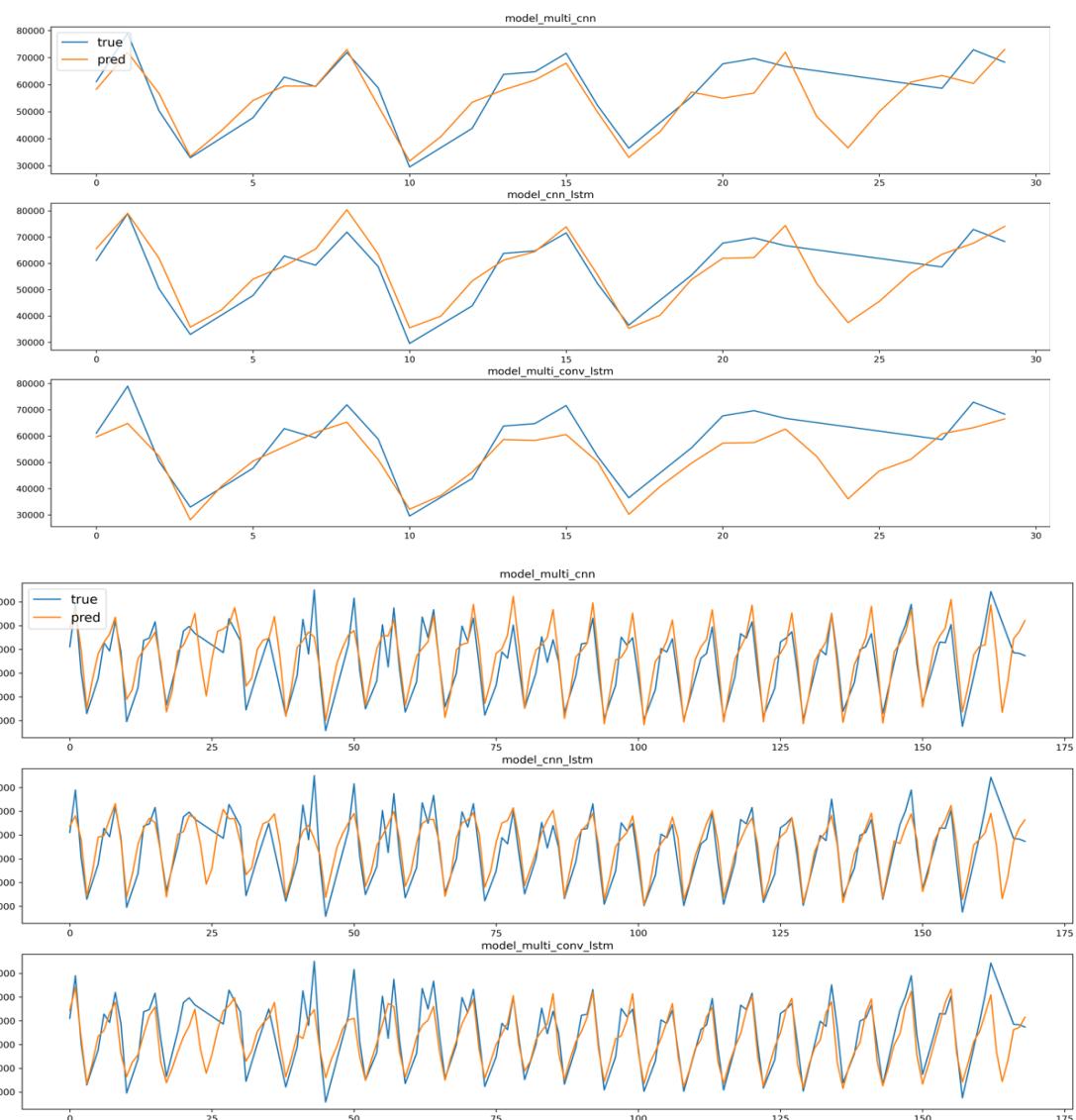


Ersten Drei Eingabesequenzen, Multi-Head Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	8488	6080	0,11
CNN-LSTM	7464	5123	0,09
ED-ConvLSTM	10754	8630	0,17

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

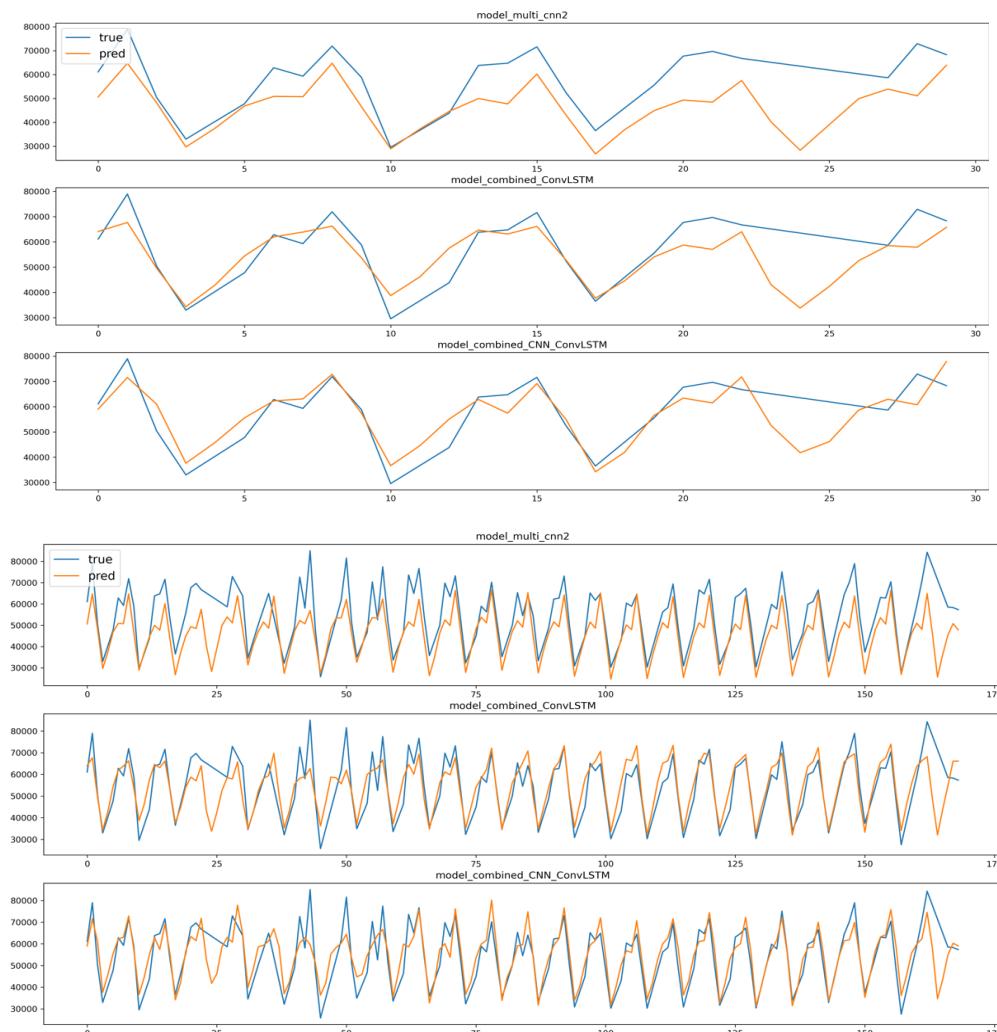
Architekturen	parameters
CNN_LSTM	{'epochs': 60, 'batch_size': 256, 'filters': 128, 'kernel_size': 2, 'pool_size': 1, 'loss': 'mae', 'dense1': 300, 'dense2': 150, 'lstm_units': 400, 'optimizer': 'adam'}
CNN	{'filters': 64, 'lstm_units': 200, 'loss': 'huber', 'kernel_size': 4, 'dense_units': 200, 'epochs': 90, 'batch_size': 256, 'optimizer': 'adam'}
ED_ConvLSTM	{'filters': 64, 'kernel_size': 5, 'pool_size': 2, 'lstm_units': 110, 'loss': 'mse', 'epochs': 70, 'batch_size': 128, 'optimizer': 'adam'}

Alle Eingabesequenzen, Mulit-Head Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	9735	7005	0,12
ED-ConvLSTM	8518	6396	0,12
ED-ConvLSTM-CNN	8057	5648	0,11

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

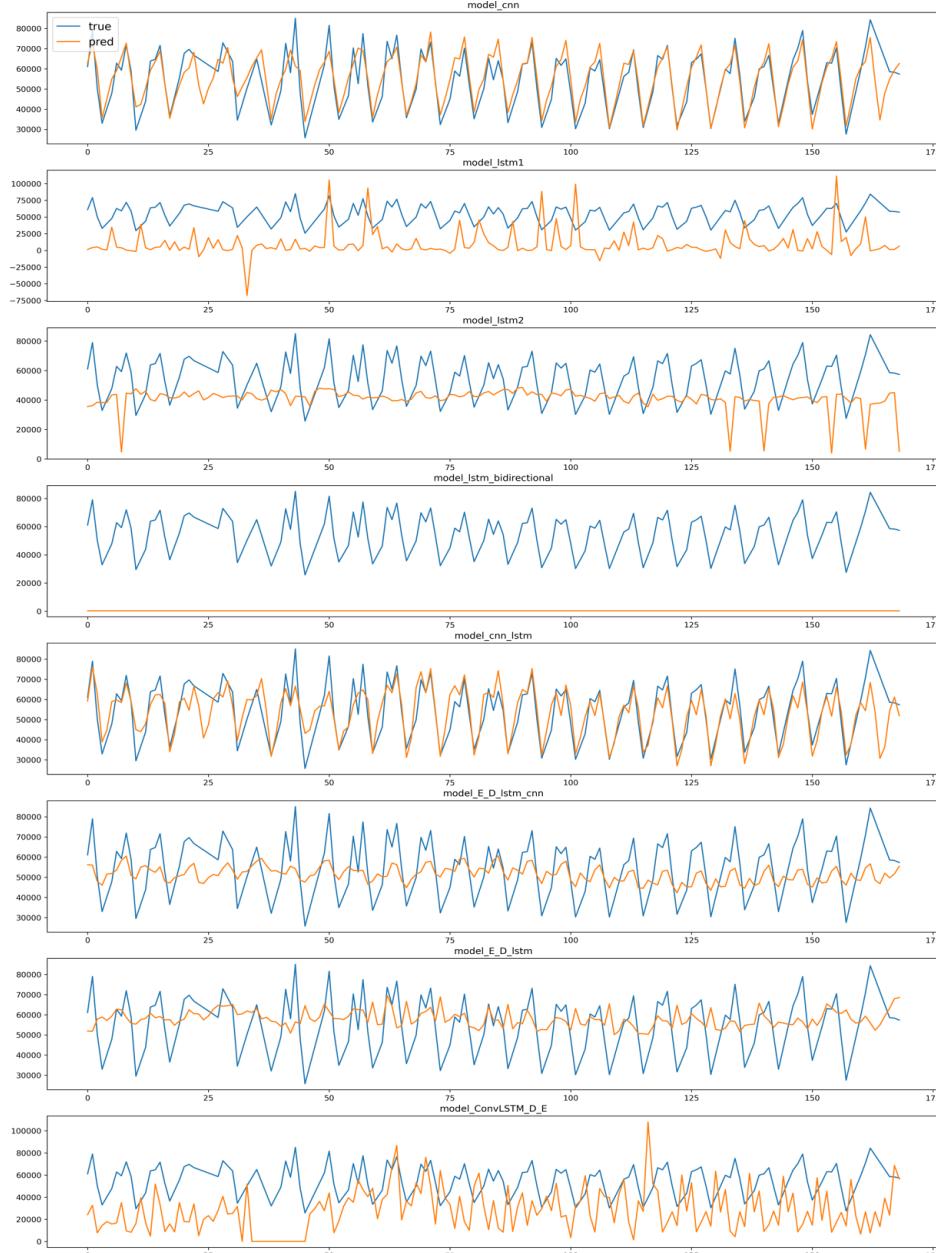
Architekturen	parameters
ED_ConvLSTM_CNN	{filters_LSTM: 64, lstm_unitsLSTM: 120, 'loss': 'huber', 'kernel_size_LSTM': 2, dense_units: 200, filters_CNN : 256, kernel_size_CNN : 5, pool_size_CNN : 2, epochs : 80, batch_size : 256, 'optimizer': 'adam'}
CNN	{filters: 128, 'loss': 'huber', 'kernel_size': 4, dense_units: 180, 'epochs': 90, 'batch_size': 256, 'optimizer': 'adam'}
ED_ConvLSTM	{filters : 128, kernel_size : 3, pool_size : 2, lstm_units : 170, dense_units: 110, loss : 'mse', epochs : 80, batch_size : 256, 'optimizer': 'adam'}

Erste Eingabesequenz, Sequenzielle Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	8223	6007	0.11
LSTM	24346	18722	0.36
LSTM-Stacked	16101	13356	0.24
BI-LSTM	41811	39542	0.72
CNN-LSTM	8290	6989	0.14
ED-LSTM	14917	12046	0.25
ED-LSTM-CNN	11408	9347	0.2
ED-ConvLSTM	10588	8477	0.16

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

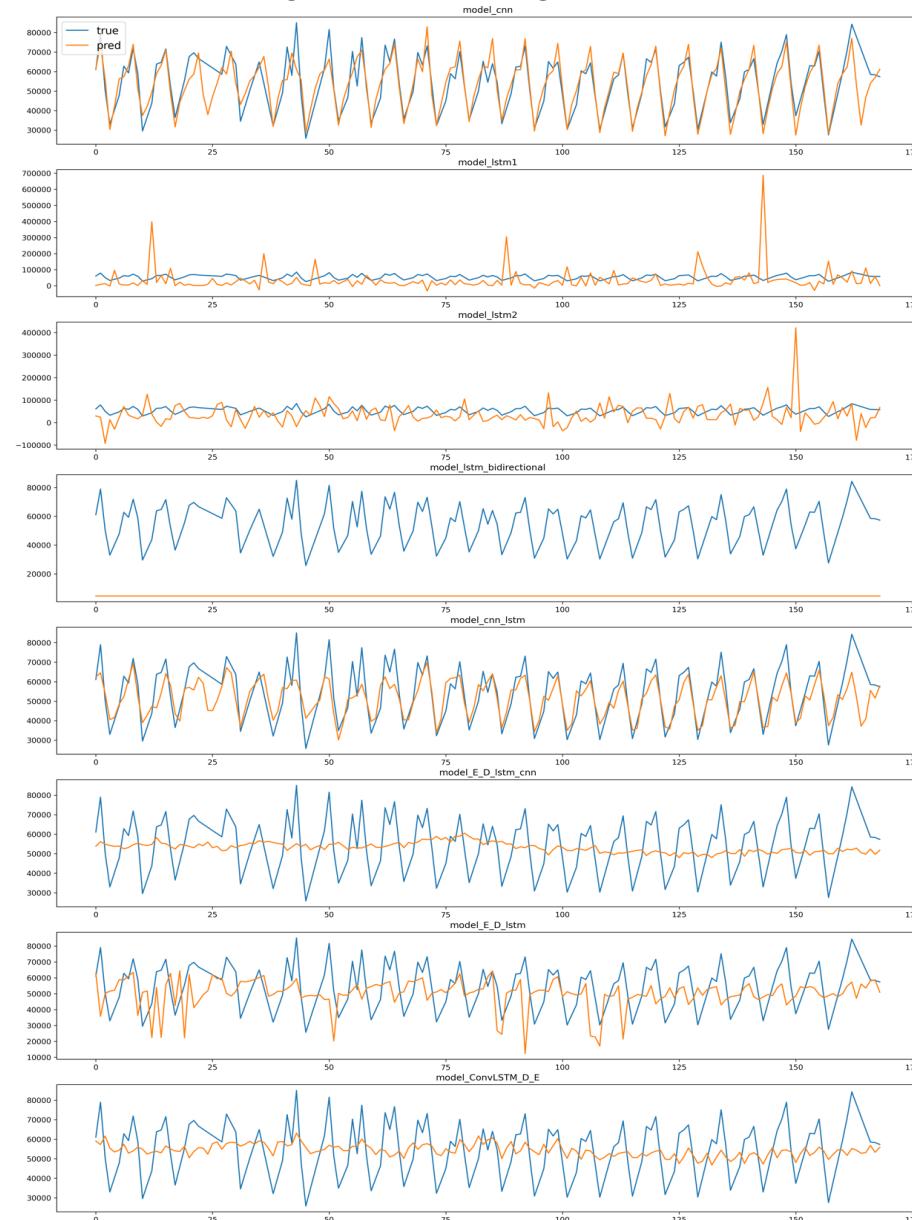
Architekturen	parameters
CNN	{'epochs': 60, 'batch_size': 128, 'filters': 16, 'kernel_size': 5, 'pool_size': 1, 'loss': 'huber', 'optimizer': 'adam'}
CNN_LSTM	{'filters': 64, 'lstm_units': 200, 'loss': 'huber', 'kernel_size': 4, 'dense_units': 200, 'epochs': 90, 'batch_size': 256, 'optimizer': 'adam'}
ED_ConvLSTM	{'filters': 64, 'kernel_size': 5, 'pool_size': 2, 'lstm_units': 110, 'loss': 'mse', 'epochs': 70, 'batch_size': 128, 'optimizer': 'adam'}

Zweite Eingabesequenz, Sequenzielle Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	8562	6533	0.12
LSTM	20835	17269	0.3
LSTM-Stacked	14076	11789	0.24
BI-LSTM	41807	39537	0.72
CNN-LSTM	9301	7122	0.14
ED-LSTM	13681	11565	0.24
ED-LSTM-CNN	12083	9964	0.21
ED-ConvLSTM	11245	9160	0.19

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

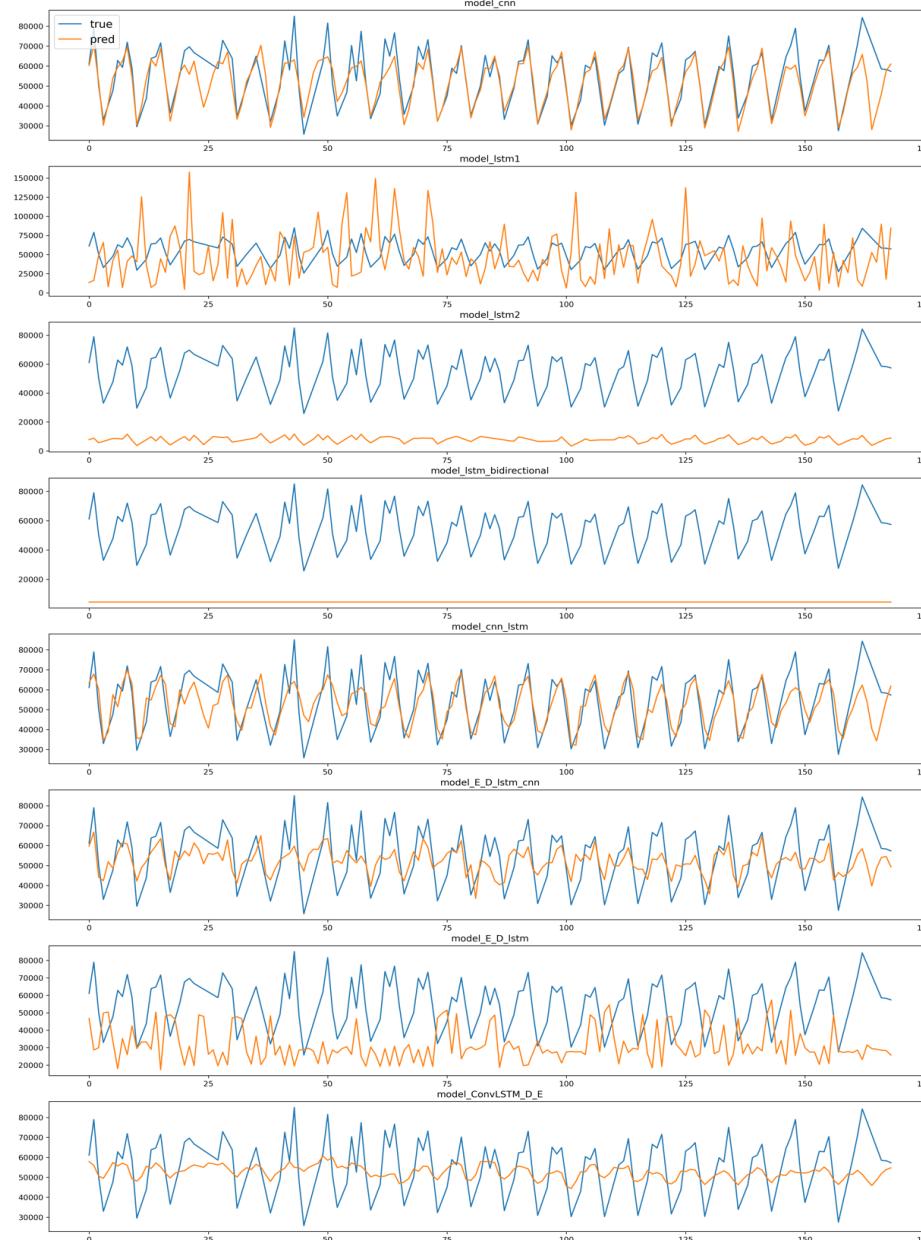
Architekturen	parameters
CNN	{'epochs': 70, 'batch_size': 32, 'filters': 8, 'kernel_size': 3, 'pool_size': 1, 'loss': 'mse', 'optimizer': 'adam'}
CNN_LSTM	{'filters': 128, 'lstm_units': 250, 'loss': 'mse', 'kernel_size': 5, 'dense_units': 210, 'epochs': 70, 'batch_size': 256, 'optimizer': 'adam'}
ED_ConvLSTM	{'filters': 128, 'kernel_size': 6, 'pool_size': 2, 'lstm_units': 170, 'loss': 'huber', 'epochs': 80, 'batch_size': 256, 'optimizer': 'adam'}

Dritte Eingabesequenz, Sequenzielle Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	8362	5784	0.11
LSTM	14463	12135	0.24
LSTM-Stacked	19073	15224	0.3
BI-LSTM	52188	53489	0.99
CNN-LSTM	8315	6011	0.11
ED-LSTM	12083	16741	0.35
ED-LSTM-CNN	11845	9479	0.19
ED-ConvLSTM	10799	8754	0.17

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

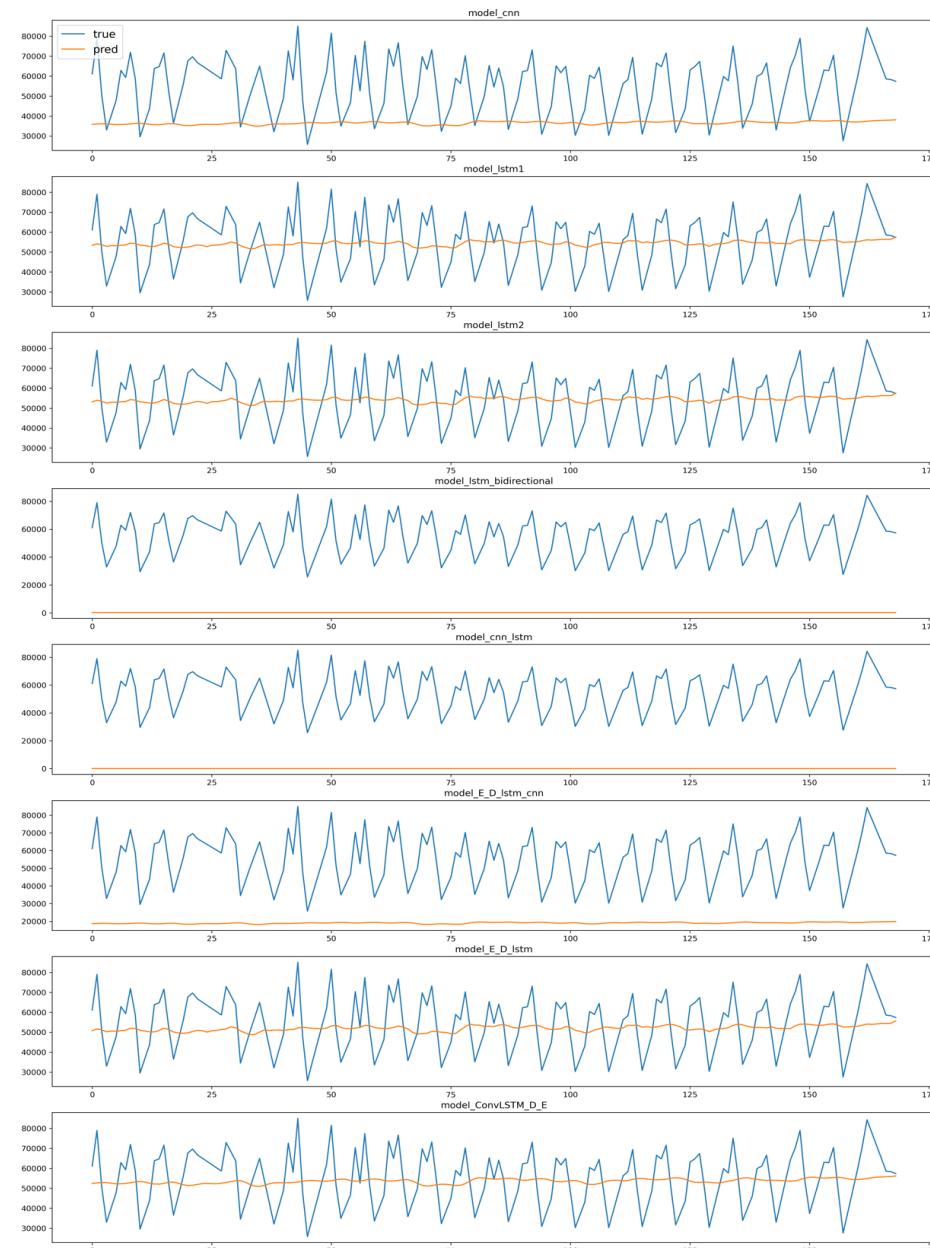
Architekturen	parameters
CNN	{'epochs': 70, 'batch_size': 64, 'filters': 32, 'kernel_size': 2, 'pool_size': 1, 'loss': 'mse', 'optimizer': 'adam'}
CNN_LSTM	{'filters': 64, 'lstm_units': 150, 'loss': 'mse', 'kernel_size': 5, 'dense_units': 150, 'epochs': 100, 'batch_size': 256, 'optimizer': 'adam'}
ED_ConvLSTM	{'filters': 256, 'kernel_size': 4, 'pool_size': 2, 'lstm_units': 150, 'loss': 'huber', 'epochs': 100, 'batch_size': 256, 'optimizer': 'adam'}

Vierte Eingabesequenz, Sequenzielle Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	22148	18537	0.31
LSTM	13668	11572	0.25
LSTM-Stacked	13628	11552	0.24
BI-LSTM	55180	53481	0.99
CNN-LSTM	55492	53803	1.0
ED-LSTM	19141	15019	0.3
ED-LSTM-CNN	13693	11609	0.24
ED-ConvLSTM	13650	11580	0.24

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

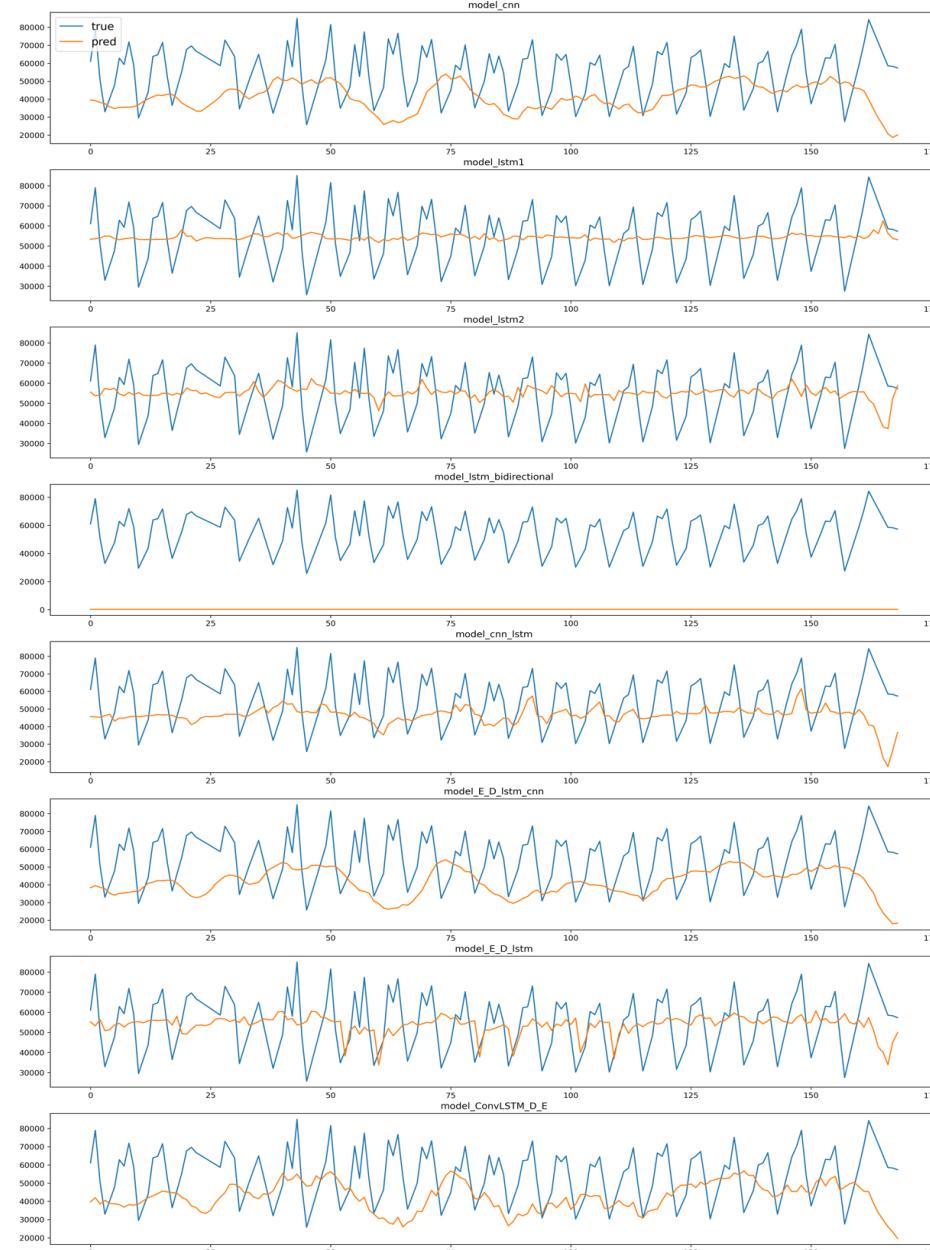
Architekturen	parameters
LSTM_Stacked	{lstm_units1 : 30, lstm_units2 : 30, optimizer : 'adam', loss : 'mse', epochs : 10, batch_size : 32, 'optimizer': 'adam'}
LSTM	{lstm_units : 45, optimizer : 'adam', loss : 'mse', epochs : 10, batch_size : 32, 'optimizer': 'adam'}
ED_ConvLSTM	{filters : 128, kernel_size : 2, pool_size : 1 lstm_units : 90, loss : 'huber', epochs : 70, batch_size : 256, 'optimizer': 'adam'}

Fünfte Eingabesequenz, Sequenzielle Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	19774	16376	0.29
LSTM	13934	11798	0.25
LSTM-Stacked	13593	11493	0.24
BI-LSTM	55189	53490	0.99
CNN-LSTM	20384	16671	0.3
ED-LSTM	14566	12227	0.26
ED-LSTM-CNN	20158	16458	0.29
ED-ConvLSTM	15259	12661	0.24

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

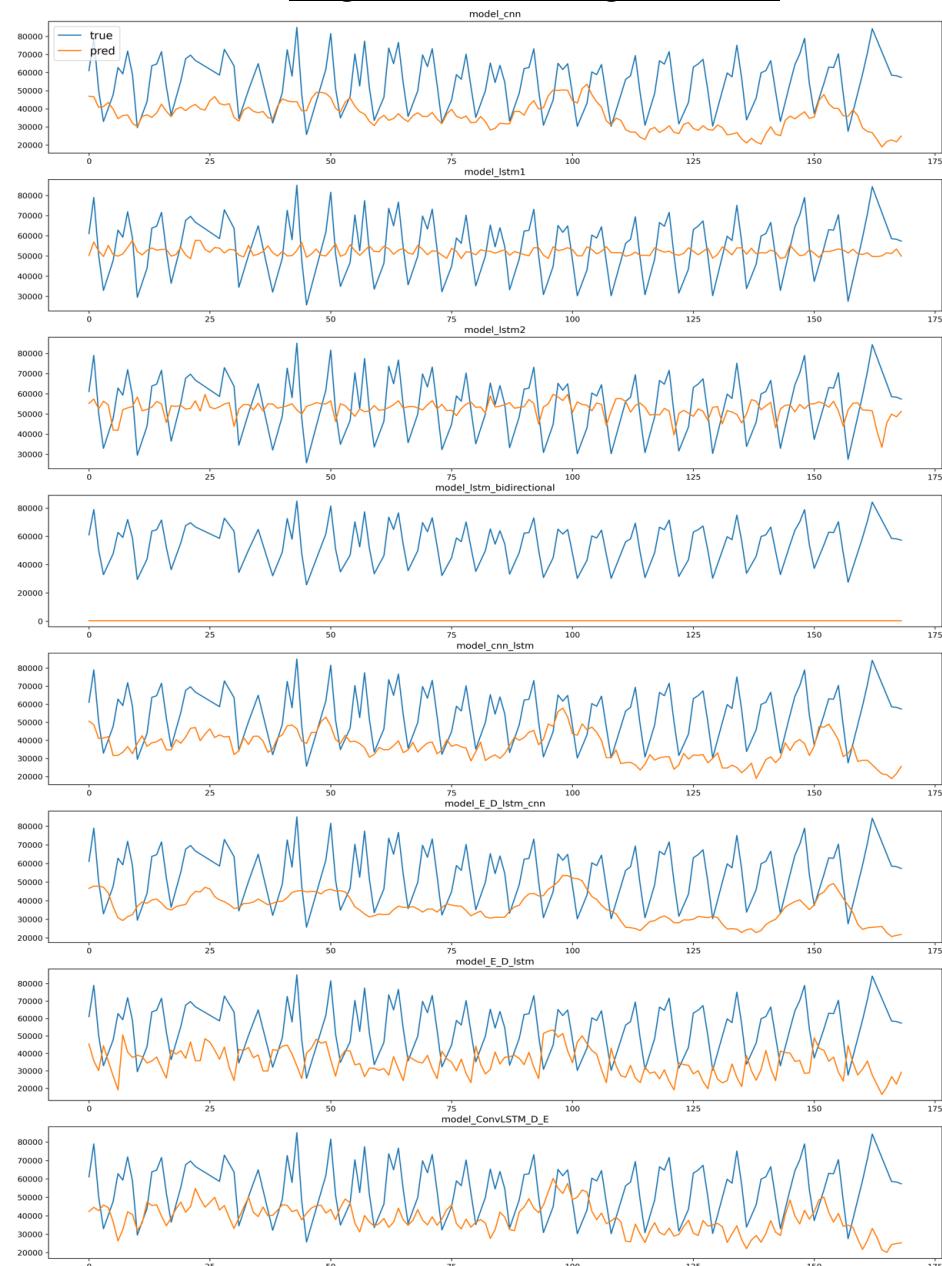
Architekturen	parameters
LSTM_Stacked	{lstm_units1 : 60, lstm_units2 : 40, optimizer : 'adam', loss : 'mse', epochs : 60, batch_size : 256, 'optimizer': 'adam'}
LSTM	{lstm_units : 40, optimizer : 'adam', loss : 'mse', epochs : 40, batch_size : 128, 'optimizer': 'adam'}
ED_LSTM	{lstm_units : 30, optimizer : 'adam', loss : 'huber', epochs : 60, batch_size : 128, 'optimizer': 'adam'}

Sechste Eingabesequenz, Sequenzielle Modelle

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN	19812	16179	0.29
LSTM	13621	11492	0.24
LSTM-Stacked	13916	11807	0.24
BI-LSTM	55190	53492	0.99
CNN-LSTM	20384	16671	0.3
ED-LSTM	20469	16706	0.29
ED-LSTM-CNN	13974	11773	0.25
ED-ConvLSTM	15259	12661	0.24

Prognosen Evaluierungsdatensatz



Optimierte Hyperparameter Konfiguration

Architekturen	parameters
LSTM	{lstm_units : 30, optimizer : 'adam', loss : 'mse', epochs : 60, batch_size : 256, 'optimizer': 'adam'}
LSTM_Stacked	{lstm_units1 : 50, lstm_units2 : 40, optimizer : 'adam', loss : 'huber', epochs : 50, batch_size : 256, 'optimizer': 'adam'}
ED_LSTM_CNN	{filters: 128, lstm_units: 110, 'loss':'huber', 'kernel_size': 3, dense_units: 100, 'epochs': 60, 'batch_size': 128, 'optimizer': 'adam'}

Evaluation Testdatensatz CNN-LSTM

Fehlermetriken

Architekturen	RMSE	MAE	MAPE
CNN-LSTM	8401	6318	0,11

Hyperparameter Konfiguration

Architekturen	parameters
CNN-LSTM	{'epochs': 60, 'batch_size': 256, 'filters': 128, 'kernel_size': 2, 'pool_size': 1, 'loss': 'mae', 'dense1': 300, 'dense2': 150, 'lstm_units': 400, 'optimizer': 'adam'}

Prognosen Testdatensatz

