# LSTM model

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## 1.Preprocessing

1. Min-Max scaling preprocessing - tanh activation function regards
2. Outlier remove - for get better accuracy
3. Missing value imputation - Solve missing value issues
4. Stationary no need - LSTM can learn the trend,seasonality and other through data.

## 2.Types of LSTM forecasting

1. Univariate - simple LSTM model
2. Future covariates - simple LSTM model
3. Past covariate - Encoder-Decoder based LSTM

## 3.How LSTM works

1. LSTM gates - input, forget and output gates learn the important values
2. **Forget Gate(f):** It determines to what extent to forget the previous data.
3. **Input Gate(i):** It determines the extent of information to be written onto the Internal Cell State.
4. **Output Gate(o):** It determines what output(next Hidden State) to generate from the current Internal Cell State.

5. LSTM trains with a sliding window data shift method, in this way the model learns the sequence.
6. In prediction it can get a few values of the series, then predict the next point of it.
7. In multivariate series, it will work with the covariate structure, if covariate in future it will ask the future covariates and predict or it will work with an encoding decoding model and predict fixed number of out chunks.

## 4. Evaluation

1. Absolute percentage error = ((actual - prediction) / actual) * 100

## 5. Further LSTM

LSTM is now improved as a transformer like model, today it has more powerful text generation like GPT3, BERT. they have the power of next sequence prediction of the previous context.