

6 Experiments

6.1 Experiment Description

- **User Input:** a tx information and given waiting time
- **Output:** Estimated fee rate

6.2 Evaluation Strategies

- MSE

$$MSE = \frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2 \quad (1)$$

- RMSE

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2} \quad (2)$$

- MAE *mean_absolute_error*

$$MAE = \frac{1}{n} \sum_{i=1}^n |y_i - \hat{y}_i| \quad (3)$$

- *R2_score* R^2 is a statistic that will give some information about the goodness of fit of a model. In regression, the R^2 coefficient of determination is a statistical measure of how well the regression predictions approximate the real data points. *An R^2 of 1 indicates that the regression predictions perfectly fit the data.* Values of R^2 outside the range 0 to 1 can occur when the model fits the data worse than a horizontal hyperplane.

$$R^2(y, \hat{y}) = 1 - \frac{\sum_{i=0}^n (y_i - \hat{y}_i)^2}{\sum_{i=0}^n (y_i - \bar{y})^2} \quad (4)$$

6.3 Comparison tx Feature Selection

The aim of this set is to test the effectiveness of treating block height as an explicit transaction feature to train our models. In our models (namely, **Block** model, **TxMempool** model and **Mempool** model), the block height has been used as an implicit condition to construct transaction samples. For example, in block model, given a block sequence b_1, b_2, b_3 , the transactions

selected to train this module must meet with the condition that the time entering mempool should be between the block generation time of b_3 and b_4 .

In Figure 3, experiments without suffix (like RMSE), 'blockheight' works as an explicit feature in transaction. While, for those experiments with suffix "_non", (like *RMSE_non*), we delete the dimension *blockheight* in transaction instances and get the new $Tx_Features = [in, out, ver, size, weight, relay, waiting]$. We evaluate the effect of explicit block height in our four models (namely, **NN model**, **Block model**, **TxMempool model** and **Mempool model**) under four strategies (RMSE, MSE, MAE and R2). The results show that 'block height' has a positive effect on NN models, while little optimization on others three models. **Based on this observations, we choose to use explicit block height in NN models and implicit block height in the other three models.**

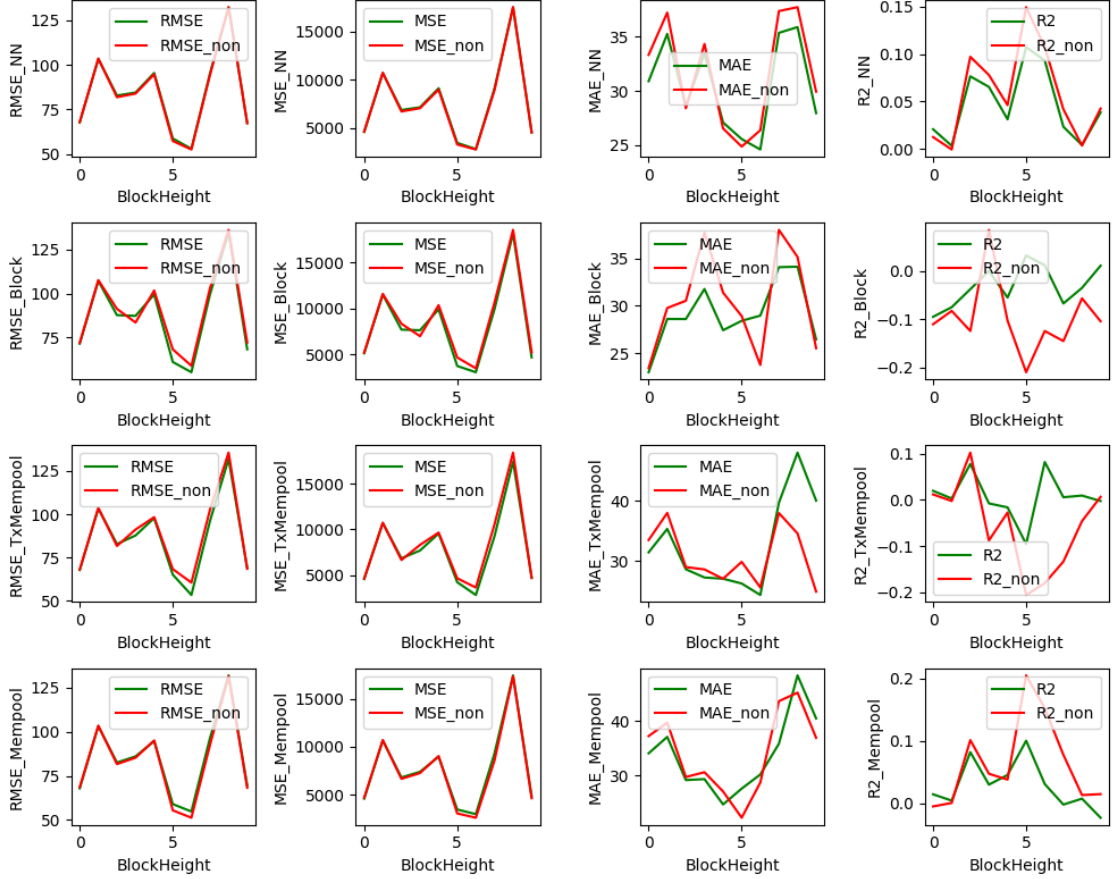


Figure 3: ComparisonBlockHeight

6.4 Proposed LSTM models Comparison under different strategies

Compared with other three models, Mempool model performs better with lower MSE, RMSE, MAE and higher R^2 score

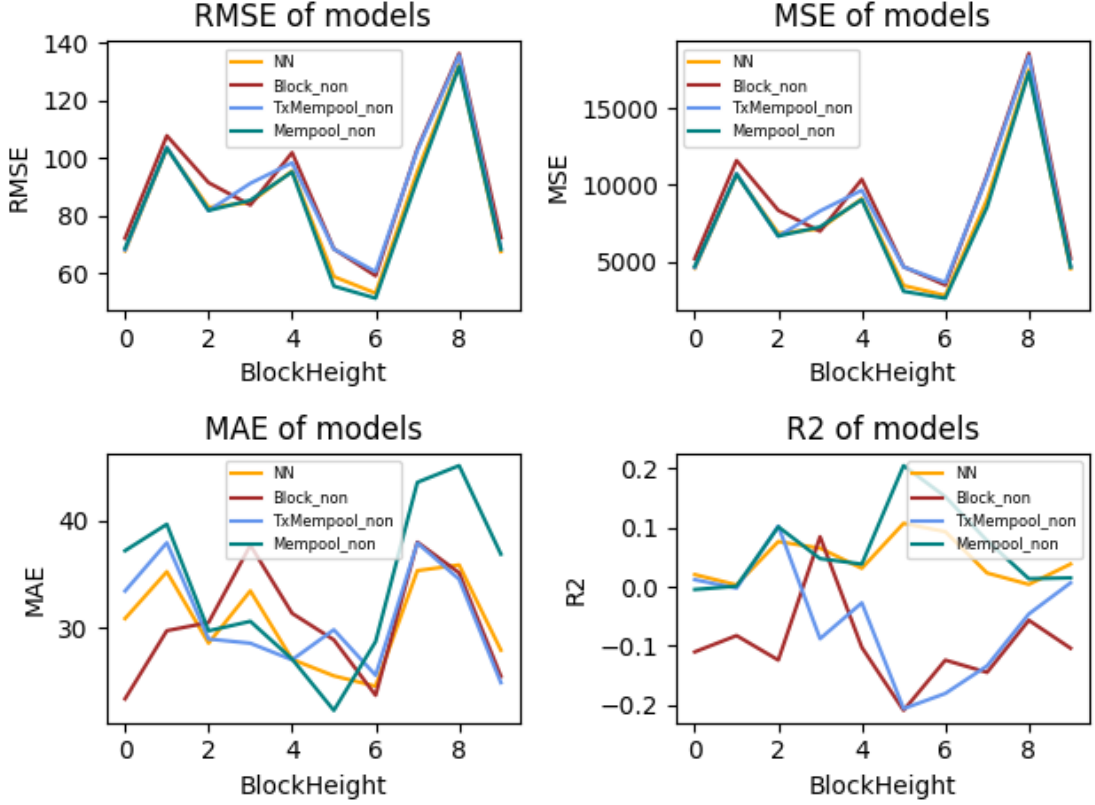


Figure 4: LSTM models Comparison under different strategies

6.5 Experiment Models Comparison under different s-strategies

LSTM model outperforms other three methods with lower MSE, RMSE, MAE and higher R^2 score

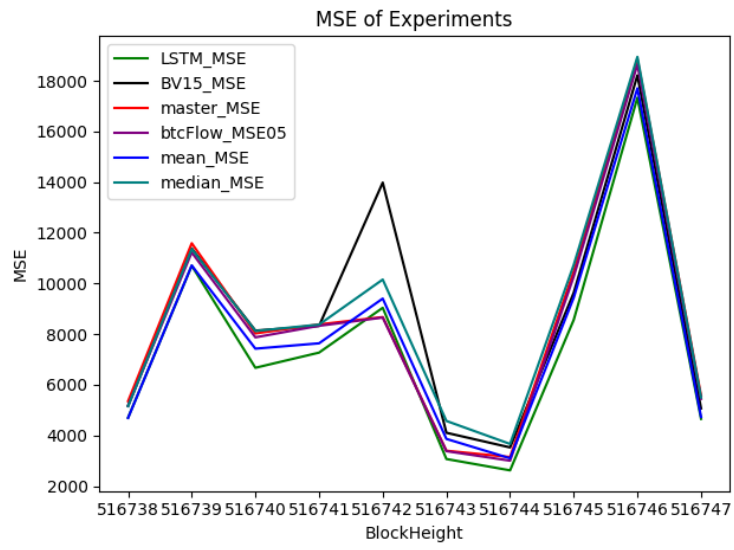


Figure 5: MSE

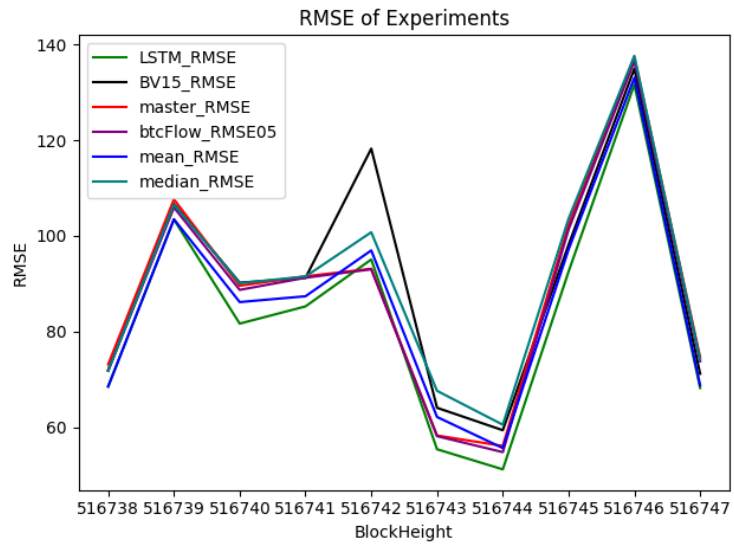


Figure 6: RMSE

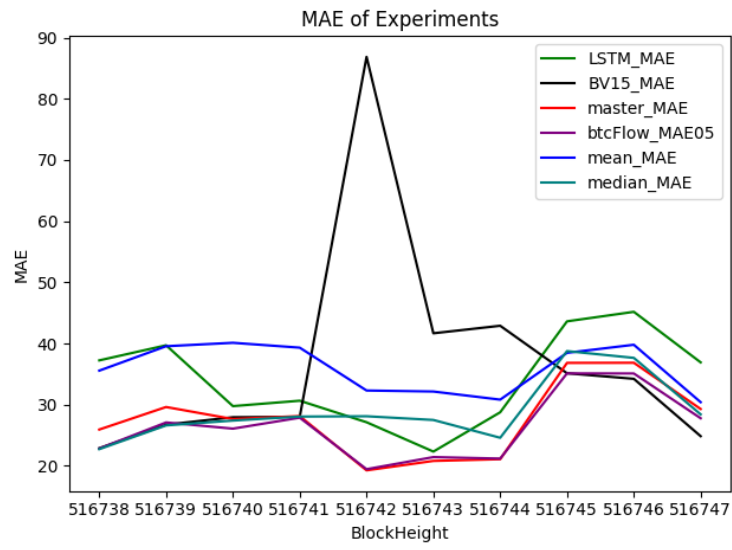


Figure 7: MAE

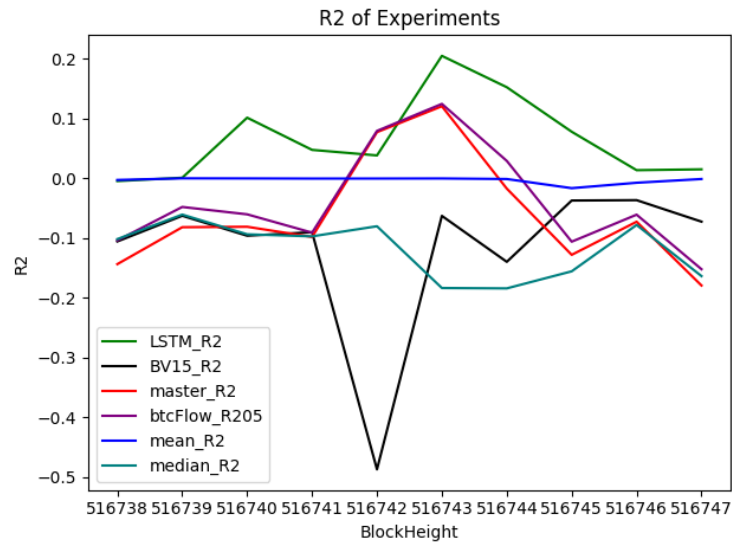


Figure 8: R2