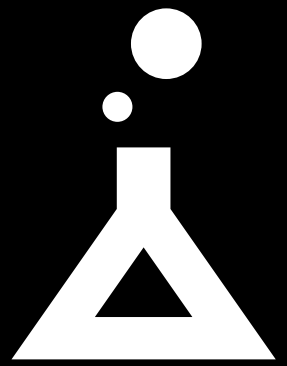
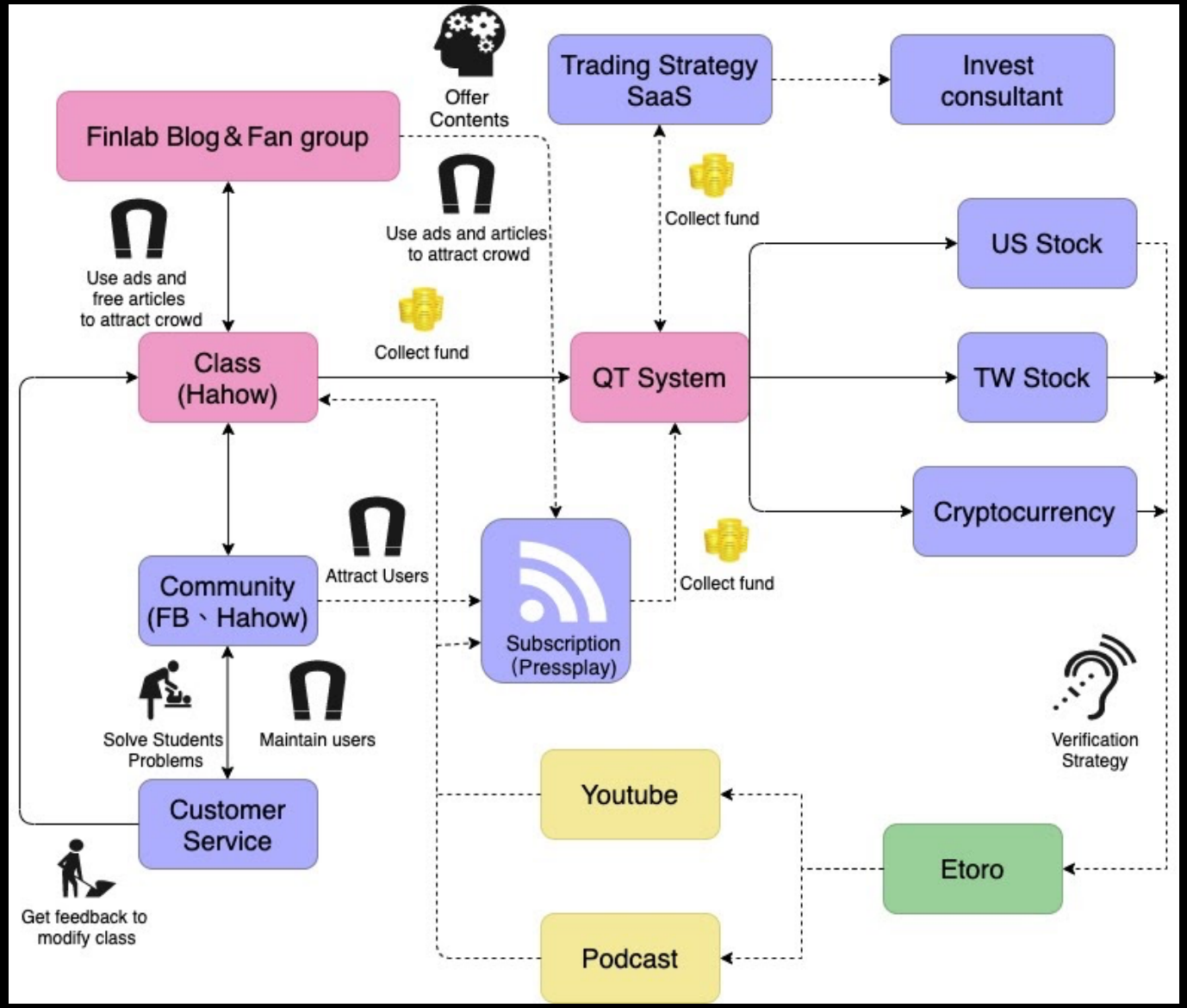


FinLab

FinLab

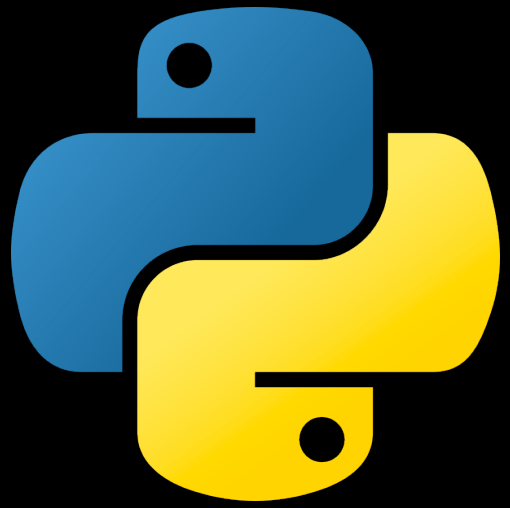

Offer Contents
Trading Strategy SaaS
Invest consultant
Finlab Blog & Fan group
Use ads and free articles to attract crowd
Use ads and articles to attract crowd
Collect fund
Collect fund
US Stock
Class (Hahow)
QT System
TW Stock
Cryptocurrency
Community (FB、Hahow)
Attract Users
Subscription (Pressplay)
Collect fund
Solve Students Problems
Maintain users
Verification Strategy
Youtube
Customer Service
Etoro
Get feedback to modify class
Podcast

Trading programming language

- Easy learning curve for the beginners
- Integrated with language editor in platforms
- Can be extend by external DLL
- Most of the functions are encrypted or the source code is not provided
- Does not support statistic analysis or machine learning toolkit

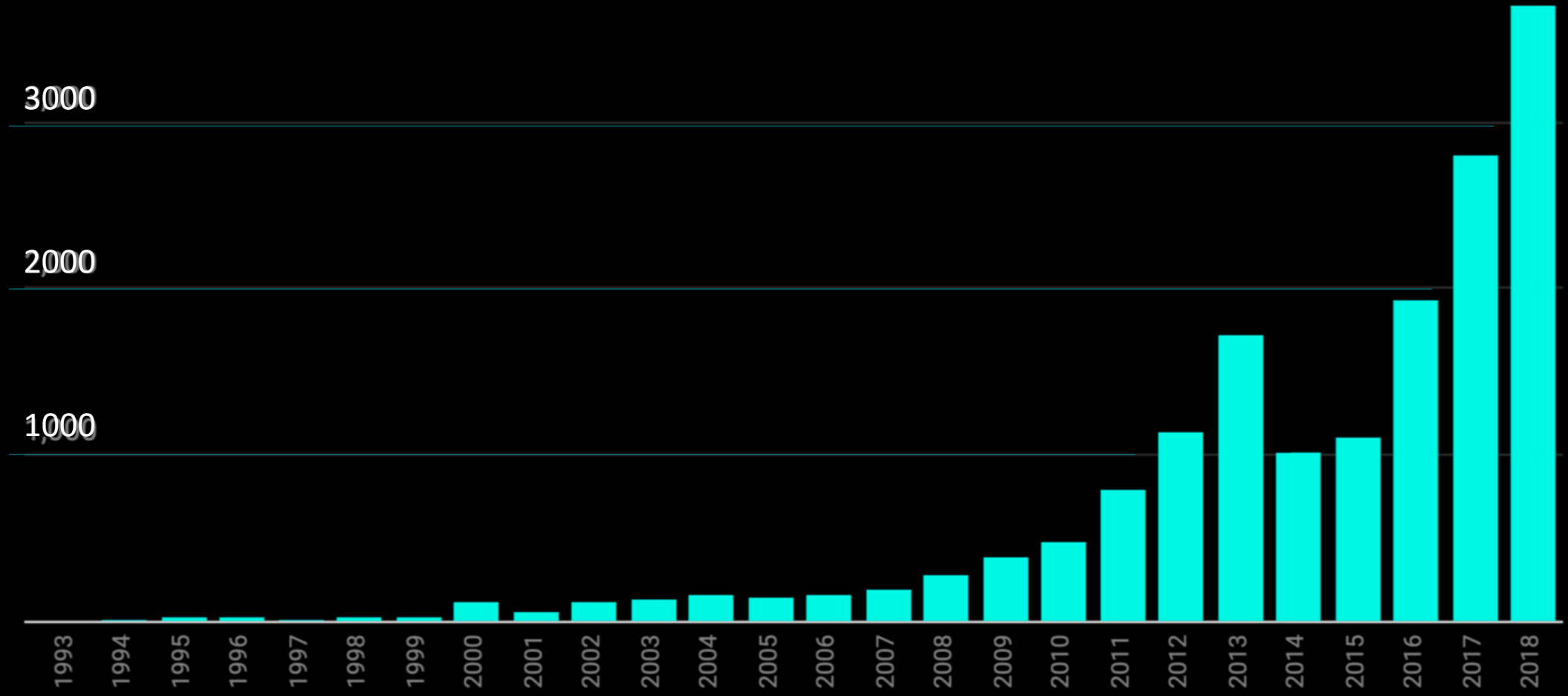
Trading programming language

- Friendly statistic toolkit



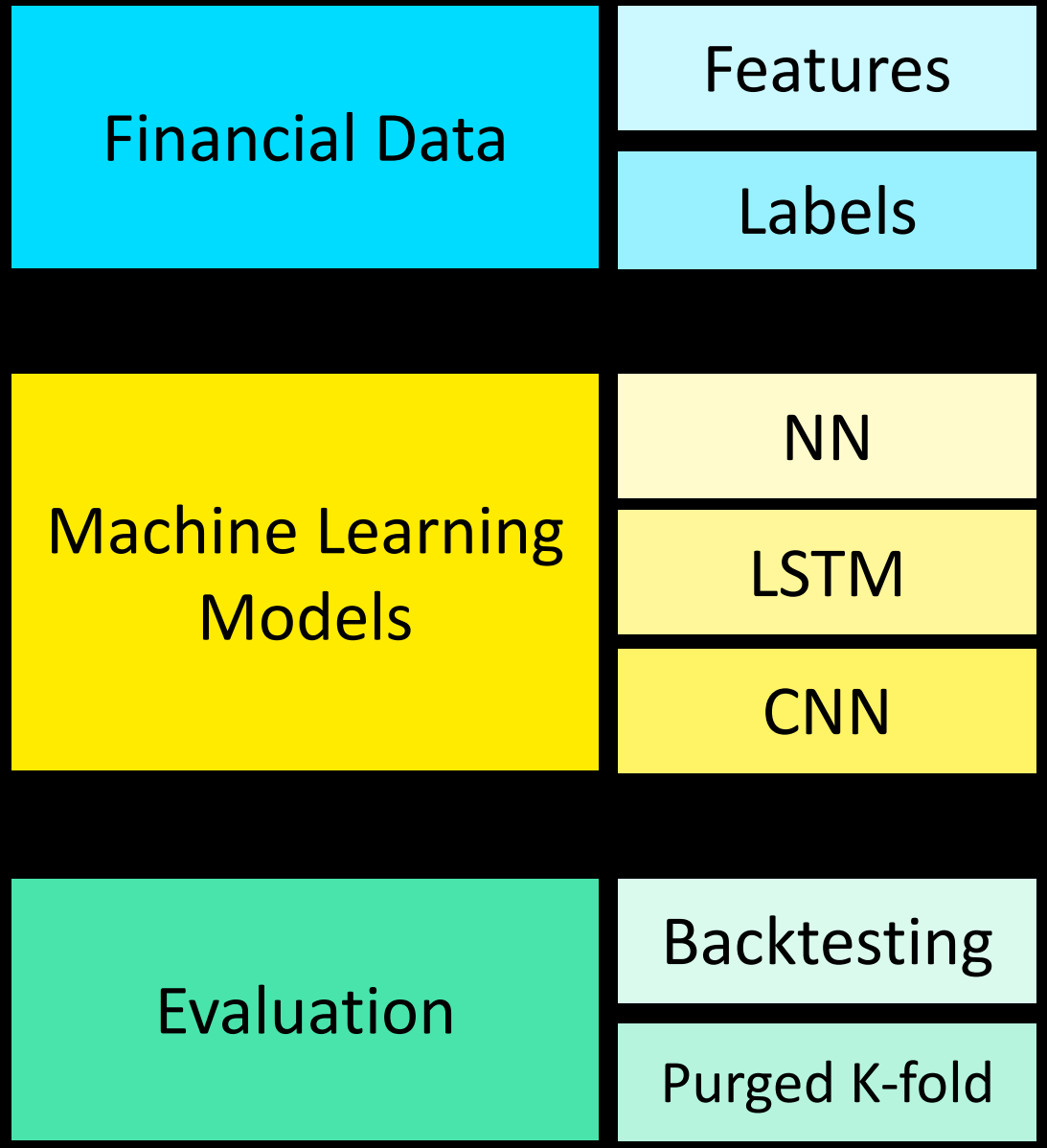
- Friendly statistic toolkit
- Strong community and widely applied
- Easy to deploy (Flask/Django/…)
- More innovative data science applications

Artificial Intelligence papers



All of the papers available in the “artificial intelligence” section (arXiv)

Outline


Financial Data
Features
Labels
Machine Learning Models
NN
LSTM
CNN
Evaluation
Backtesting
Purged K-fold

ML algorithms in finance?

Supervised Machine Learning

Training

features | labels

Color	Weight	Age	Category
■	3.2 kg	2	cat
■	4.2 kg	5	cat
■	6.2 kg	4	dog

→ ML Model

Testing

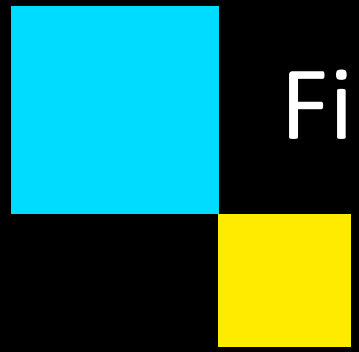
features

Color	Weight	Age
■	3.2 kg	2
■	4.2 kg	5
■	6.2 kg	4

→ ML Model →

labels

True Answer	Prediction
cat	cat
cat	dog
dog	dog



Financial Data (Features)

Financial Data Structures

Fundamental data

Focusing on creating a portrait of a company

- Useful to combine other data types
- Difficult to confirm data release date
- Missing data is often backfilled
- Consider multiple correction

Trading data

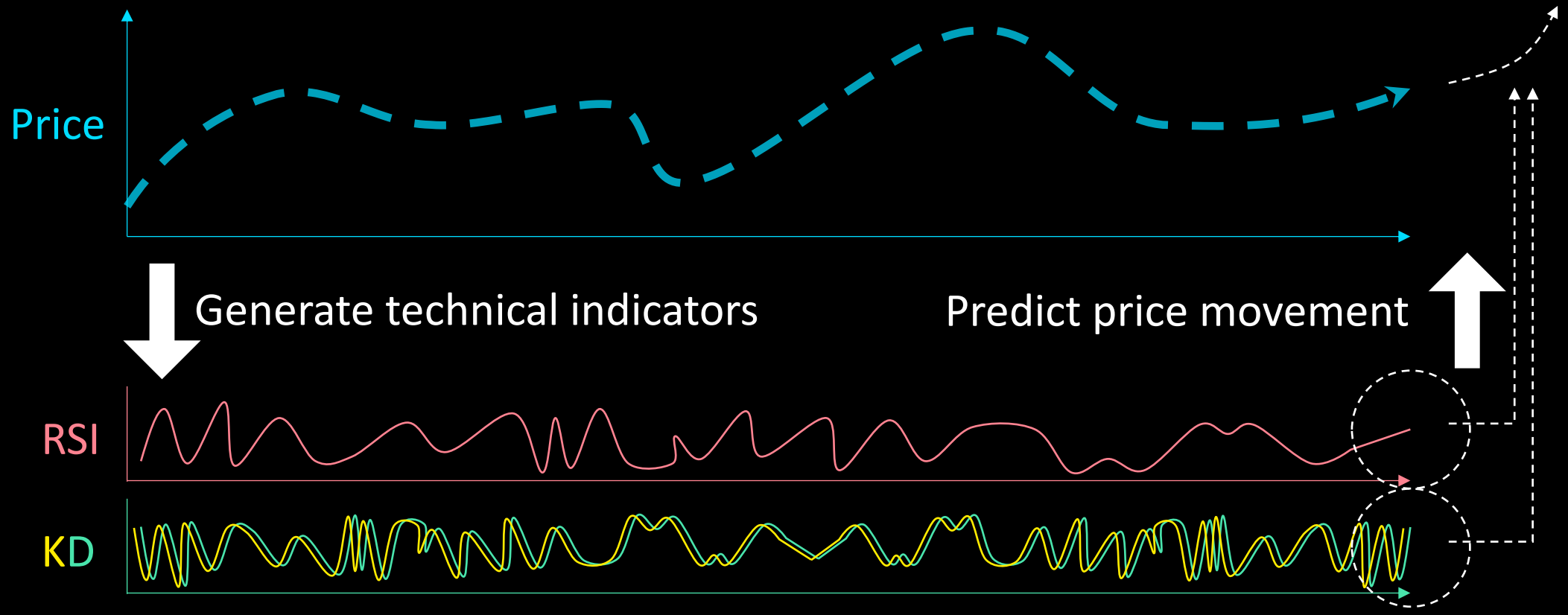
Market participant characteristic footprint

Trading book, price, broker trading summary…etc

- Data often with timestamp
- Generate extra features (ex: technical indicators)
- Massive amount of data generated in one day
- Some of the data is difficult to obtain

Creating Technical indicators

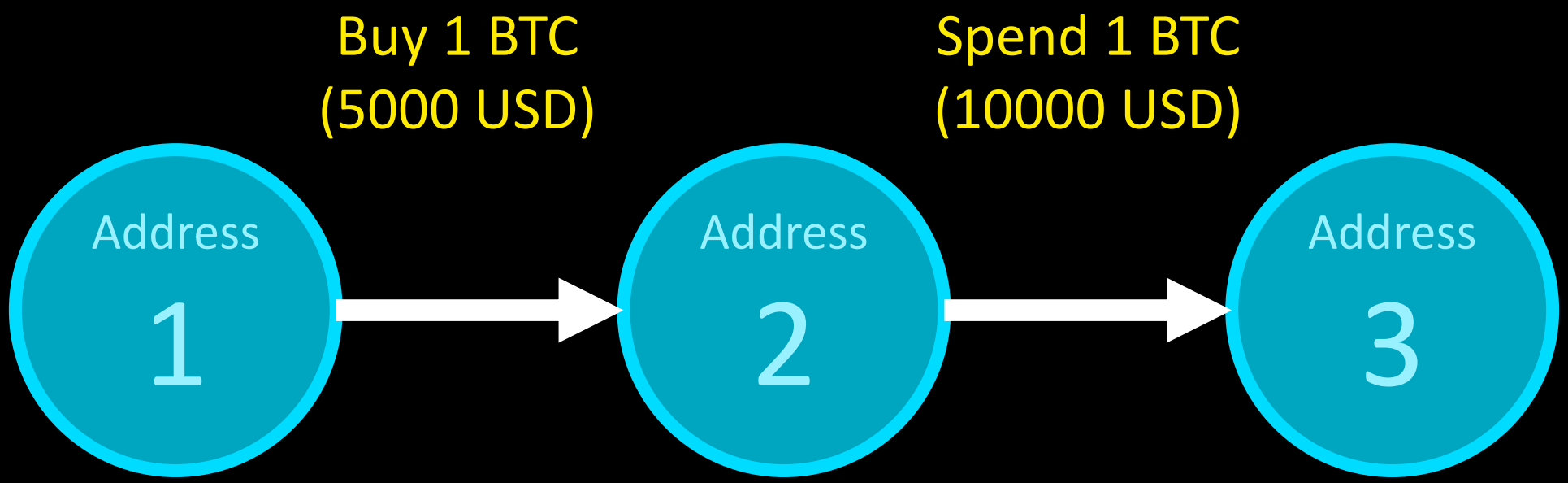
Price historical data



Fundamental Indicators

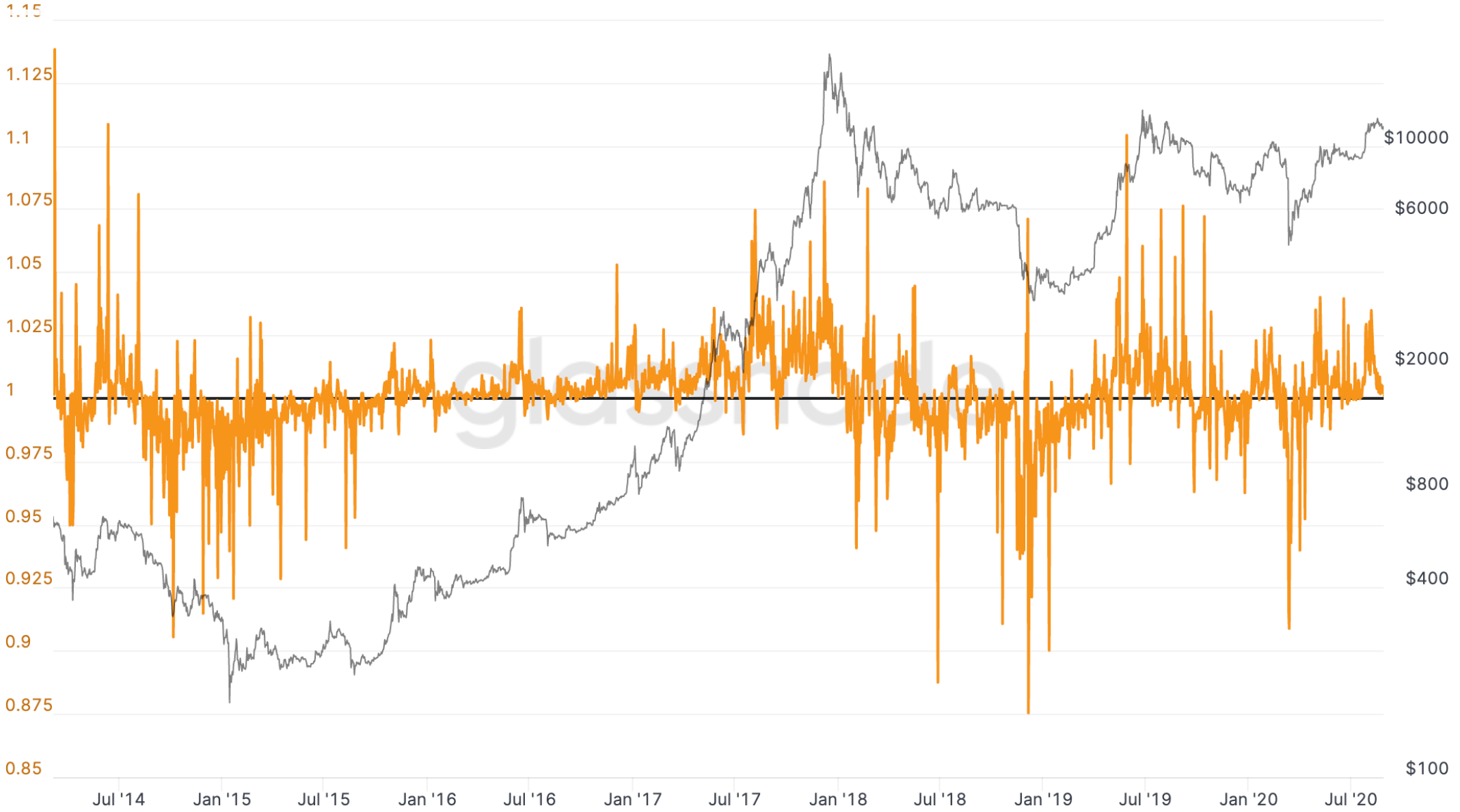
- Spent Output Profit Ratio
- Network value to transaction ratio
- Transfers volume to exchanges

Spent Output Profit Ratio



SOPR = 10000/5000 = 2

Spent Output Profit Ratio



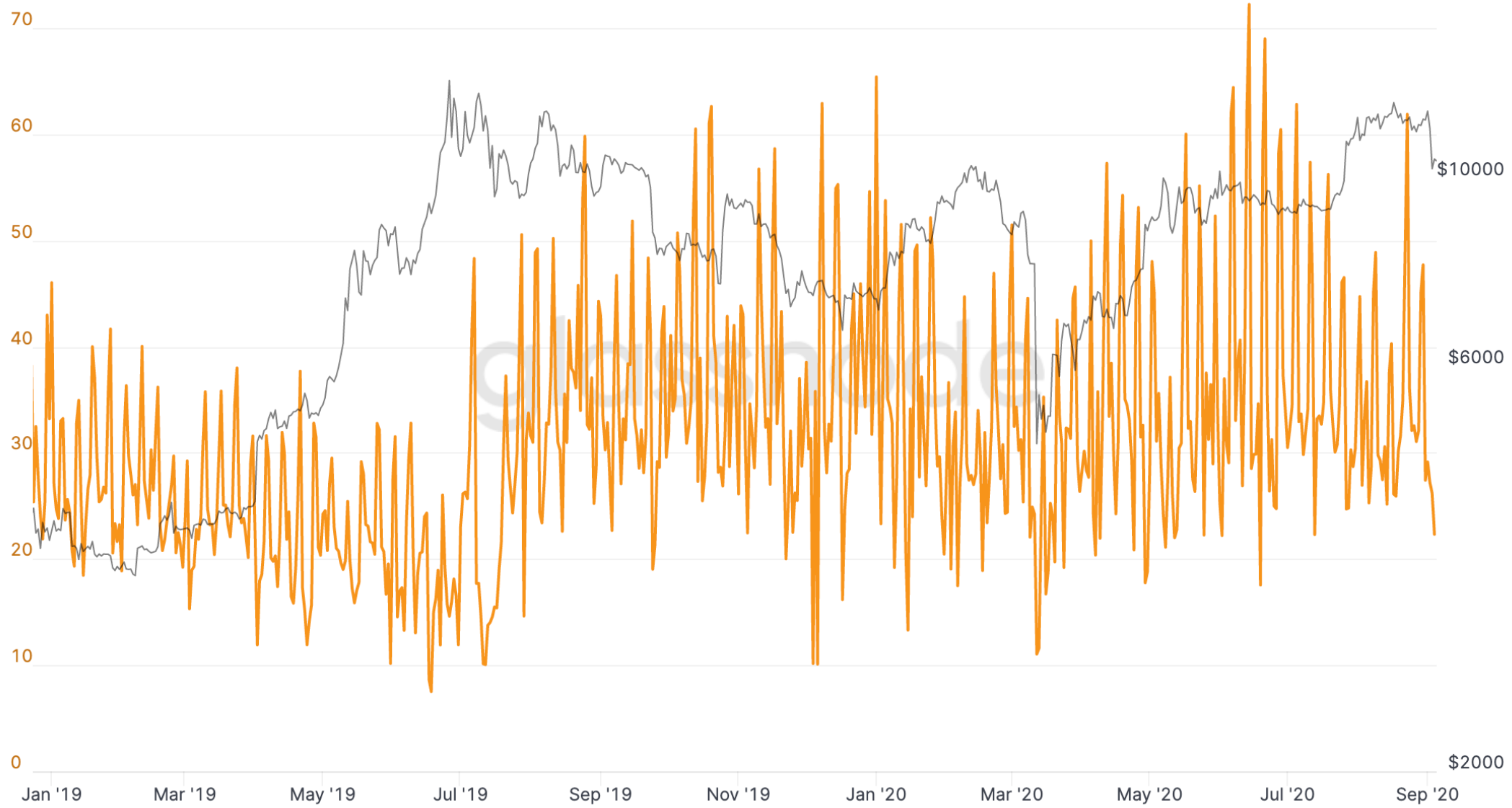
Network Value to transaction ratio

$$\text{本益比} = \frac{\text{總市值}}{\text{總盈餘}}$$

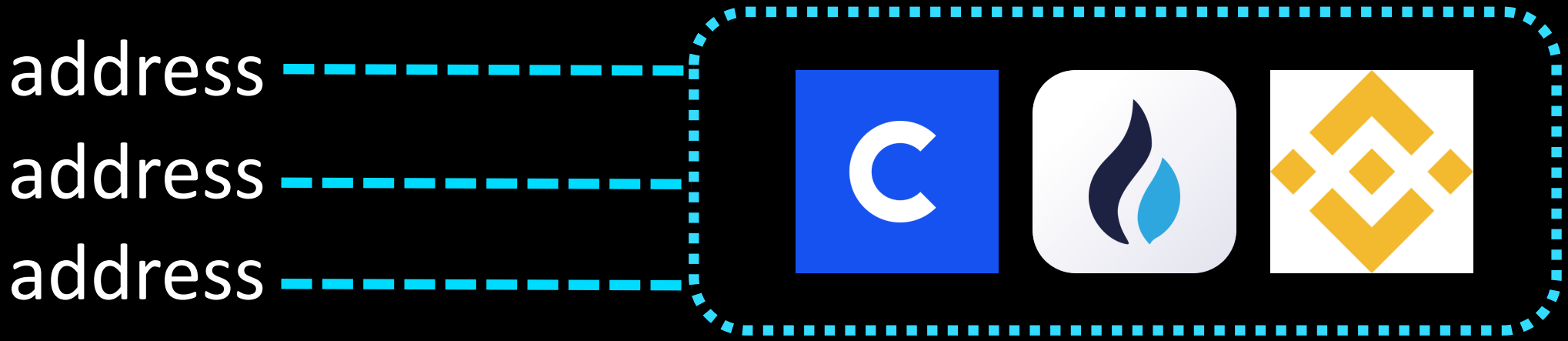
Network value to transaction ratio

$$NVT = \frac{\text{總市值}}{\text{總金流}}$$

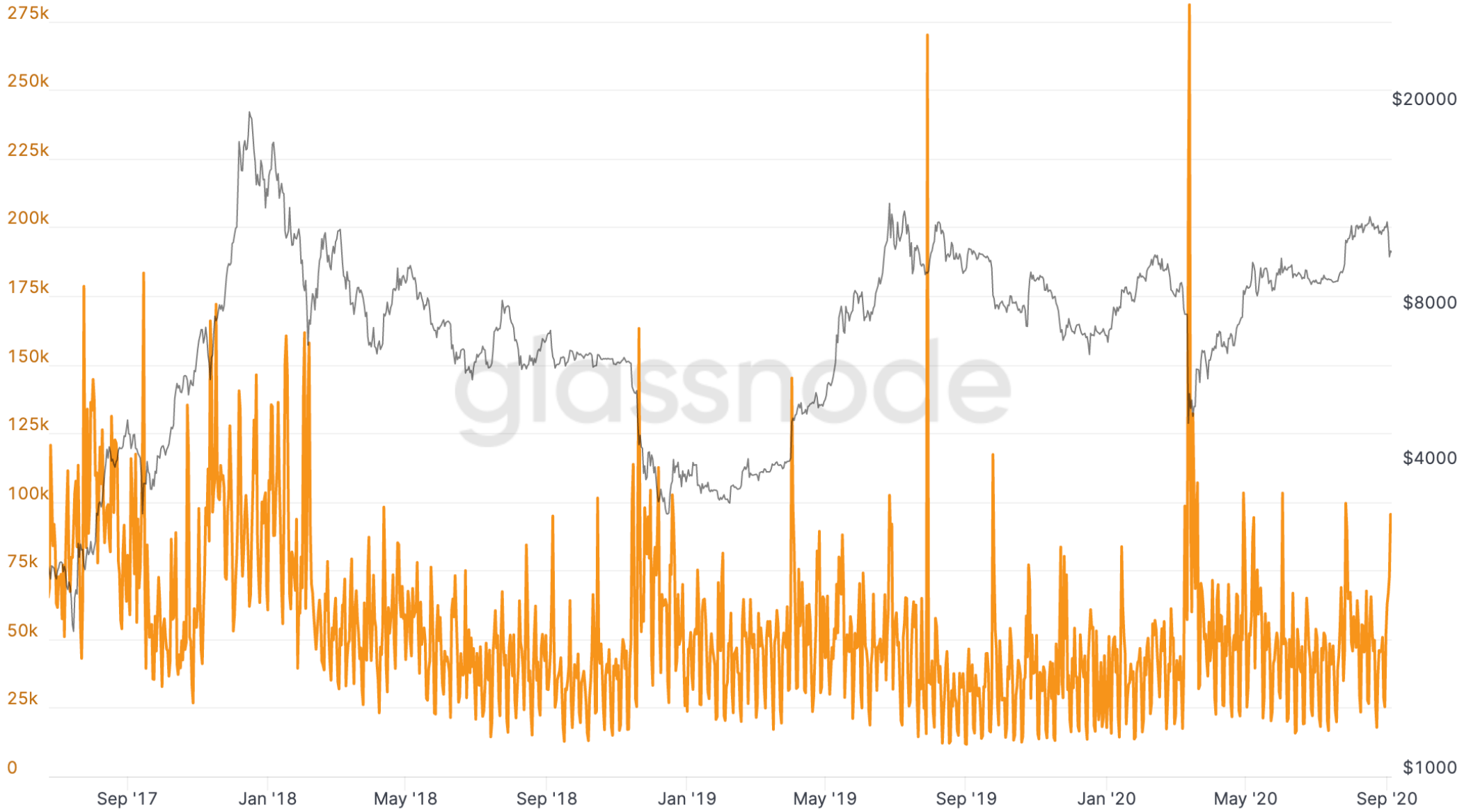
Network value to transaction ratio

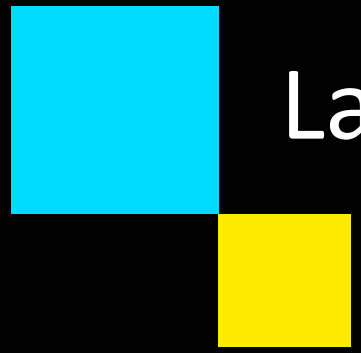


Network Value to transaction ratio



Network Value to transaction ratio





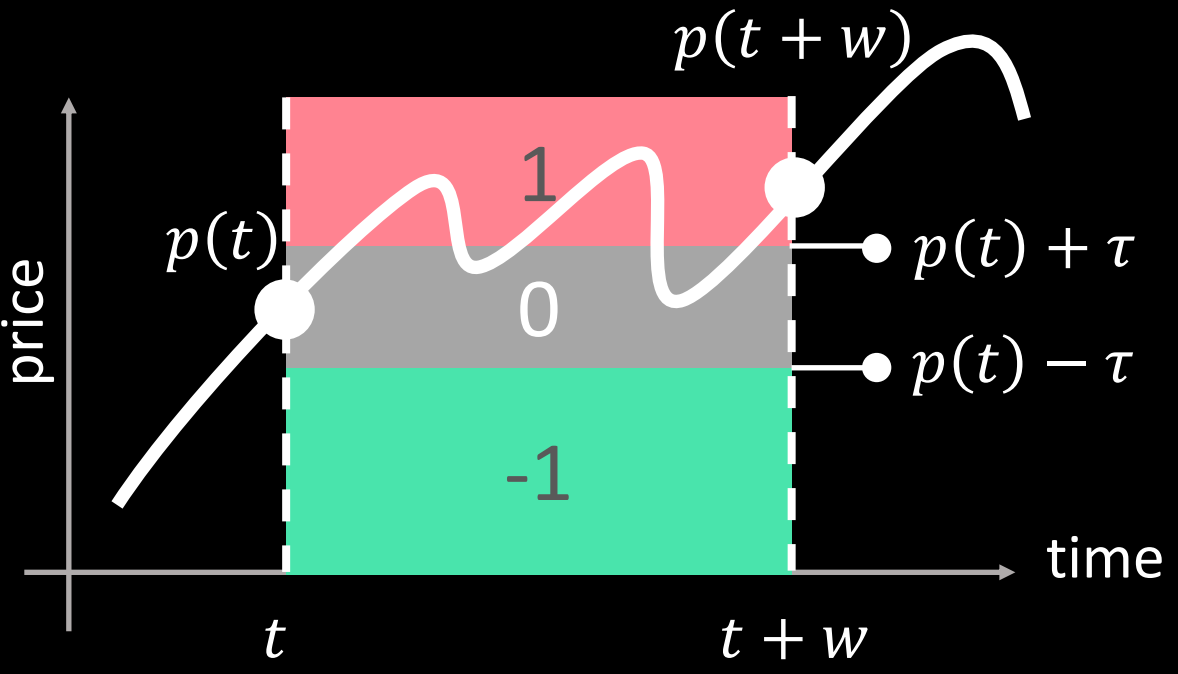
Labeling

Challenging of Labeling the data

Fixed time horizon

A popular method in the literature

- τ is a constant
- Do not have stop-loss limits



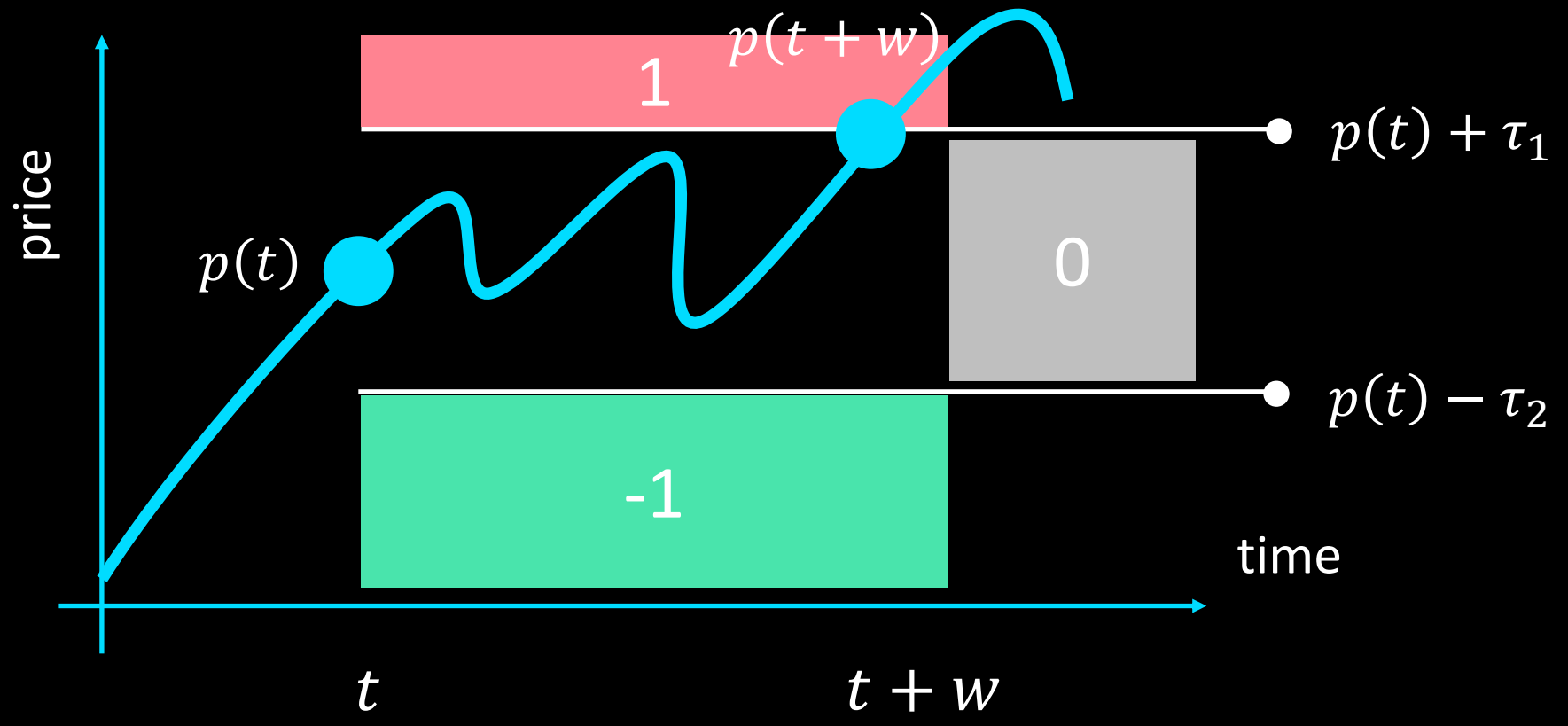
Label Generation Methods

- Triple barrier [Prado 2018]
- Continuous trading signals [Dash 2016]
- Trading Point decision [Chang 2009]

[Prado 2018] Advances in Financial Machine Learning
[Tsantekidis 2017] Using Deep Learning to Detect Price Change Indications in Financial Markets
[Dash 2016] A hybrid stock trading framework integrating technical analysis with machine learning techniques
[Chang 2009] Integrating a Piecewise Linear Representation Method and a Neural Network Model for Stock Trading Points Prediction

Triple barriers [Prado 2018]

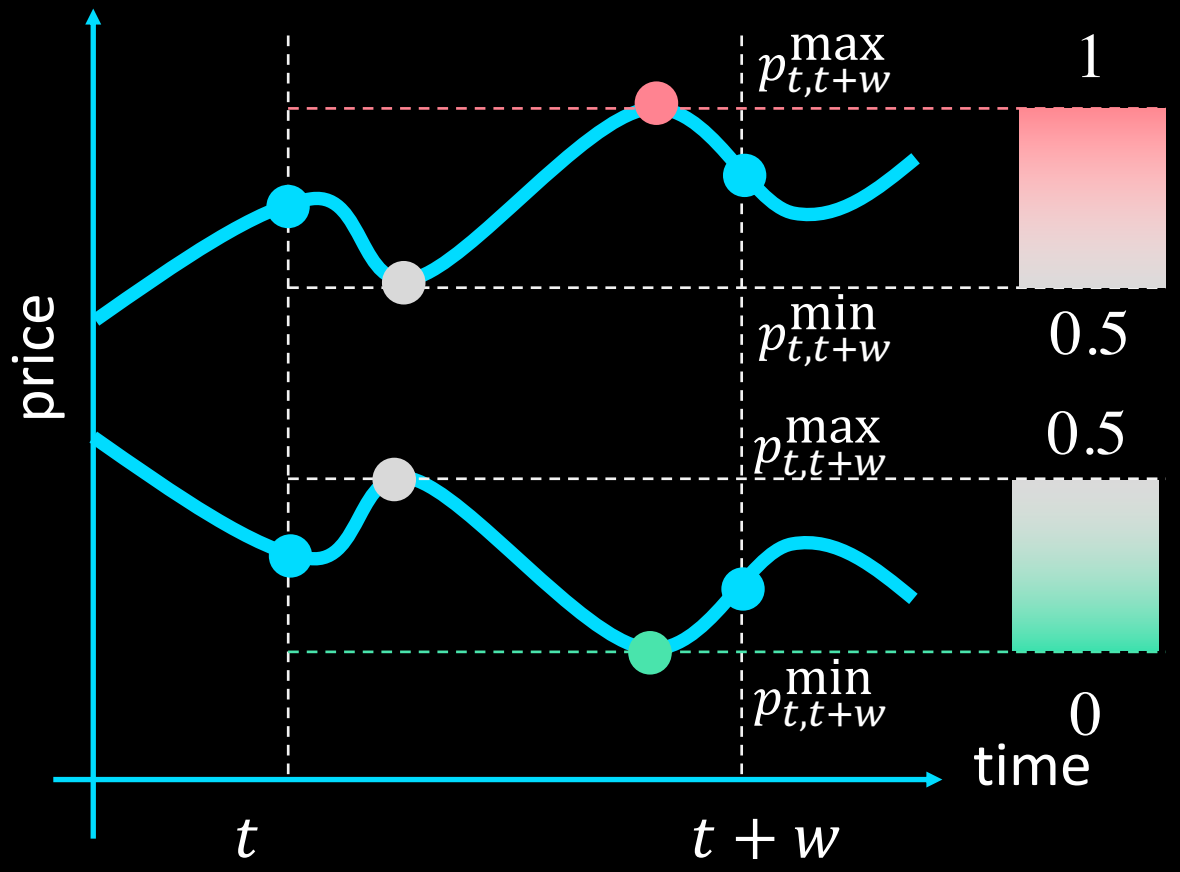
- Horizontal barriers are defined by profit-taking and stop-loss limit
- τ_1 and τ_2 are dynamic according to estimated volatility



Continuous trading signals [Dash 2016]

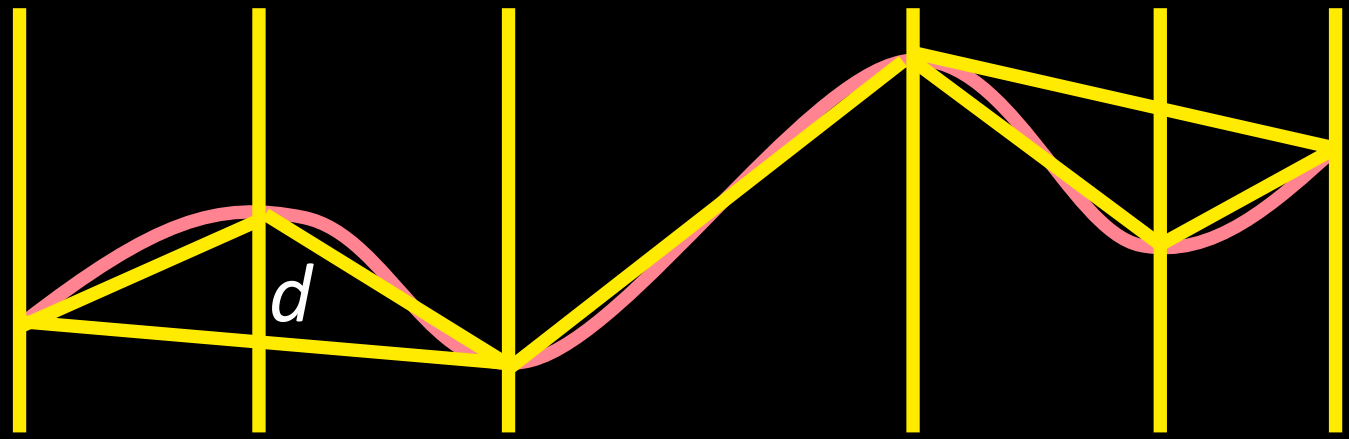
- Using momentum of the stock price
- *y*(*t*)'s are continuous
- Provides more detailed information

$$y(t) = \begin{cases} \frac{p_{t+w} - p^{\min}_{t,t+w}}{p^{\max}_{t,t+w} - p^{\min}_{t,t+w}} & \text{if } p_{t+w} > p_t \\ 0.5\left(1 - \frac{p_{t+w} - p^{\min}_{t,t+w}}{p^{\max}_{t,t+w} - p^{\min}_{t,t+w}}\right) & \text{else} \end{cases}$$



Trading point decision

- Find the local minimum and maximum points
- Divide the time series into subsegments
- Threshold value d → length of trend



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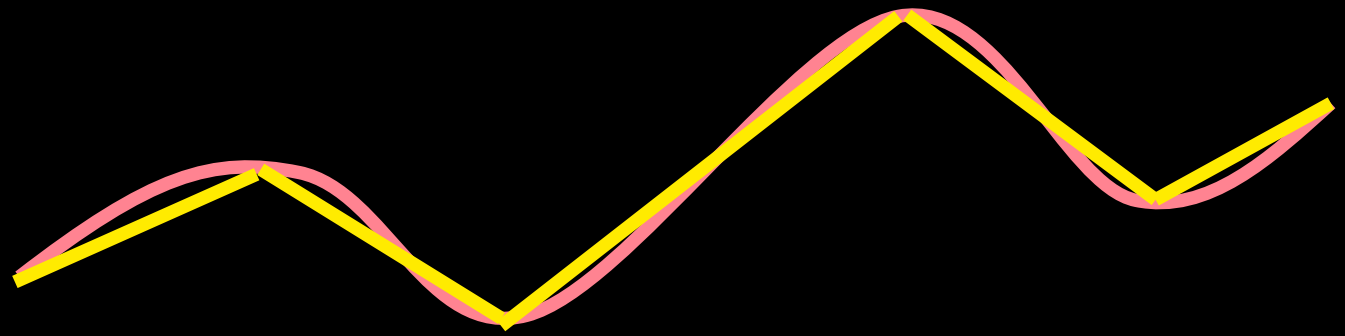
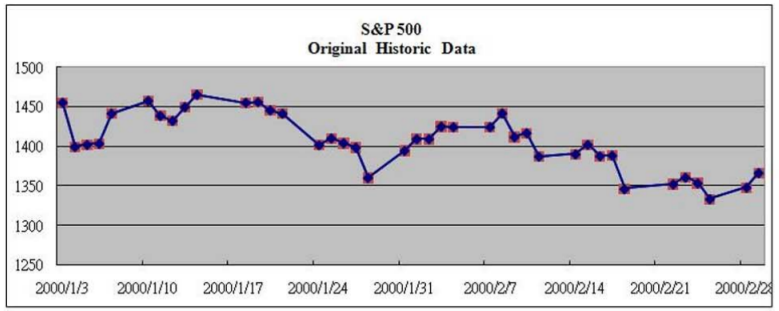
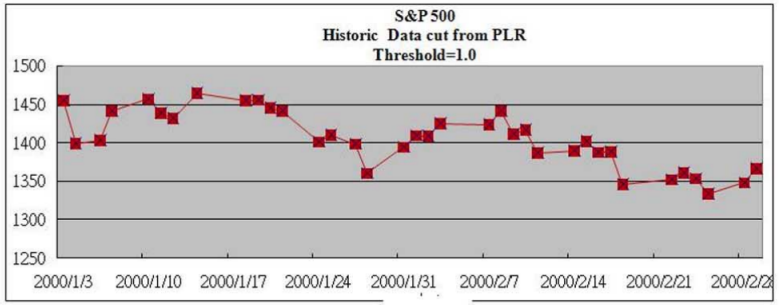
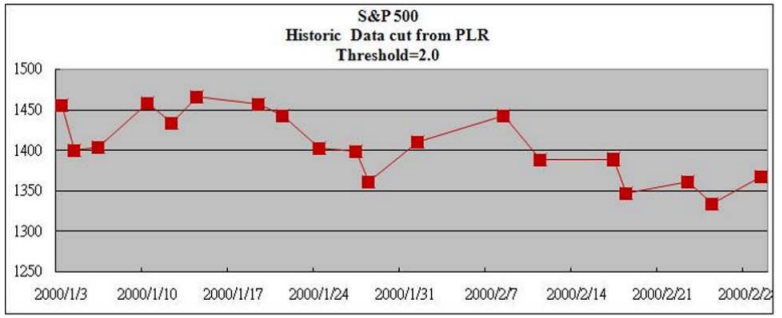
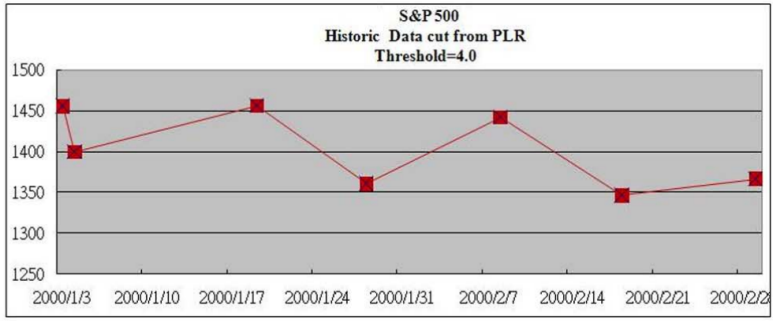
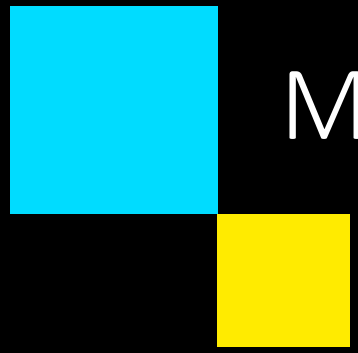










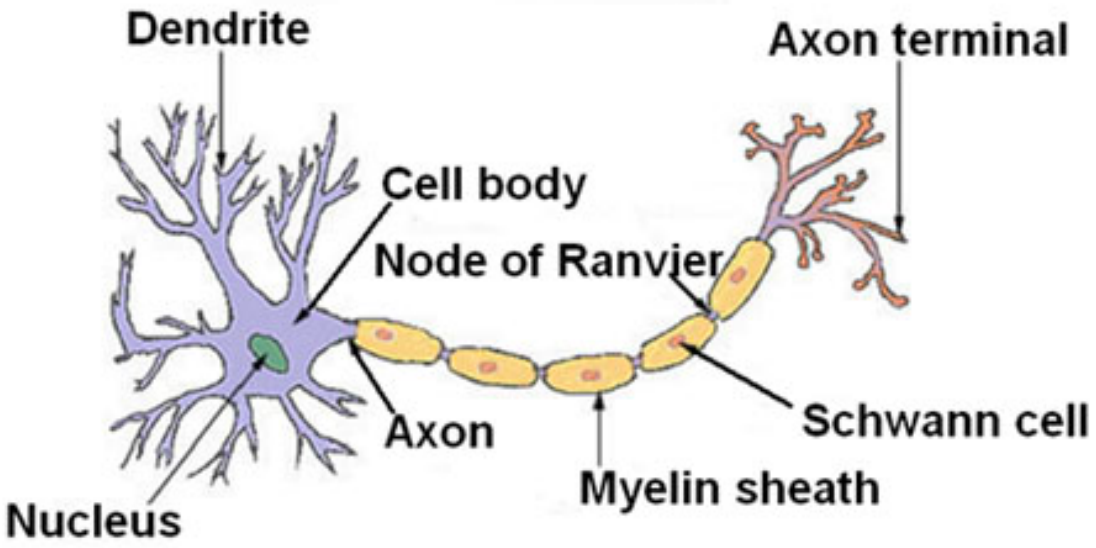


ML Models

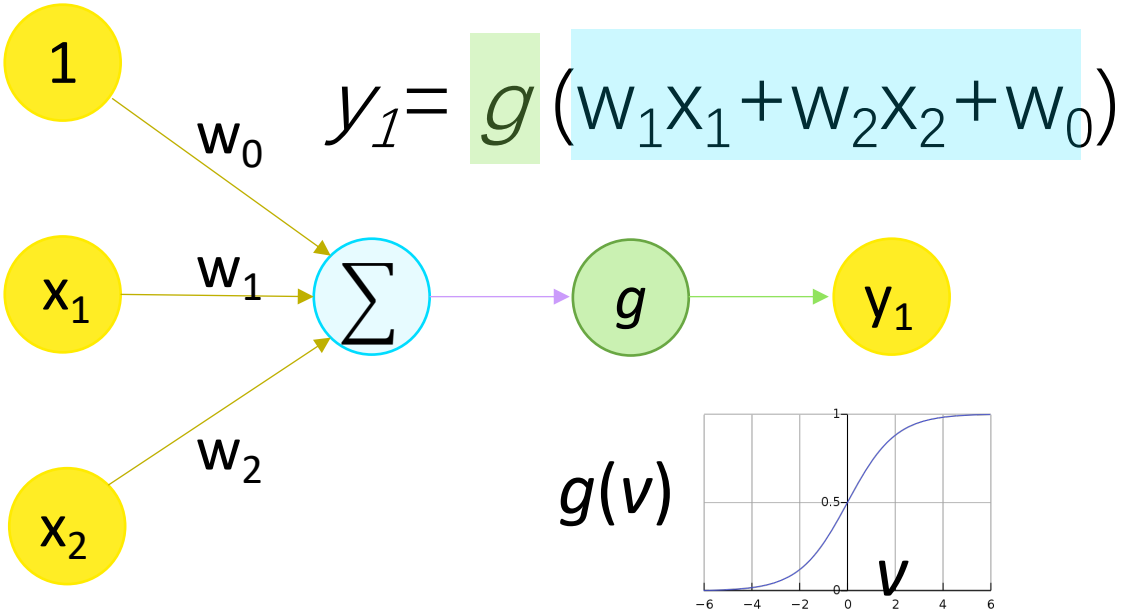
Neural Network

- Built to model the human brain
- interpret numeric data through a kind of machine perception

Human neuron structure

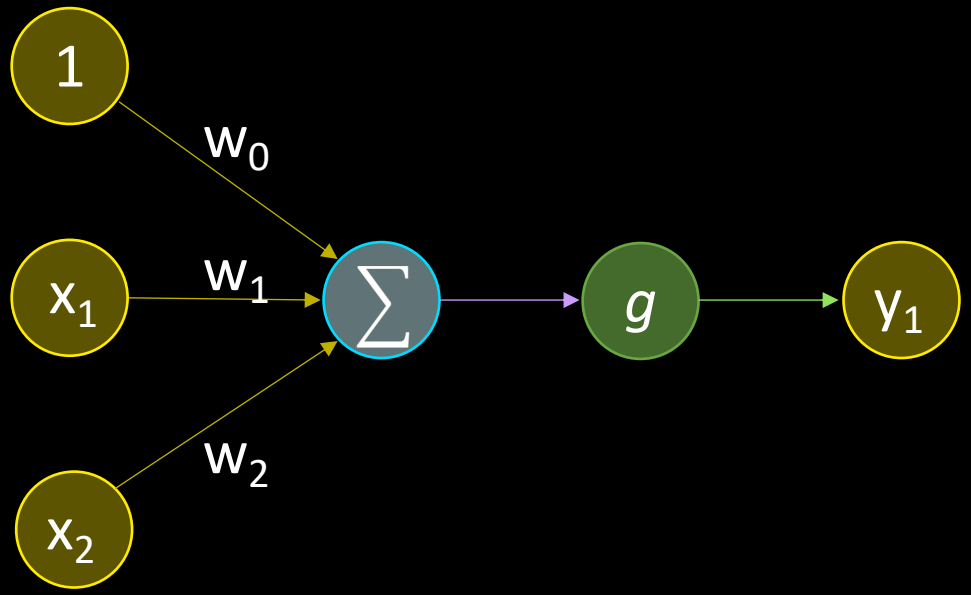


Single neuron model



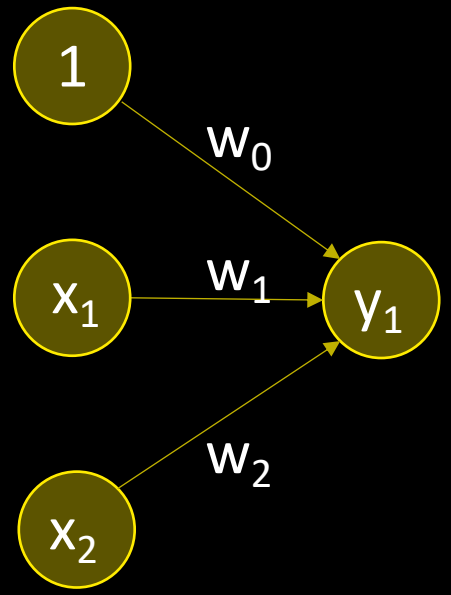
Neural Network

Single node in neural network



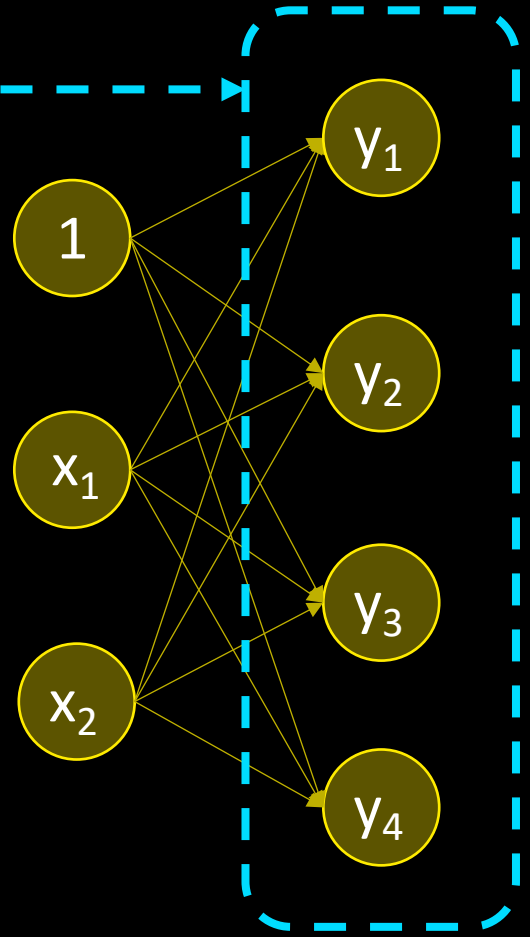
Neural Network

Simplified expression



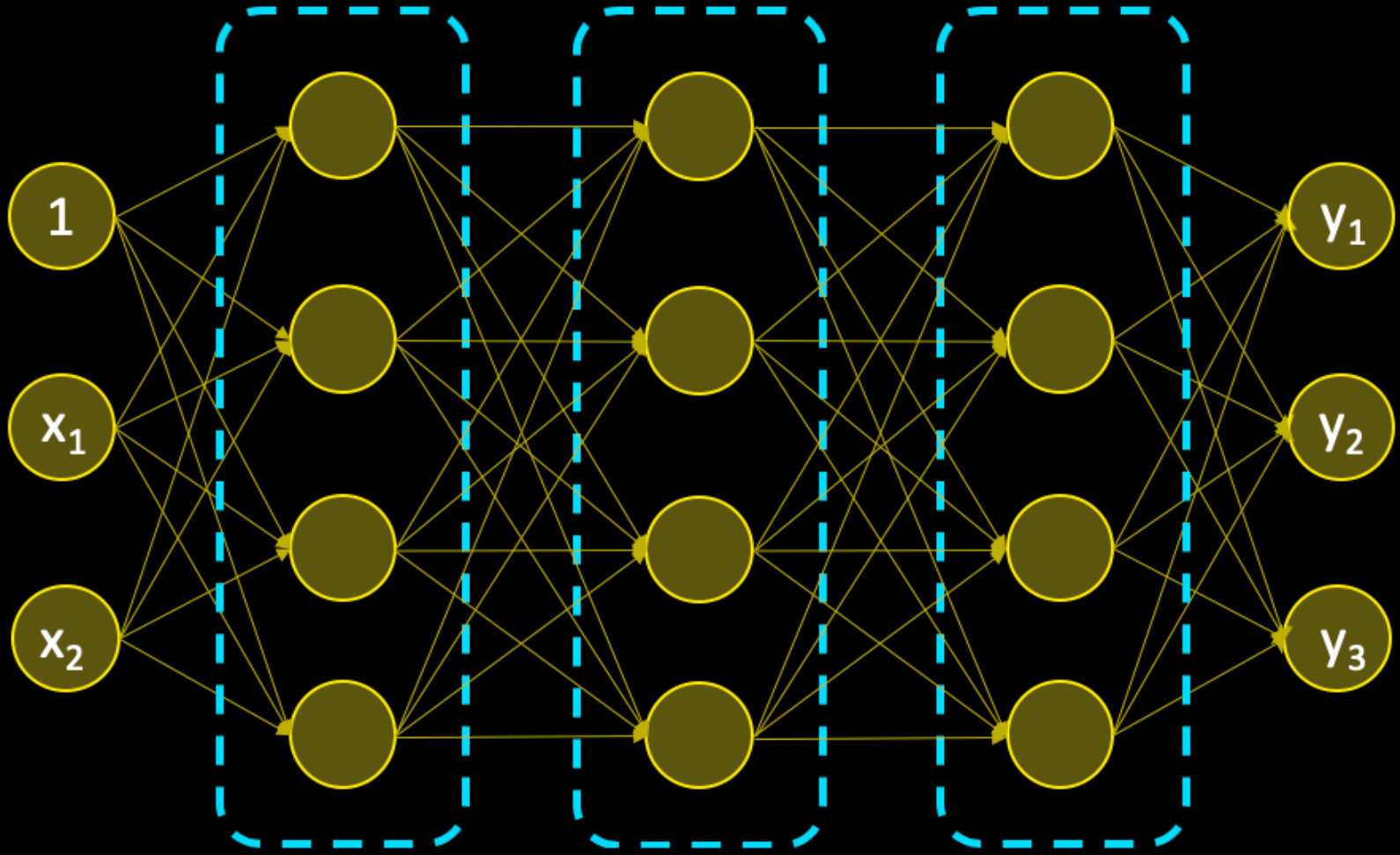
Neural Network

A layer contain multiple neurons



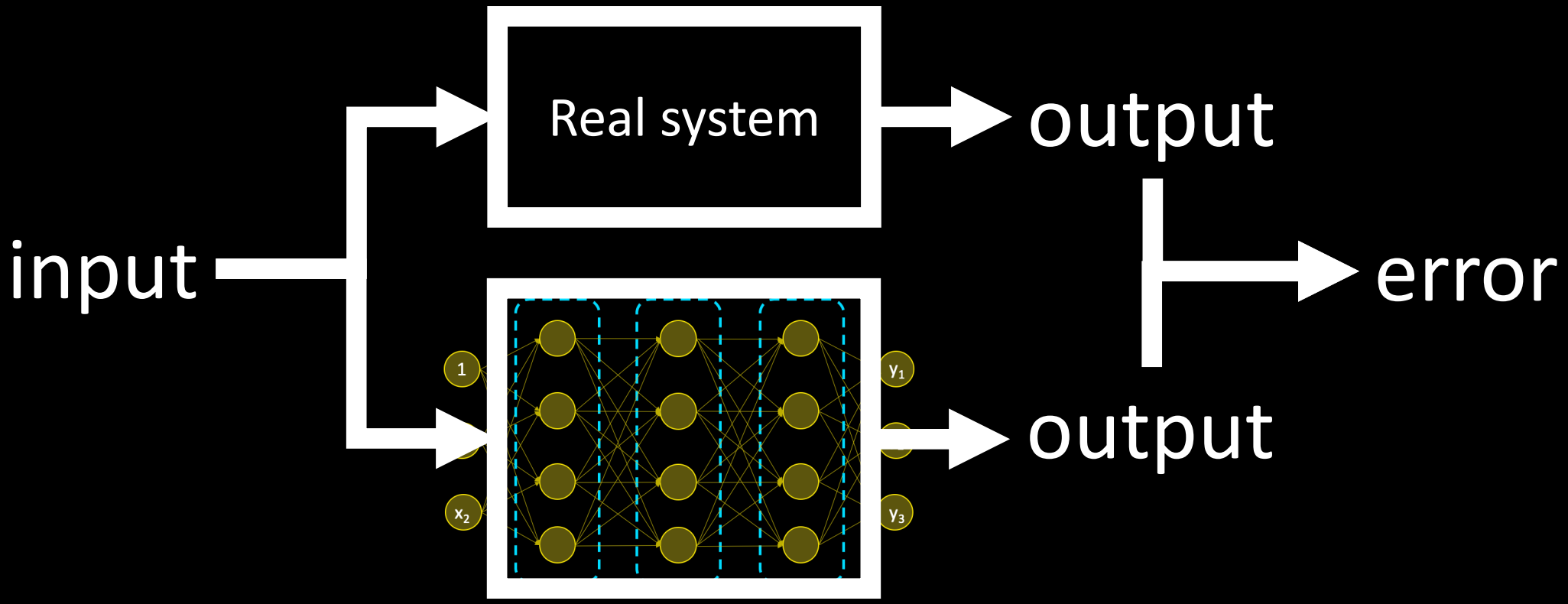
Deep Neural Network

Multi-layer deep neural network



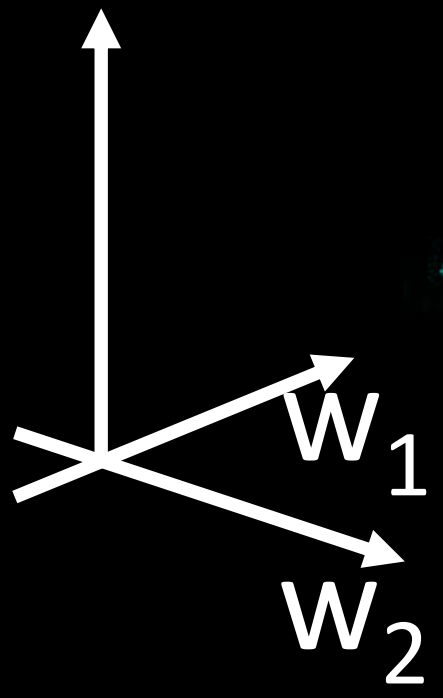
Deep Neural Network

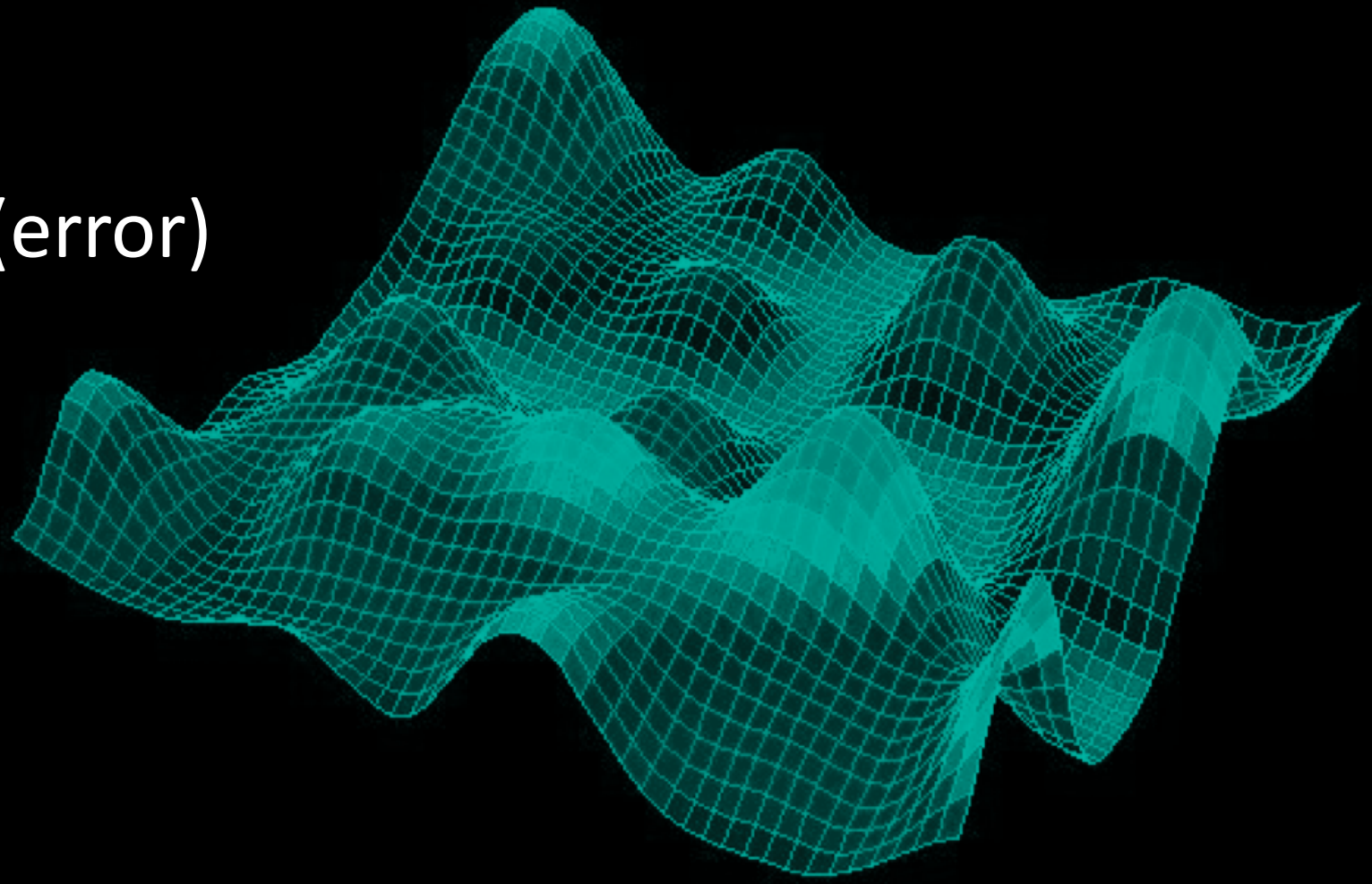
Multi-layer deep neural network



Neural Network Optimization

Cost function (error)





Deep Neural Network Training Result

Asset

Taiwan Capitalization Weighted Stock Index

Data split

Train	Validate	Backtest
2006 ~ 2014	2015	2016 ~ 2019-3-1

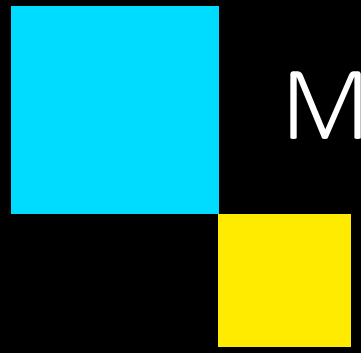
Features

Scaled Technical Indicators

Labels

Fixed time horizon

2018-1-1 2019-7-1

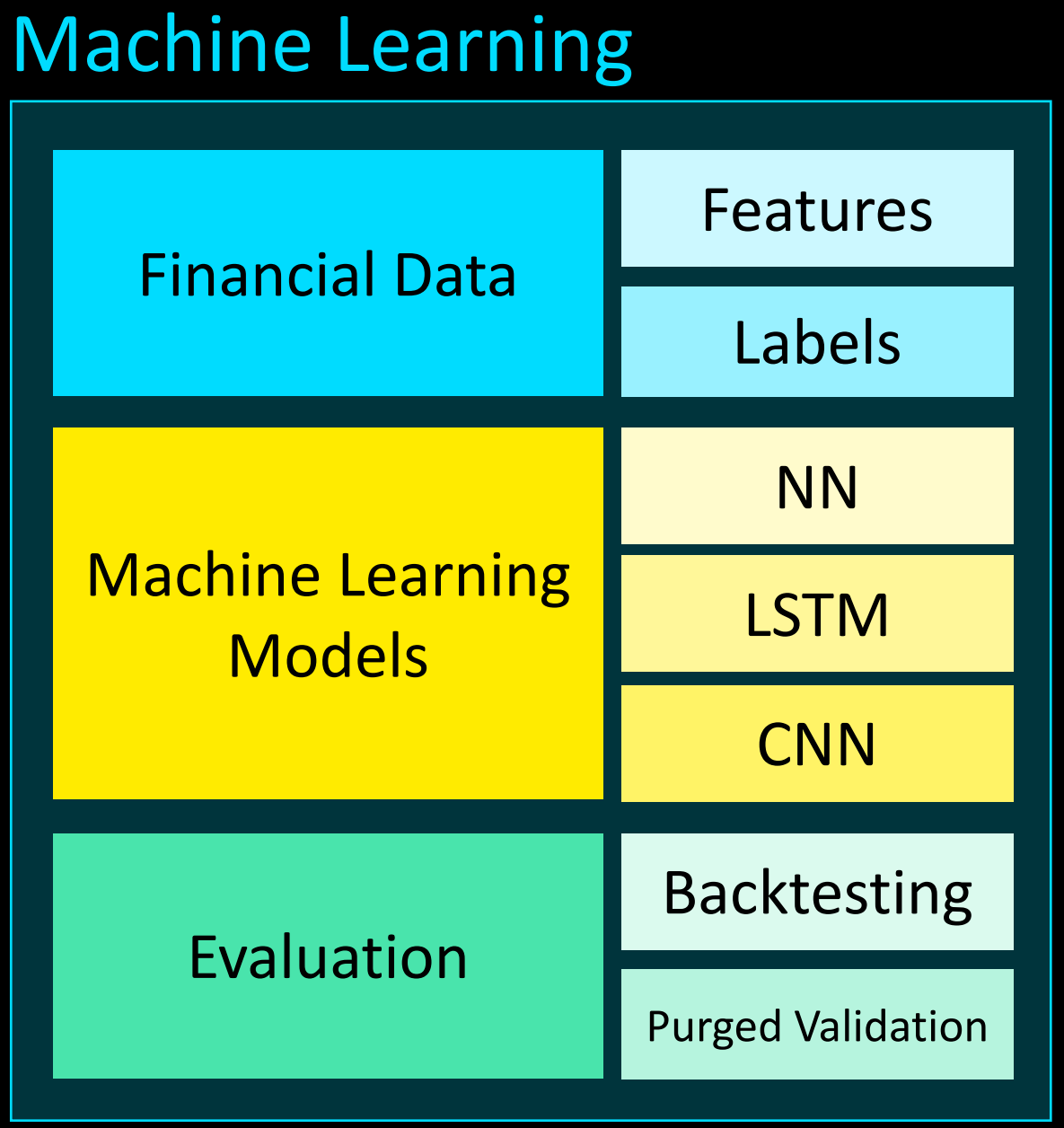


Model Interpretation

Backtest

- Survivor bias, lookahead bias, transection cost, outlier, overfitting
- Finding the lottery tickets that won the last game
- Solutions
  - Develop model for entire asset or classes
  - Use Bootstrap aggregating
  - Record every backtest conducted
  - Resist the temptation of reusing a failed strategy

Conclusion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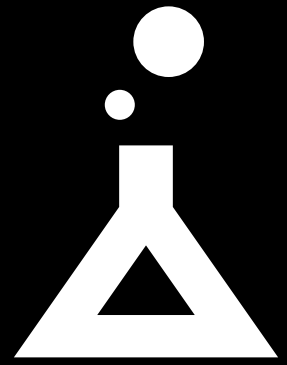

FinLab