

Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results

# Forecasting Stocks

Brady Metherall

Wednesday November 29, 2017

# Black-Scholes Model

Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results

To generate data the Black-Scholes model was used. The Black-Scholes model is a mathematical model for the financial market. It is defined by the stochastic differential equation

$$dS = \mu S dt + \sigma S dW_t,$$

where  $\mu$  is the trend,  $\sigma$  the variance / volatility, and  $W_t$  is a Brownian motion. This can be discretized as

$$S_{t+1} = S_t \left( 1 + \mu \Delta t + \sigma \mathcal{N}(0, 1) \sqrt{\Delta t} \right).$$

# Black-Scholes Model

Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results

However, historical financial data is only available on a day-to-day basis. To have similar data, we let  $\Delta t = 1 \text{ min.}$  so that  $1440\Delta t = 1 \text{ day.}$  And so, the open, close, min, and max can be extracted in each block of 1440 time steps.

# Black-Scholes Model

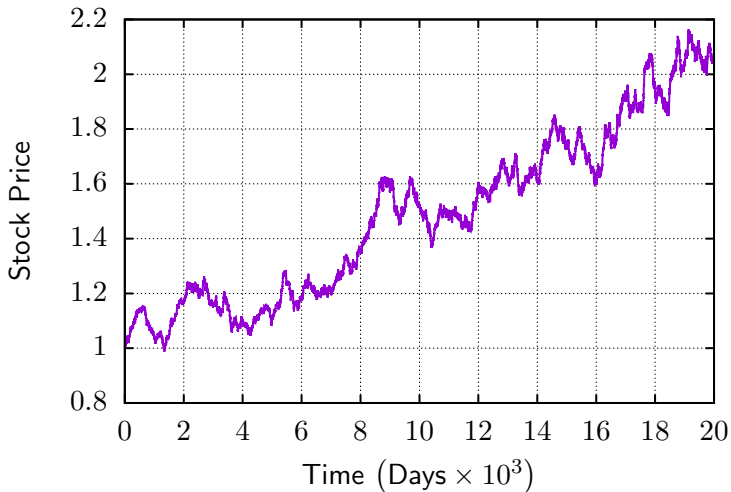
Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results



# Network

Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results

## Network Parameters:

Parameter	First Layer	Second Layer
Type	LSTM	Fully Connected
Number of Neurons	64	5
Activation	Tanh	Tanh
Dropout	10%	N/A

## Training Parameters:

Parameter	Value
Loss	Mean Absolute Percent Error
Optimizer	Adam
Window	15
Batch Size	64
Validation	20%
Epochs	50

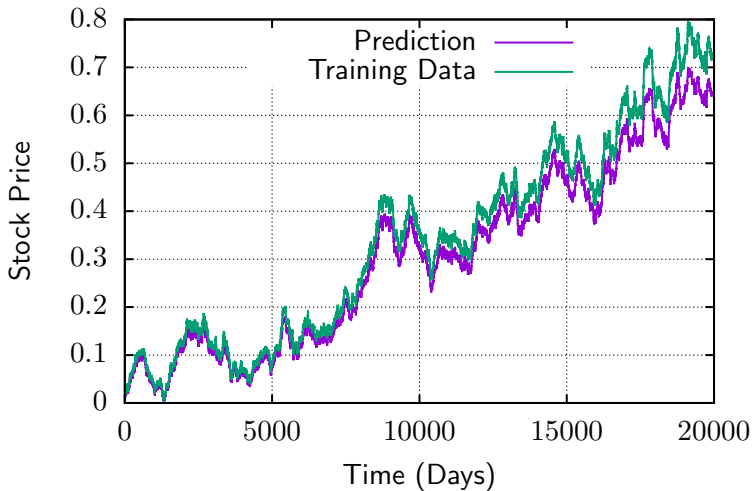
# Regular Normalization

Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network  
Results



# Flipped Normalization

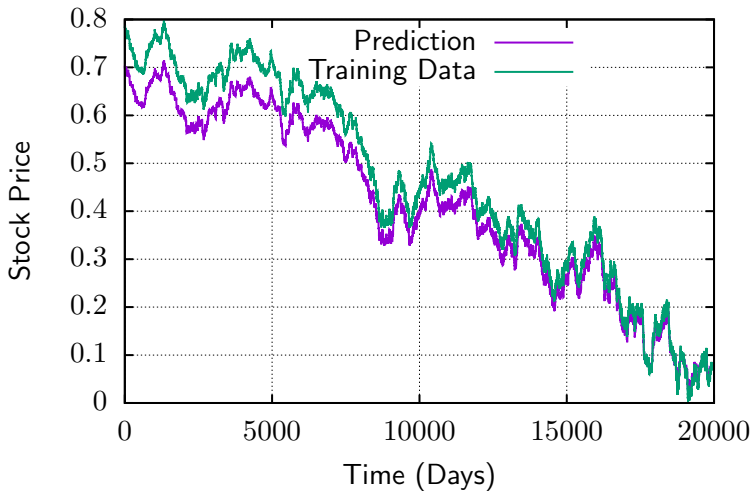
Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results



# Google

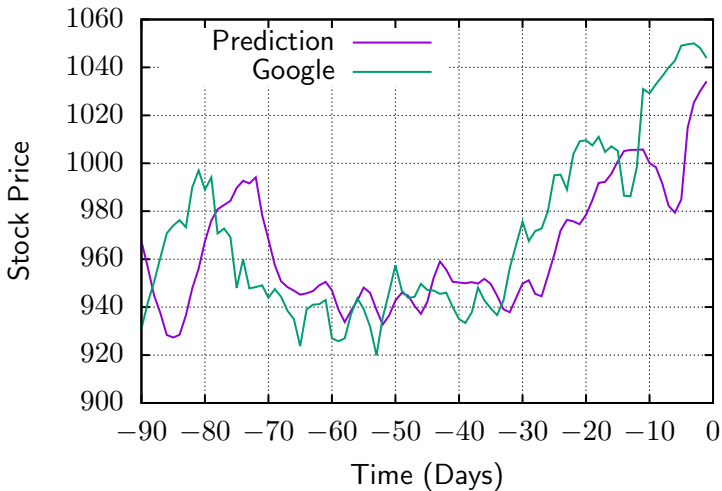
Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results





# Apple

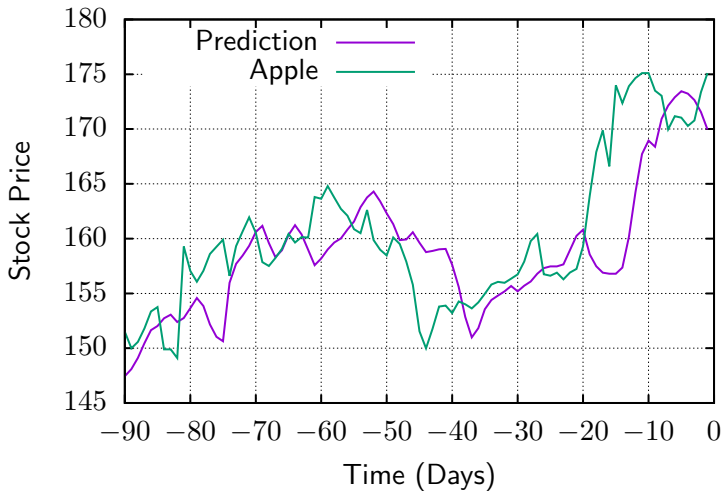
Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results



# Absolute Difference

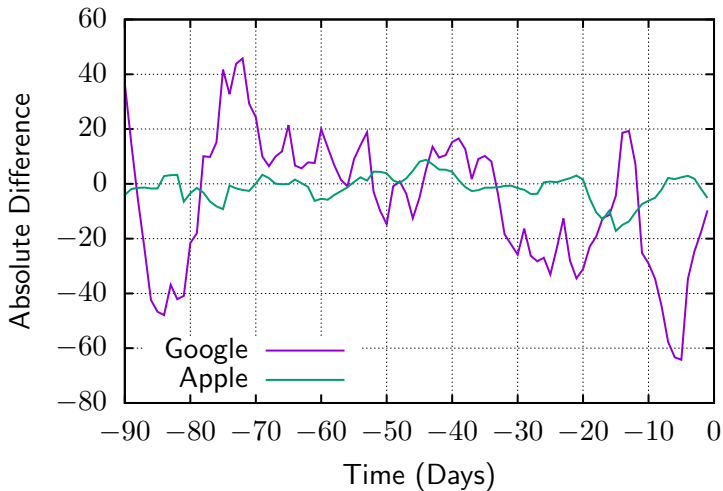
Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results



# Percent Difference

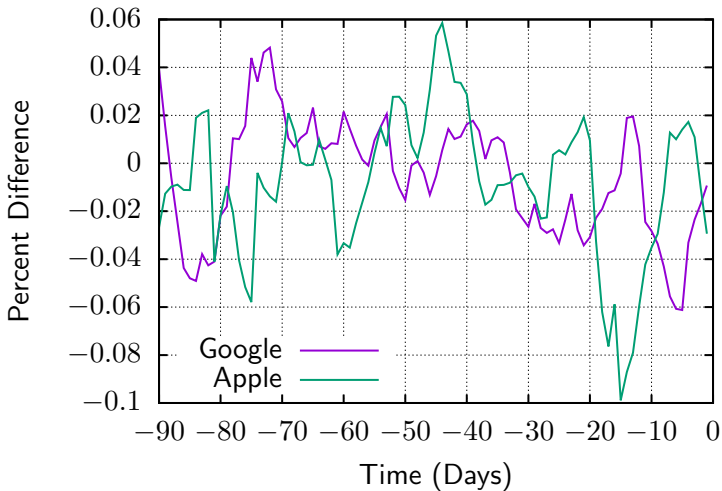
Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results



# Conclusion

Forecasting  
Stocks

Brady  
Metherall

Black-Scholes  
Model

Network

Results

This model can predict stock prices within about 2%, however, this is more than the day-to-day fluctuations. Moreover, the prediction seems to lag behind the stock by approximately a week, and so it is probably unwise to invest money based this model.