Table 1: LSTM hyperparameters, Stage one [1]

Hyperparameters	**Attempt 1**	**Attempt 2**	**Attempt 3**
Length of input (lags)	1	**13**	52
Prediction method	regular	**walk forward validation**	/
Stationarity	stationary input	**non-stationary input**	/

[1] The bold options are selected for the stage two hyperparameter tuning on both univariate and multivariate LSTMs.

Table 2: LSTM hyperparameters, Stage two [1]

Model	Model Type	Hidden layers	Hidden units	Features
1	Univariate Uni-LSTM	1	512	Weekly total bookings
2	Univariate Uni-LSTM	2	1024	Weekly total bookings
3	Univariate Uni-LSTM	3	1536	Weekly total bookings
4	Univariate Bi-LSTM	1	512	Weekly total bookings
5	Univariate Bi-LSTM	2	1024	Weekly total bookings
6	Univariate Bi-LSTM	3	1536	Weekly total bookings
7	Multivariate Uni-LSTM	1	512	Weekly bookings of 9 areas
8	Multivariate Uni-LSTM	2	1024	Weekly bookings of 9 areas
9	Multivariate Uni-LSTM	3	1536	Weekly bookings of 9 areas
10	Multivariate Uni-LSTM	1	512	Weekly bookings of 5 product platforms
11	Multivariate Uni-LSTM	2	1024	Weekly bookings of 5 product platforms
12	Multivariate Uni-LSTM	3	1536	Weekly bookings of 5 product platforms
13	Multivariate Bi-LSTM	1	512	Weekly bookings of 9 areas
14	Multivariate Bi-LSTM	2	1024	Weekly bookings of 9 areas
15	Multivariate Bi-LSTM	3	1536	Weekly bookings of 9 areas

[1] A grid search was taken for LSTM. The results of each attempted model and the models with the best performance are reported in Section **??**.

Table 3: Results of LSTM hyperparameters tuning

Model [1]	**Model Type**	**RMSE**	**MSE**	**MAE**	**MAPE**
1	Univariate Uni-LSTM	0.530	0.281	0.405	0.024
2	Univariate Uni-LSTM	0.507	0.257	0.403	0.024
3	Univariate Uni-LSTM	0.683	0.466	0.502	0.029
4	Univariate Bi-LSTM	0.471	0.222	0.362	0.022
5	Univariate Bi-LSTM	0.484	0.235	0.377	0.022
6	Univariate Bi-LSTM	0.667	0.445	0.521	0.030
7	Multivariate Uni-LSTM	0.505	0.255	0.394	0.023
8	Multivariate Uni-LSTM	0.644	0.415	0.502	0.029
9	Multivariate Uni-LSTM	0.514	0.265	0.423	0.025
10	Multivariate Uni-LSTM	0.563	0.317	0.461	0.028
11	Multivariate Uni-LSTM	0.597	0.356	0.452	0.026
12	Multivariate Uni-LSTM	0.824	0.680	0.722	0.044
13	Multivariate Bi-LSTM	0.469	0.220	0.374	0.022
14	Multivariate Bi-LSTM	0.749	0.561	0.588	0.034
15	Multivariate Bi-LSTM	0.583	0.339	0.450	0.026

[1] A grid search was taken for LSTM. The parameters of the respective model can be found in Table 2. The underlining models are the best models in the respective type of LSTM model.

Table 4: Regression Metrics [1]

Model	RMSE	MSE	MAE	MAPE
AR(13)	0.601	0.361	0.479	0.028
ARIMA(13, 1, 0)	0.600	0.360	0.489	0.029
ARIMA(3, 1, 2)(3, 0, 0, 52)	0.471	0.222	**0.356**	0.022
ARIMA(2, 1, 1)(2, 0, 0, 52)	0.478	0.229	0.382	0.023
Univariate LSTM	0.507	0.257	0.403	0.0242
Univariate Bi-LSTM	0.471	0.222	0.361	**0.022**
Multivariate LSTM	0.505	0.255	0.394	0.023
Multivariate Bi-LSTM	**0.469**	**0.220**	0.373	0.022

[1] The chosen LSTM models are respectively model 2, 4, 7, and 18 in Table 2 and 3.

Table 5: Information Criteria and Residual Diagnostics of AR and ARIMA

Model	AIC	BIC	Ljung-Box (p)
AR(13)	**466.668**	**519.309**	0.71
ARIMA(13, 1, 0)	494.546	544.341	0.74
ARIMA(3, 1, 2)(3, 0, 0, 52)	490.361	522.373	0.82
ARIMA(2, 1, 1)(2, 0, 0, 52)	506.585	527.926	**0.91**