Predicting Stock Market Prices using AI

Daksh Dobhal, Arindam Jain and Khyati Mahendru

January 30, 2019

MC 312

Abstract

Predicting the price of stocks is a difficult task which can be carried out using Artificial Intelligence Algorithms. Prices of Stocks change continuously and can be treated effectively as a time series of data. In this project, we propose the use of Gated Recurring Units(GRUs) to predict stock prices.

1 Stock Prices and Trading

The price of a particular stock which is traded in the market is determined by the economic forces of demand and supply. A price at which the seller is willing to sell and the buyer is ready to buy, is the point of equilibrium which decides the price of the stock. Trading involves two principle actions: going short and going long. Going long means buying a stock and hoping to sell at a higher price in the future. Shorting implies selling the stock in anticipation of a future dip in its price. Technically, therefore, just knowing whether the price will go up or down in the future can enable a trader to earn large profits. In this case, an artificial intelligence algorithm can facilitate the task of forecasting prices of the stock.

2 Gated Recurrent Units(GRU)

Since the data of stock prices is a time series data, in which the present value of the variable depends upon the past values, the most suitable Artificial Intelligence technique to apply to it is Recurrent Neural Network(RNN). RNNs are a special case of Neural Networks which can be thought of as 'looping', the output from one time step is fed back as input in the next. In essence, there are two inputs to a layer, the present input along with the output from the previous layer. This enables the network to learn dependencies on past values. The basic equation describing the RNN may be written as:

$$h^t = f(h^{t-1}, x^t, \theta) \tag{1}$$

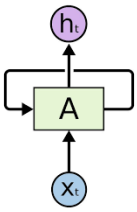

Figure 1: Recurrent Neural Network
http://colah.github.io/posts/2015-08-Understanding-LSTMs/img/RNN-rolled.png

Basically,current hidden state h(t) is a function f of the previous hidden state h(t-1) and the current input x(t). θ are the parameters of the function f.

Gated Recurrent Units are modified and improved versions of basic RNNs. They use two 'gates', a reset gate, 'r' and an update gate, 'z', which learn to discard information from the past, or remember it, as the problem requires. The workings of the GRU can be explained by the following equations:

$$z^t = \sigma(W^{(z)} + U^z h^{t-1}) \tag{2}$$

$$r^t = \sigma(W^{(r)} + U^r h^{t-1}) \tag{3}$$

$$h'^t = tanh(W x^t + r^t * U h^{t-1}) \tag{4}$$

$$h^t = z^t * h^{t-1} + (1 - z^t) * h'^t \tag{5}$$

Here σ represents the sigmoid activation function and the W and U matrices are weight matrices which are updated in each iterations of the network.