DeepStock

stock price prediction with deep learning

Siyang Jing, Jiacheng Tian, Jiyu Xu, Yuhui Huang

University of North Carolina, Chapel Hill

Oct 10th, 2017

Background and Data

- **Stock price prediction:** Previous studies have mostly focused on low frequency [1]. Machine Learning + Big Data = High Frequency.
- **Goal:** Predict stock price solely based on price and volume data (of its own and other stocks), without fundamental analysis.
- **Data:**
  - Minute-level US equity pricing and volume data since 2002. Five minute window.
  - 50 largest stocks as ranked by market capitalization.
  - Stocks are correlated, so we will use 600 dimensional lagged stock returns (50 stocks and 12 lagged returns) as raw level input data.
  - 2002-2017 as training set, 2017-2018 as test set.

Model and Method

Our model follows the research of Chong et al.[2]:

$$\mathbf{r}_t = [r_1, r_2, ..., r_{50}]$$
$$\mathbf{R}_t = [\mathbf{r}_t, \mathbf{r}_{t-1}, ..., \mathbf{r}_{t-12}]^T$$
$$\mathbf{r}_{t+1} = f \circ \phi(\mathbf{R}_t)$$

ϕ:

- Data $\rightarrow$ Features, e.g. mean, variance, etc.
- PCA, autoencoder, RBM, and other unsupervised learning techniques.

f:

- Predictor function.
- Recurrent Neural Network (RNN), state of the art for financial time series data analysis [3].

Evaluation and Promise

- **Measurements:** normalized mean squared error, mean absolute error, root mean squared error, and mutual information.
- **Bootstrap analysis:** will be performed on assessment of the accuracy of the estimator by random resampling with replacement from the original dataset.
- **Sensitivity:** of the result with respect to each feature and each stock will also be analyzed.

We believe an accurate prediction for stock price will lay a solid ground for a successful trading strategy. It will also shed light on the research of economics, finance, behavioral science, and mathematics.

Thanks!

These slides are modified from maminian's template[4].

[1] M. Kearns and Y. Nevmyvaka, "Machine learning for market microstructure and high frequency trading," 2013.

[2] E. Chong, C. Han, and F. C. Park, "Deep learning networks for stock market analysis and prediction: Methodology, data representations, and case studies," *Expert Systems with Applications*, vol. 83, pp. 187 – 205, 2017.

[3] M. Abe and H. Nakayama, "Deep Learning for Forecasting Stock Returns in the Cross-Section," *ArXiv e-prints*, Jan. 2018.

[4] maminian, "uncmathbeamer." `https://github.com/maminian/uncmathbeamer`, 2017.