

Summary - CNN LSTM SOC'22

Stock Market Trend Predictor Using Deep Learning

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Data collection:

S&P 100 (^OEX) data collection from Yahoo Finance from 01/01/2000 to 30/06/2022.

Total 5661 data values. First 4500 training set. Last 1161 test set.s

Model Design:

In order to evaluate the forecasting effect of CNN-LSTM, the mean absolute error (MAE), root mean square error (RMSE), and R^2 (coefficient of determination) are used as the evaluation criteria of the methods. Parameters, model structure and steps would be those mentioned in the paper with the features on the input dimension changed to 7 and corresponding change in convolution layer filters.

1. **Input data:** input the data required for CNN-LSTM training.
2. **Data standardization:** as there is a large gap in the input data, in order to train the model better, the z score standardization method is adopted to standardize the input data, as shown in the following formula:
$$y_i = (x_i - \bar{x}) / s ; x_i = y_i * s + \bar{x}$$
where y_i is the standardized value, x_i is the input data, \bar{x} is the average of the input data, and s is the standard deviation of the input data.
3. **Initialize network:** initialize the weights and biases of each layer of the CNN-LSTM.
4. **CNN layer calculation:** the input data are successively passed through the convolution layer and pooling layer in the CNN layer, the feature extraction of the input data is carried out, and the output value is obtained.
5. **LSTM layer calculation:** the output data of the CNN layer are calculated through the LSTM layer, and the output value is obtained.
6. **Output layer calculation:** the output value of the LSTM layer is input into the full connection layer to get the output value.
7. **Calculation error:** the output value calculated by the output layer is compared with the real value of this group of data, and the corresponding error is obtained.
8. **End condition:** the conditions for the end are to complete a predetermined number of cycles, the weight is lower than a certain threshold, and the error rate of the forecasting is lower than a certain threshold. If one of the conditions for the end is met, the training will be completed, update the entire CNN-LSTM network, and go to step 10; otherwise, go to step 9.
9. **Error backpropagation:** propagate the calculated error in the opposite direction, update the weight and bias of each layer, and go to step 4 to continue to train the network.
10. **Save the model:** save the trained model for forecasting.
11. **Input data:** input the input data required for the forecasting.
12. **Data standardization:** the input data are standardized according to formula.
13. **Forecasting:** input the standardized data into the trained model of CNN-LSTM, and then get the corresponding output value.

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14. **Data standardized restore:** the output value obtained through the model of CNN-LSTM is the standardized value, and the standardized value is restored to the original value. As shown in the following formula where x_i is the standardized restored value, y_i is the output value of the CNN-LSTM, s is the standard deviation of the input data, and x is the average value of the input data.
15. **Output result:** output the restored results to complete the forecasting process and compare them with actual data and plot them and its differences.