | --- | --- | --- | --- |
| default\_params | 0.006796070283839948 | 0.007285995978415394 | 0.00728418528200731 | 0.0069427005159541965 |
| params\_one | 0.004792246505649399 | 0.004999201637891569 | 0.005078654152523908 | 0.004870231346732643 |
| params\_two | 0.005080281136352966 | 0.005388566824830438 | 0.0054764990968533475 | 0.005190364305617732 |

### Key Findings / Observations *More experiments were performed on the dataset, Only the best params that works for these datasets were only recorded in this report.*

* relu is the best activation function, which provides the highest performance scores
* the best achitecture in my experiments is (12, 24, 48, 96)
* smaller batch sizes performes well
* learning rate of 0.001 gives best results
* feature engineering is key to better results