STUDYPIE

Predicting Financial Time Series using Deep Learning

Module3. Important Metrics for Financial Time Series Prediction

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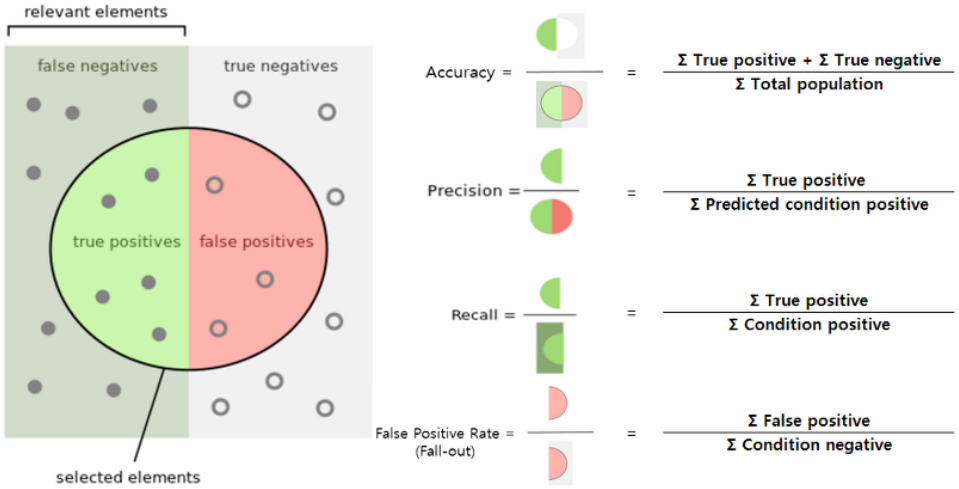
Important Metrics for Financial Time Series Prediction

I don't agree with the metrics which are conventionally used in ML or Finance for our situation

Metrics from Machine Learning

- We know conventional metrics from Machine Learning
  - For Categorical Outcome: Confusion Matrix



  - For Continuous Variable: Mean Absolute Error

$$\mathrm{MAE} = \frac{\sum_{i=1}^{n} |y_i - x_i|}{n} = \frac{\sum_{i=1}^{n} |e_i|}{n}$$

Does it still hold for financial time series prediction?

Without theory, how do we assure whether our algorithms have consistent alpha seeking capability?

Does it still hold for financial time series prediction?

- The key of trading algorithm is consistent performance over multiple periods, rather than a profit from short time periods regardless of how much they are profitable (lucky punch).
  - "지속적으로 수익을 내는 것이 아닌, 한번에 크게 번 알고리즘은 좋은 알고리즘이 아니다"
- However, aforementioned metrics do not measure consistency of profitability

We shouldn't use some common metrics in ML

- For example: mean average return
  - We usually calculate mean average return
  - However, if we lose 10% and gain 10% then our remaining budget become 99% (100*0.9*1.1 = 99), not 100%
  - Therefore, we need to evaluate the return by geometric mean of return rather than arithmetic average

Metrics from Finance Literature

- Also, I think common metrics in Finance doesn't fit well on ML problems
  - For example: Sharpe Ratio
    - There are two key parameter:
      - Standard Deviation
      - Portfolio Return
      - (assume Rf is fixed)
    - Measuring Standard Deviation is so Naïve Approach
      - How do we determine the size of windows under highly volatile situation?

The ELI5 Version of the Sharpe Ratio

$$\frac{R_p - R_f}{\sigma_p}$$

Where:

R_p = Portfolio Return

R_f = Risk-Free Rate (3-month Treasury Rate is standard)

σ_p = Portfolio Risk, aka Standard Deviation of Returns

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We need a new standard of metrics for algorithm evaluation

- Although there are scarce literature in Finance for algorithmic trading
- We need a valid set of measurements for evaluation of algorithms
- Thus, below list of measurements are not from literature, but ideas from brainstorming
    - Measurement for Consistency
    - Measurement for Robustness
    - Measurement for Risk

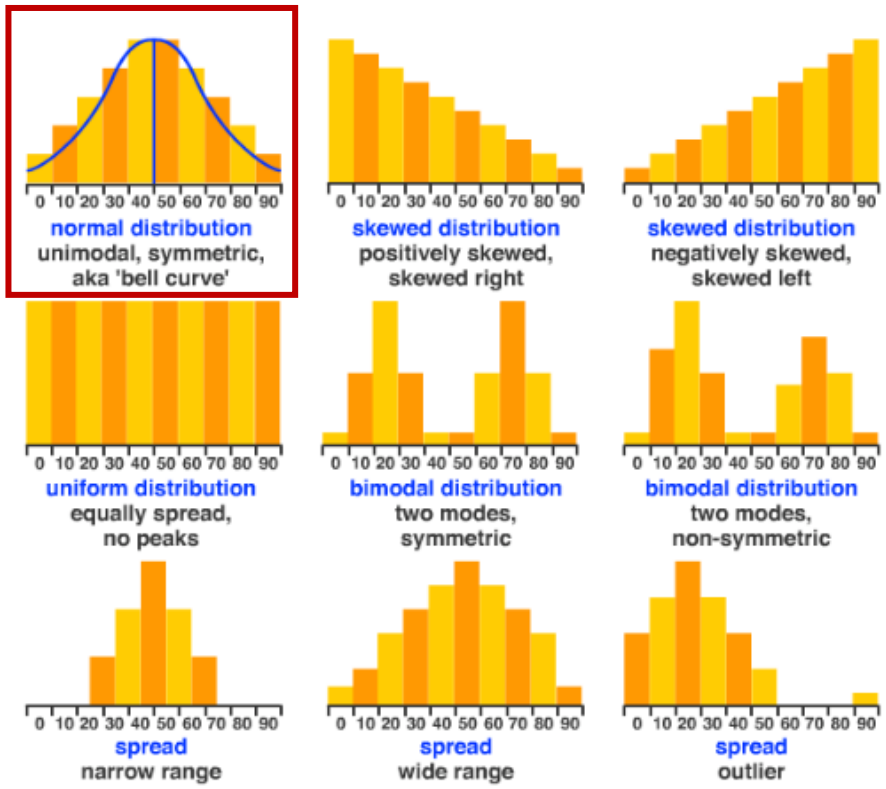
Measurement for Consistency

- Evaluate truncated geometric average return
- Try to remove biased performance: when we measure the average performance, remove top 10% and bottom 10% returns in magnitude, after then evaluate the geometric average return by remaining 80%

Measurement for Robustness

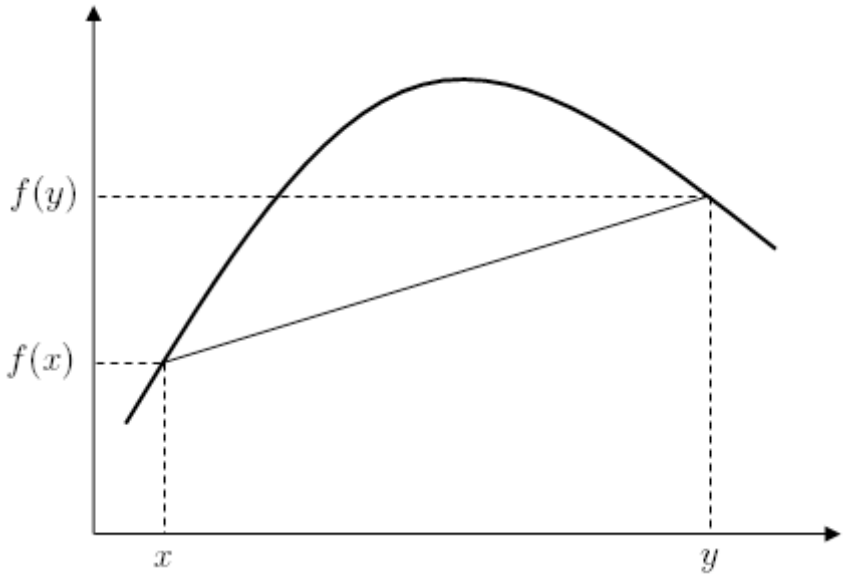
- Are the distributions of the average performance of the algorithm on different test samples (sampled by different periods) normally distributed?

This is the best! →



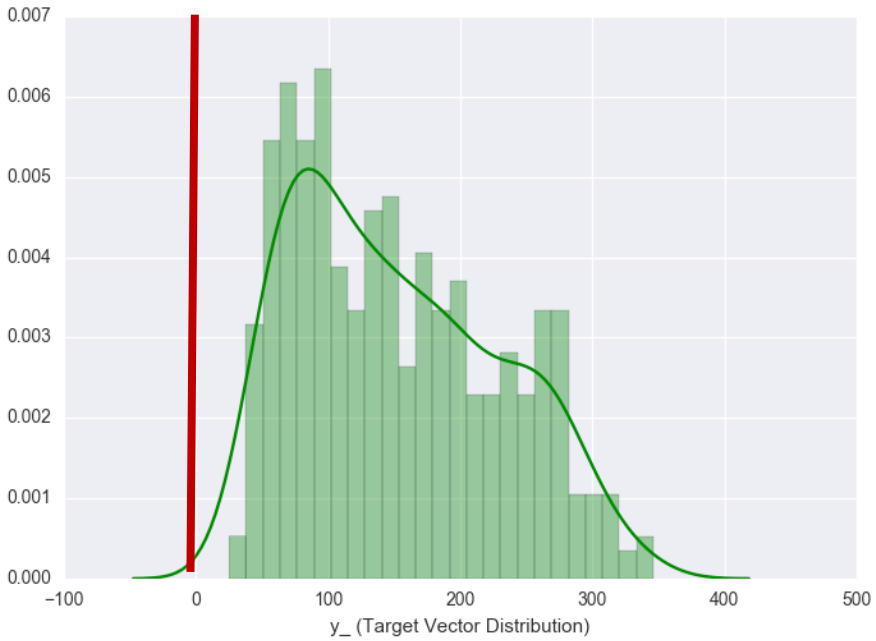
Measurement for Robustness

- Performance should be concave for the nearby hyper-parameter
  - If your algorithm is so right then the performance should be consistent for minor parameter changes
  - For example: 10-minute trading, 11-minute trading, etc. all have similar profitability



Measurement for Risk

- How many test samples show loss of principal (원금 손실 비중)
  - Choose the algorithm with less number of loss of principal



Measurement for Risk

- Measuring maximum drawdown
  - Choose the algorithm with the minimum of maximum drawdown

- 역사적 상황에서 입을 수 있었던 최대 손실
- 전체 기간 내 전략의 최대 손실

Another Tips

- How do we reflect such ideas on our algorithms?
  - Develop customized loss functions

- Draw your portfolio value in log scale
  - If your strategy is consistently good then the portfolio value over time should be flat (log scale makes it much visible)

Thank you ☺

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