高等机器学习

金融科技

边江
微软亚洲研究院

Microsoft

清華大學
Tsinghua University

Background

Industrial Chain of Intelligent Finance

资产获取 → 资产生成 → 资金对接 → 场景深入

智能风控
有效进行风险定价

智能投顾
投资策略个性化、配置合理化、流程自动化

智能投研
人机协作提高投研质量和效率

智能支付
便捷安全的支付手段

银行、保险、证券

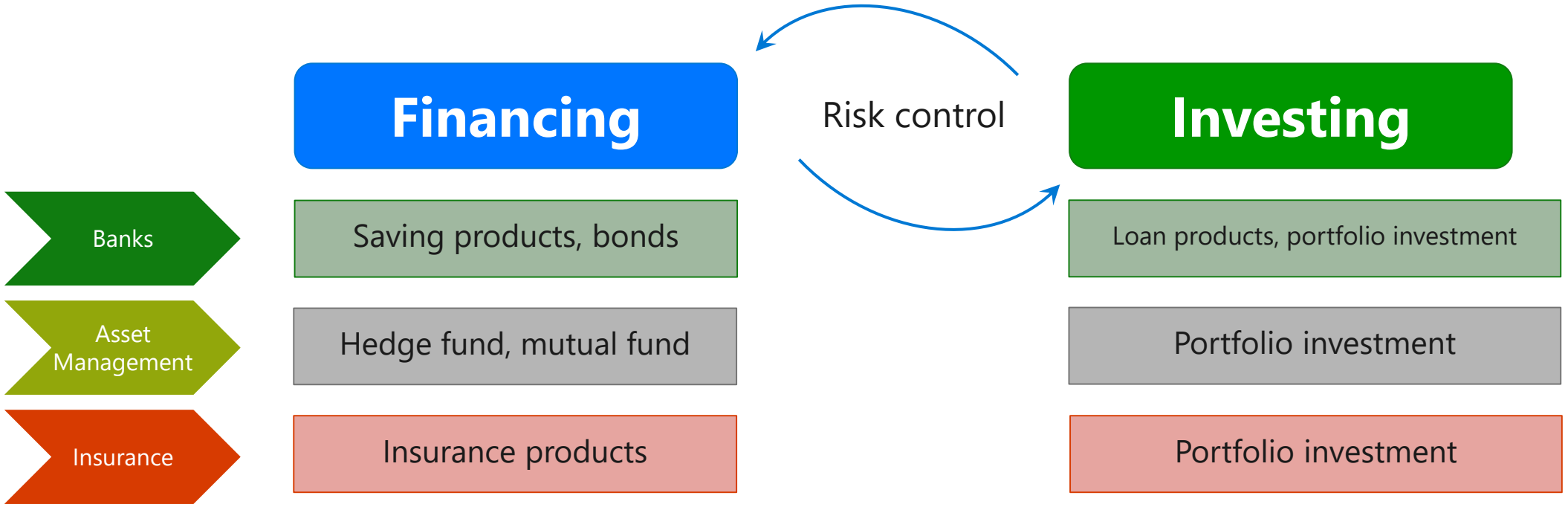
消费金融、供应链金融

智能客服、智能营销
降低人力成本；精准定位用户，引流获客、提高留存

人工智能技术

金融大数据

Investment: Core Business of Finance



Background

max **RETURN**
s.t. Controlled **RISK**

Eagle Alpha

xAI Asset Management and Research

TWO SIGMA

Renaissance

Palantir

KENSHO

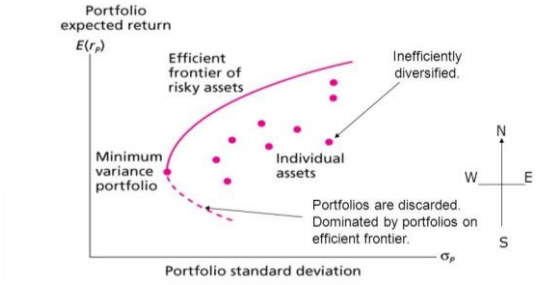
alphasense

CBINSIGHTS

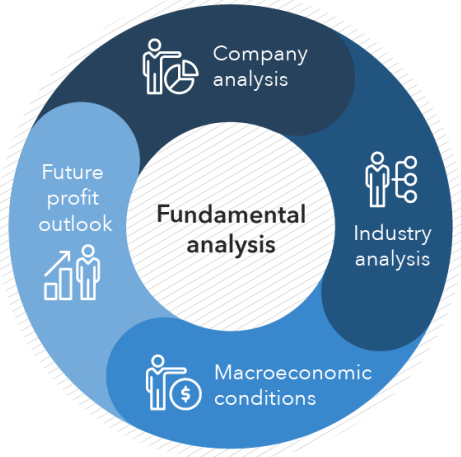
DataFox

Bloomberg

Portfolio Construction



Alpha producing



Raw data

Price-volumes

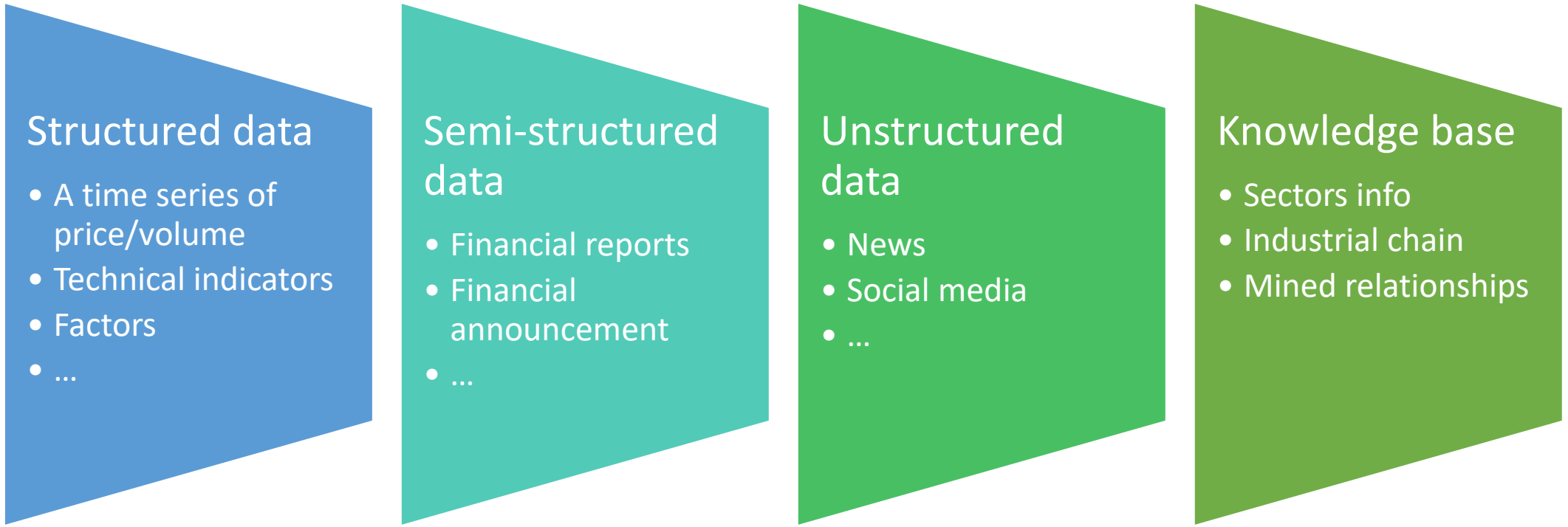
Financial reports

Economic

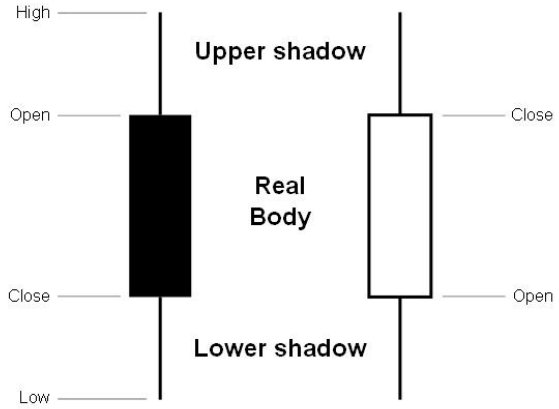
Media

Analyst

Data in Investment



Structured Data: Price/Volume



Microsoft Corporation (MSFT) ☆
NasdaqGS - NasdaqGS Real Time Price. Currency in USD
141.34 +1.15 (+0.82%)
At close: July 26 4:00PM EDT

Indicators | Comparison | Events | Date Range | 1D | 5D | 1M | 3M | 6M | YTD | 1Y | 2Y | 5Y | Max | Interval 1D | Candle | Draw | Setti

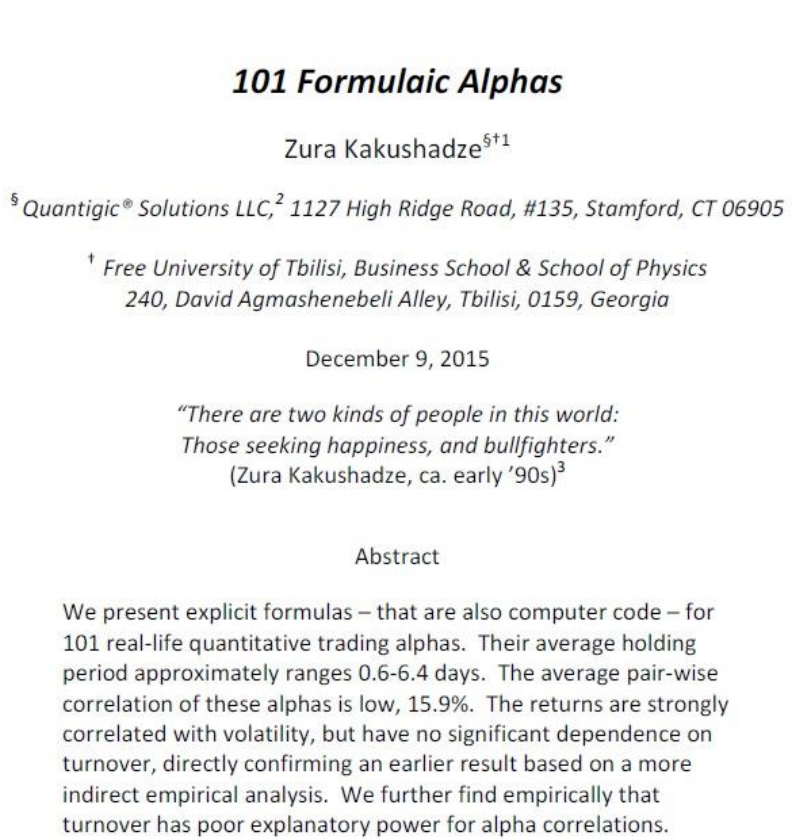
MSFT 111.70 | MA (5,C,MA,0) 112.14 | MA (10,C,MA,0) 110.46 | MA (20,C,MA,0) 108.16 | MA (50,C,MA,0) 105.10

Open	112.89
High	113.02
Low	111.67
Close	112.53
Volume	23.50M
% Change	6.13%

Structured Data: Technical Indicators

形态学指标（K线）	价格涨跌幅，K线各段长度
形态学指标（K线组合）	周K线及前3根K线的组合形态
形态学指标（短期高点）	短期高点K线实体长度
形态学指标（短期低点）	短期低点K线实体长度
形态学指标（中期高点）	短期高点K线实体长度
形态学特征（中期低点）	短期低点K线实体长度
乖离率	收盘价相对于k日均线的乖离率
振幅	K日平均振幅
ROC	K日ROC
MACD	当日MACD DIF和DEA交叉形态
情绪类	分析师综合评级分值，预期变化-1M，资金流入
成长类	单季度ROE增长率，净利润增长环比，累计经营性现金流增长率
价值类	EBITDAvsEV（企业价值倍数），动态BP（Balance of Payments）
流动性	K个月平均换手率，成交额-1M

Structured Data: Factors



101 Formulaic Alphas

Zura Kakushadze[§†1]

[§] *Quantigic® Solutions LLC,[2] 1127 High Ridge Road, #135, Stamford, CT 06905*

[†] *Free University of Tbilisi, Business School & School of Physics*
240, David Agmashenebeli Alley, Tbilisi, 0159, Georgia

December 9, 2015

"There are two kinds of people in this world:
Those seeking happiness, and bullfighters."
(Zura Kakushadze, ca. early '90s)[3]

Abstract

We present explicit formulas – that are also computer code – for 101 real-life quantitative trading alphas. Their average holding period approximately ranges 0.6-6.4 days. The average pair-wise correlation of these alphas is low, 15.9%. The returns are strongly correlated with volatility, but have no significant dependence on turnover, directly confirming an earlier result based on a more indirect empirical analysis. We further find empirically that turnover has poor explanatory power for alpha correlations.

MFI	100 - 100/(1+SUM(TYP>REF(TYP,1)?TYP*VOL:0,N)/SUM(TYP<REF(TYP,1)?TYP*VOL:0,N))	资金流量指标MFI
UOS	SUM(CLOSE-MIN(LOW, REF(CLOSE,1)), N)/ SUM(MAX(HIGH, REF(CLOSE,1))-MIN(LOW, REF(CLOSE,1)), N)	技术指标UOS，用来衡量波动
ADTM	STM=SUM(OPEN<=REF(OPEN,1)?0:MAX(HIGH-OPEN,OPEN-REF(OPEN,1)),N) SBM=SUM(OPEN>=REF(OPEN,1?0:MAX(OPEN-LOW,OPEN-REF(OPEN,1)),N) STM>SBM?(STM-SBM)/STM:STM==SBM?0:(STM-SBM)/SBM	动态买卖人气指标ADTM
SHT	(CLOSE-MEAN(CLOSE,24))/MEAN(CLOSE,24)*(1+MEAN((VOLUME-DELAY(VOLUME,1))/DELAY(VOLUME,1),5))*100	钱龙短线指标，综合反映价格变动和成交量变动

gj_alpha149	REGBETA(FILTER(CLOSE/REF(CLOSE,1)-1,INDEXCLOSE<REF(INDEXCLOSE,1)),FILTER(INDEXCLOSE/REF(INDEXCLOSE,1)-1,INDEXCLOSE<REF(INDEXCLOSE,1)),252)	计算指数下跌日的回归beta 同理可计算上涨日的回归beta
gj_alpha155	DIFF=MEAN(VOLUME,13)-MEAN(VOLUME,27) (DIFF-MEAN(DIFF, 10))/VOLUME	两条成交量均线之差 去除量纲(分母需要进一步考虑)
gj_alpha160 gj_alpha174	MEAN((CLOSE<=REF(CLOSE,1)?STD(CLOSE,20):0),20) MEAN((CLOSE>=REF(CLOSE,1)?STD(CLOSE,20):0),20)	只考虑下跌日的波动；实际上因为STD通过窗口计算具有滞后性，效果可能不如SUMN。
gj_alpha161 gj_alpha175	MEAN(TR, 12)/CLOSE	真实波动的移动平均，去除量纲； Alpha175参数N=24

Semi-Structured Data: Financial Reports

利润分配表

项目	
一、净利润	
加：年初未分配利润	
其他转入	
二、可供分配的利润	
减：提取法定盈余公积	
提取法定公益金	
提取职工福利及奖励基金	
提供储备基金	
提供企业发展基金	
利润转作投资	
补充流动资本	
三、可供投资者分配的利润	
减：应付优先股股利	
提取任意盈余公积	
应付普通股股利	
转作资本（或股本）的普通股股利	
四、未分配利润	

现金流量表

项　目	
一、经营活动产生的现金流量：	
销售商品、提供劳务收到的现金	
收到的税费返还	
收到其他与经营活动有关的现金	
经营活动现金流入小计	
购买商品、接受劳务支付的现金	
支付给职工以及为职工支付的现金	
支付的各项税费	
支付其他与经营活动有关的现金	
经营活动现金流出小计	
经营活动产生的现金流量净额	
二、投资活动产生的现金流量：	
收回投资收到的现金	
取得投资收益收到的现金	
处置固定资产、无形资产和其他长期资产收回的现金净额	
处置子公司及其他营业单位收到的现金净额	
收到其他与投资活动有关的现金	
投资活动现金流入小计	
购建固定资产、无形资产和其他长期资产支	
投资支付的现金	
取得子公司及其他营业单位支付的现金净额	
支付其他与投资活动有关的现金	
投资活动现金流出小计	
投资活动产生的现金流量净额	

三、筹资活动产生的现金流量：	
吸收投资收到的现金	
取得借款收到的现金	
收到其他与筹资活动有关的现金	
筹资活动现金流入小计	
偿还债务支付的现金	
分配股利、利润或偿付利息支付的现金	
支付其他与筹资活动有关的现金	
筹资活动现金流出小计	
筹资活动产生的现金流量净额	
四、汇率变动对现金及现金等价物的影响	
五、现金及现金等价物净增加额	
加：期初现金及现金等价物余额	
六、期末现金及现金等价物余额	

资产负债表

资　产	
流动资产：	
货币资金	
交易性金融资产	
应收票据	
应收账款	
预付款项	
应收利息	
应收股利	
其他应收款	
存货	
一年内到期的非流动资产	
其他流动资产	
流动资产合计	
非流动资产：	
可供出售金融资产	
持有至到期投资	
长期应收款	
长期股权投资	
投资性房地产	
固定资产	
在建工程	
工程物资	
固定资产清理	
生产性生物资产	
油气资产	
无形资产	
开发支出	
商誉	
长期待摊费用	
递延所得税资产	
其他非流动资产	
非流动资产合计	

负债和所有者权益（或股东权益）	
流动负债：	
短期借款	
交易性金融负债	
应付票据	
应付账款	
预收款项	
应付职工薪酬	
应交税费	
应付利息	
应付股利	
其他应付款	
一年内到期的非流动负债	
其他流动负债	
流动负债合计	
非流动负债：	
长期借款	
应付债券	
长期应付款	
专项应付款	
预计负债	
递延所得税负债	
其他非流动负债	
非流动负债合计	
负债合计	
所有者权益（或股东权益）：	
实收资本（或股本）	
资本公积	
减：库存股	
盈余公积	
未分配利润	
所有者权益（或股东权益）合计	

Semi-Structured Data: Financial Announcement

Entity Mark Table		
Mark	Entity	Entity (English)
[PER]	刘维群	Weiqun Liu
[ORG]	国信证券股份有限公司	Guosen Securities Co., ltd.
[DATE1]	2017年9月22日	Sept. 22nd, 2017
[DATE2]	2018年9月6日	Sept. 6th, 2018
[DATE3]	2018年9月20日	Sept. 20th, 2018
[DATE4]	2019年3月20日	Mar. 20th, 2019
[SHARE1]	750000股	750000 shares
[SHARE2]	975000股	975000 shares
[SHARE3]	525000股	525000 shares
[SHARE4]	1500000股	1500000 shares
[SHARE5]	16768903股	16768903 shares
[RATIO]	1.0858%	1.0858%

Event Role

Event Record

Event Argument

Entity Mention

Event Table of Equity Pledge						
Pledger	Pledged Shares	Pledgee	Begin Date	End Date	Total Holding Shares	Total Holding Ratio
[PER]	[SHARE2]	[ORG]	[DATE1]	[DATE4]	[SHARE5]	[RATIO]
[PER]	[SHARE3]	[ORG]	[DATE2]	[DATE4]	[SHARE5]	[RATIO]

ID	Sentence
5	[DATE1]，[PER]将其持有的公司[SHARE1]股份质押给[ORG]。
	In [DATE1], [PER] pledged his [SHARE1] to [ORG].
7	公司实施资本公积金转增股本后，其质押股份变为[SHARE2]。
	After the company carried out the transferring of the capital accumulation fund to the capital stock, his pledged shares became [SHARE2].
8	[DATE2]，[PER]将其持有的[SHARE3]公司股份质押给[ORG]，作为对上述质押股份的补充质押。
	In [DATE2], [PER] pledged [SHARE3] to [ORG], as a supplementary pledge to the above pledged shares.
9	上述质押及补充质押股份合计为[SHARE4]，原定购回日期为[DATE3]。
	The aforementioned pledged and supplementary pledged shares added up to [SHARE4], and the original repurchase date was [DATE3].
10	[DATE3]，[PER]针对其质押的[SHARE4]股份办理了延期购回业务，购回日期延长至[DATE4]。
	In [DATE3], [PER] extended the repurchase date to [DATE4] for [SHARE4] he pledged.
12	截至本公告日，[PER]持有公司股份[SHARE5]，占公司总股本的[RATIO]。
	As of the date of this announcement, [PER] hold [SHARE5] of the company, accounting for [RATIO] of the total share capital of the company.

Unstructured Data: News & Social Media

沪指涨0.32%　房地产板块涨幅居前

沪指早盘涨2.25%　房地产板块涨幅居前

沪指大涨4.26%　房地产板块涨幅居前

军工集团改革预期加强 航天军工板块涨幅居前

沪指早盘涨0.69%　煤炭板块涨幅居前

沪指早盘涨2.36%　煤炭板块涨幅居前

沪指涨0.75%　煤炭板块涨幅居前

沪指涨1.25%　煤炭板块涨幅居前

沪指早盘涨1.03%　煤炭板块涨幅居前

沪指早盘涨0.78%　钢铁板块涨幅居前

沪指跌0.26%　钢铁板块涨幅居前remove -1 0.823447 两市涨幅扩大 国防军工板块走强

房地产公司成机构调研重点

沪深两市双双低开 航天军工涨幅居前

国际油价频创新低 化工品沦成重灾区

机械行业：结构性行情有望出现

*ST天利与中石油签署《重大资产重组框架协议》

量子通信商业化加速 10股孕育重大机遇

国务院：超前部署基础前沿研究 使北京成"世界创新"新引擎

京东金融等三巨头"厮杀" 瞄准消费金融及消费体验

河北钢铁国际战略谋变：控股德高公司只是一小步

互联网+工程机械 徐工炫动工业4.0时代新"魔方"

我国现代煤化工发展仍面临诸多挑战

"新丝绸之路"蕴藏澳洲基础设施投资机遇 -QIC

新三板最颠覆！做市比不上协议的 基础层比创新层贵

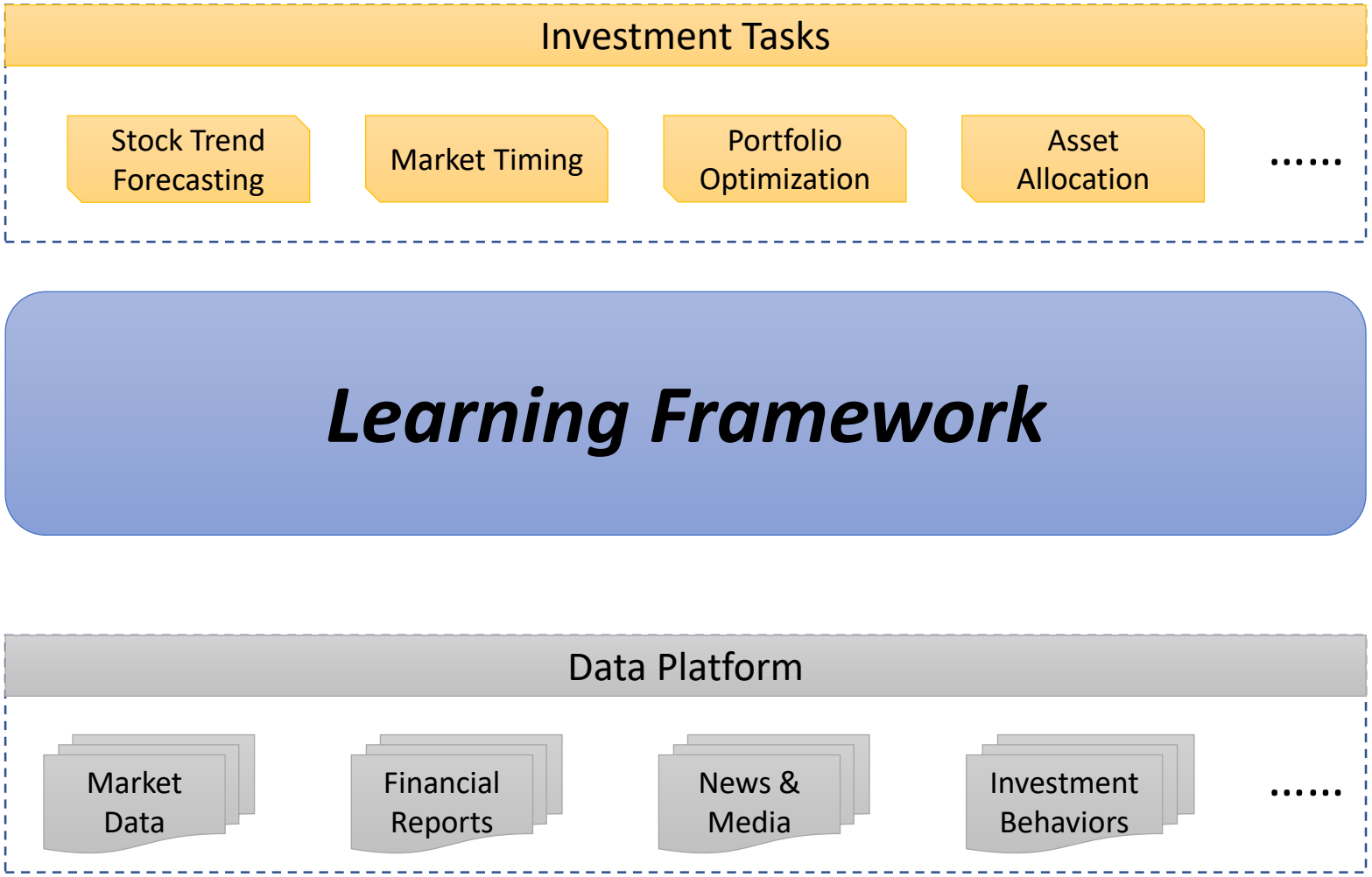
煤化工遭西部大开发冷落 现代煤化工仍是大势

"十三五"电力规划正编制 主推绿色低碳

煤化工遭遇低油价严环保双重夹击

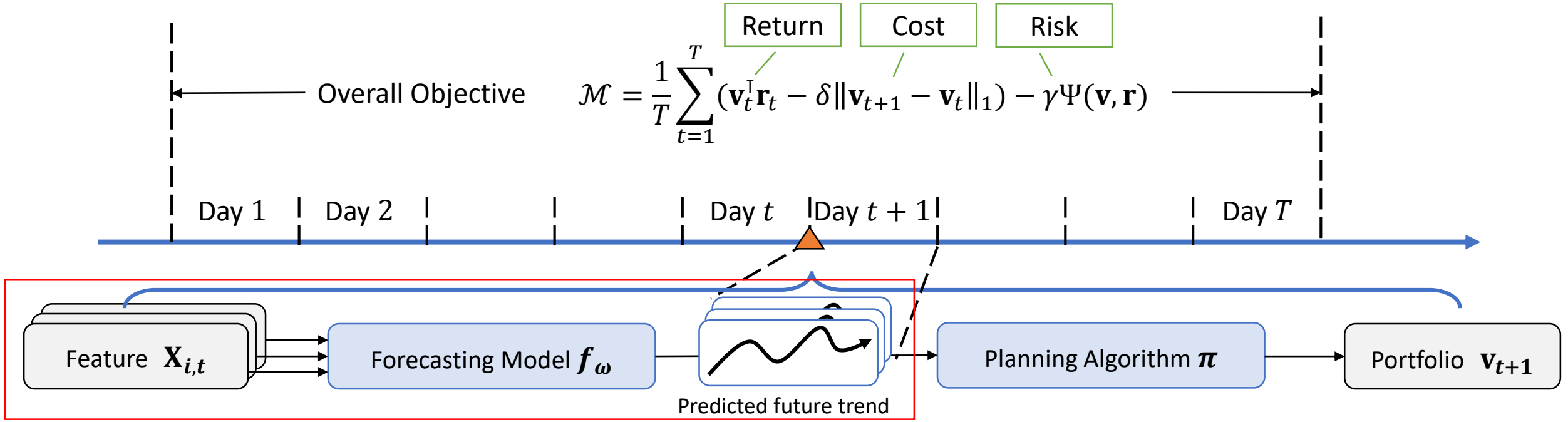
银河电子拟定增23.6亿 发力新能源汽车及国防装备

The Goal of Intelligent Investment



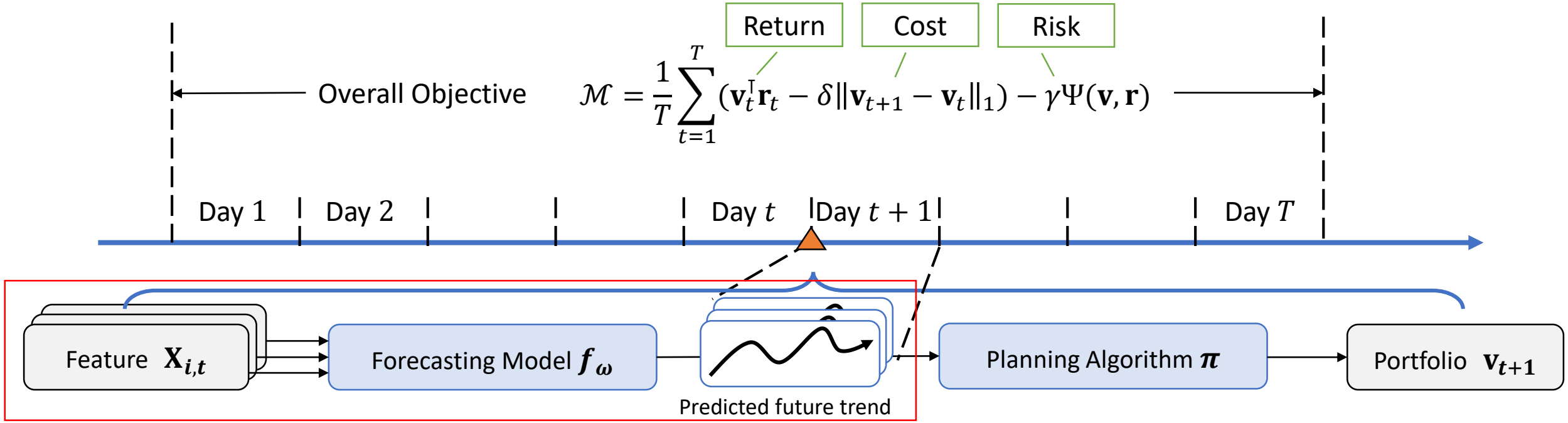
Intelligent Investment

Process and Framework



- Periodically (daily or weekly) adjusting the portfolio, decided by a *forecasting-and-planning* process.
  - Step 1: **forecasting** the price trend in the next time period for each stock
  - Step 2: **planning** the target portfolio according to stocks' predicted trend, thus maximizing the short-term objective in expectation.

Process and Framework



Take Enhanced Index Fund (EIF) as an example!

A Brief Introduction to Enhanced Index Fund

Problem Settings

- Transaction frequency: daily or even lower
- Transaction mode: compute the portfolio at the end of day T, and conduct trading at day T+1 (using $VWAP_{T+1}$ in backtest)
- Transaction cost: 0.4%
- Blacklist: ST, $|VWAP_T/close_T-1| > 9.5\%$
- Sometimes, restricted set of stocks to trade

$$\mathrm{VWAP} = \frac{\sum \mathrm{Price} * \mathrm{Volume}}{\sum \mathrm{Volume}}$$

Evaluation Metrics

- Annualized excess return > 12%
- Sharpe ratio > 2.5

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$$

where:

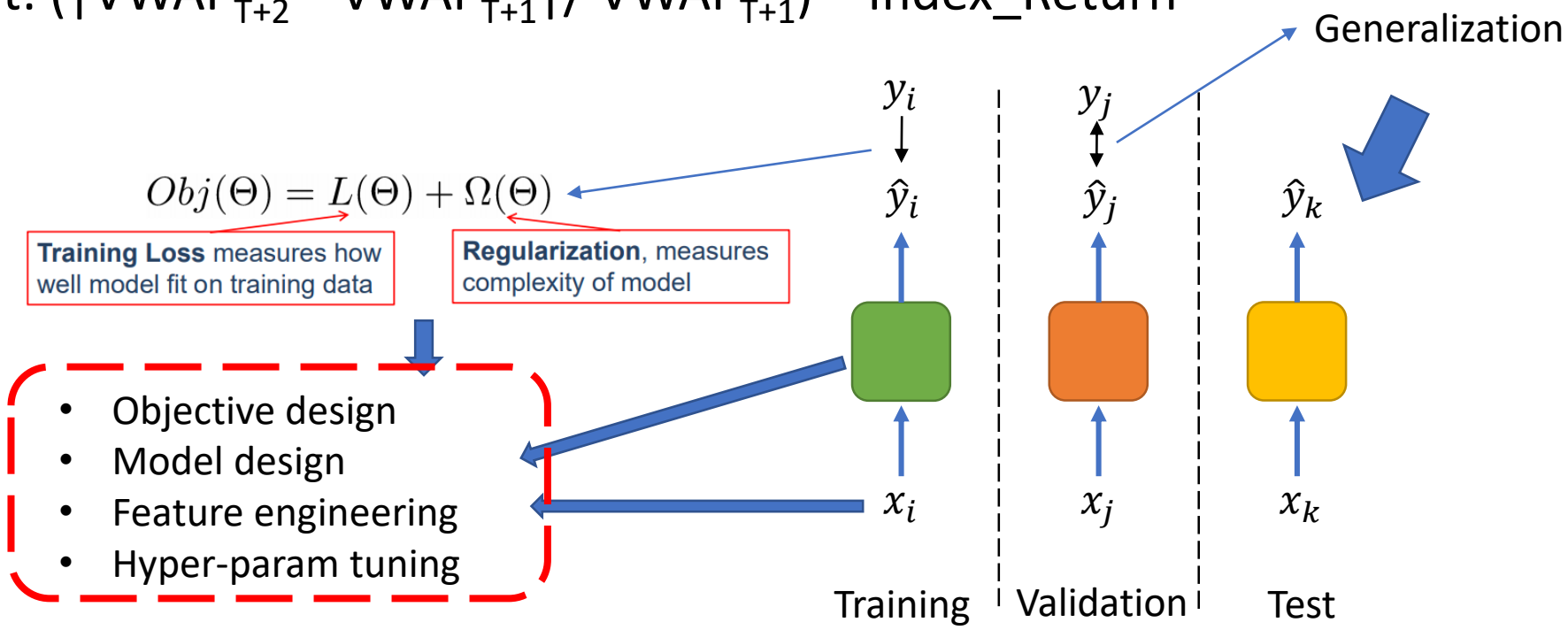
R_p = return of portfolio

R_f = risk-free rate

σ_p = standard deviation of the portfolio's excess return

Focusing on the Stock Trend Forecasting

- A Supervised Learning Task
  - To forecast the future excess return of each stock
  - Features: information before the end of day T
  - Target: ($|VWAP_{T+2} - VWAP_{T+1}| / VWAP_{T+1}$) – Index_Return



To Obtain the Forecasting Model

- Objective design
- Model design
- Feature engineering
- Hyper-param tuning

Objective Design

Classification

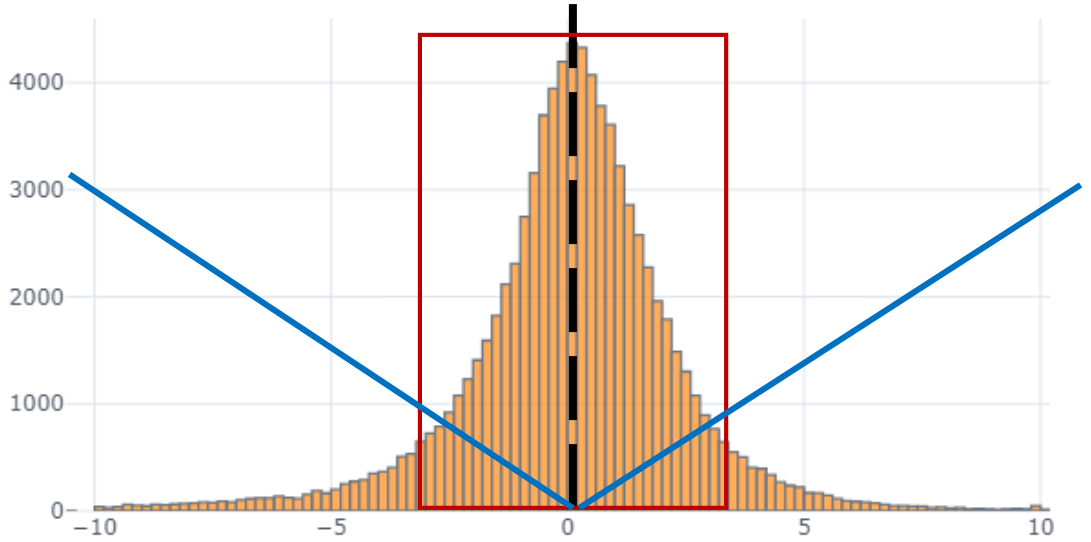
$$y^{(i)} = 1\left(label^{(i)} > 0\right)$$

$$L(\theta) = \frac{1}{m}\sum_{i=1}^{m} w^{(i)} * \left[y^{(i)} * \log\left(h_\theta\left(x^{(i)}\right)\right) + \left(1 - y^{(i)}\right) * \log\left(1 - h_\theta\left(x^{(i)}\right)\right)\right]$$

$$w^{(i)} = \left(\left|label^{(i)}\right| * const + 1\right)$$

Regression

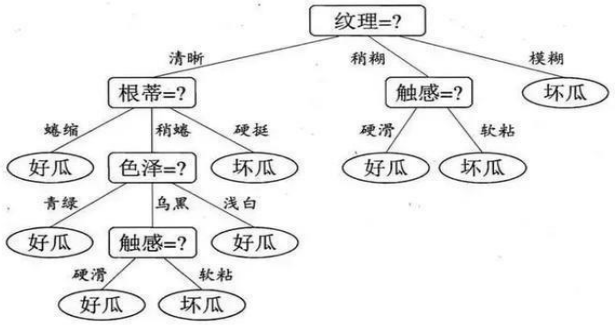
$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$$



Model Design

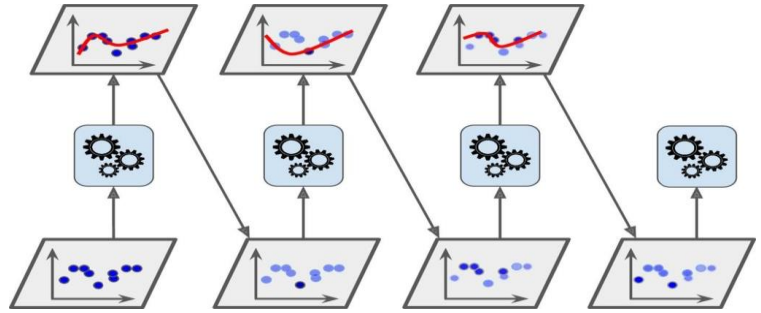
- GBDT (Gradient Boosting Decision Tree)，

Decision Tree



Ensemble Learning

Boosting



Feature Engineering

Time series of Price-Volume

- High, open, low, close, volume, VWAP in the past 60 days

Technical Indicators

- Widely-used 158 technical indicators generated based on time series of price-volume

截面指标		
K_LENGTH	(CLOSE-OPEN)/OPEN	中间实体绝对长度(当日涨跌)，有符号，可以通过ABS获得长度绝对值
K_MAX_LENGTH	(HIGH-LOW)/OPEN	K线最大长度(当日最大振幅)
K_LENGTH2	(CLOSE-OPEN)/(HIGH-LOW)	中间实体相对长度(占总长度的比例)，有符号

序列统计		
MA	MEAN(CLOSE, N)/CLOSE	N日MA，与技术指标BIAS等价，去除量纲
STD	STD(CLOSE, N)/CLOSE	N日STDEV，与BOLL指标相关，去除量纲
QTLU	QUANTILE(HIGH, N, q)/CLOSE	N日q分位数，相对压力位，去除量纲

技术指标		
BIAS	(CLOSE-MEAN(CLOSE, N))/MEAN(CLOSE, N)	技术指标-乖离率，等价于无量纲的MA(倒数)
BOLL_UP	(MEAN(CLOSE, N)+2*STD(CLOSE, N)-CLOSE)/MEAN(CLOSE, N)	到布林指标上界的距离
BOLL_DOWN	(MEAN(CLOSE, N)-2*STD(CLOSE, N)-CLOSE)/MEAN(CLOSE, N)	到布林指标下界的距离

Feature Engineering

Time series of Price-Volume

- High, open, low, close, volume, VWAP in the past 60 days

Technical Indicators

- Widely-used 158 technical indicators generated based on time series of price-volume

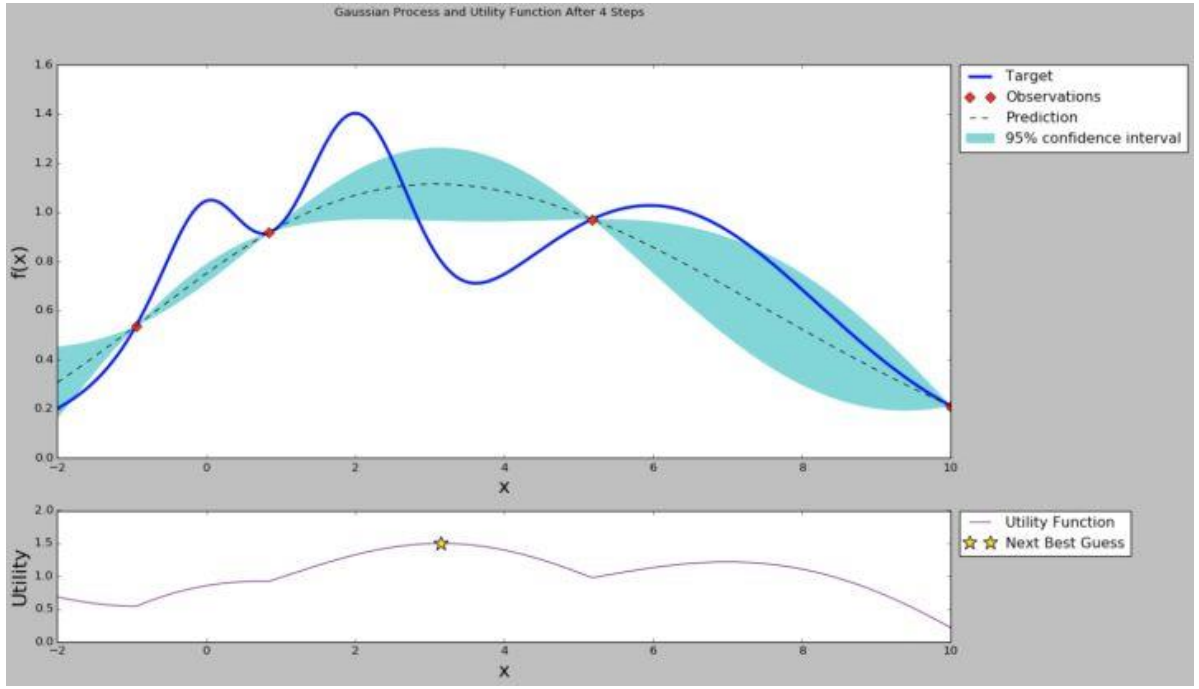
Long-short back-testing in two years

	Time series of PV	Technical indicators
Annualized Return	1.316621	1.535857
Sharpe Ratio	14.80259	15.42814
Correlation of two models	0.794755	

Hyper-Parameters Tuning

- Hyper-Parameters：
  - Model structure： max tree depth, max leaf nodes, etc.
  - Model optimization： learning rate, etc.
  - Sample related： sample weight, etc.

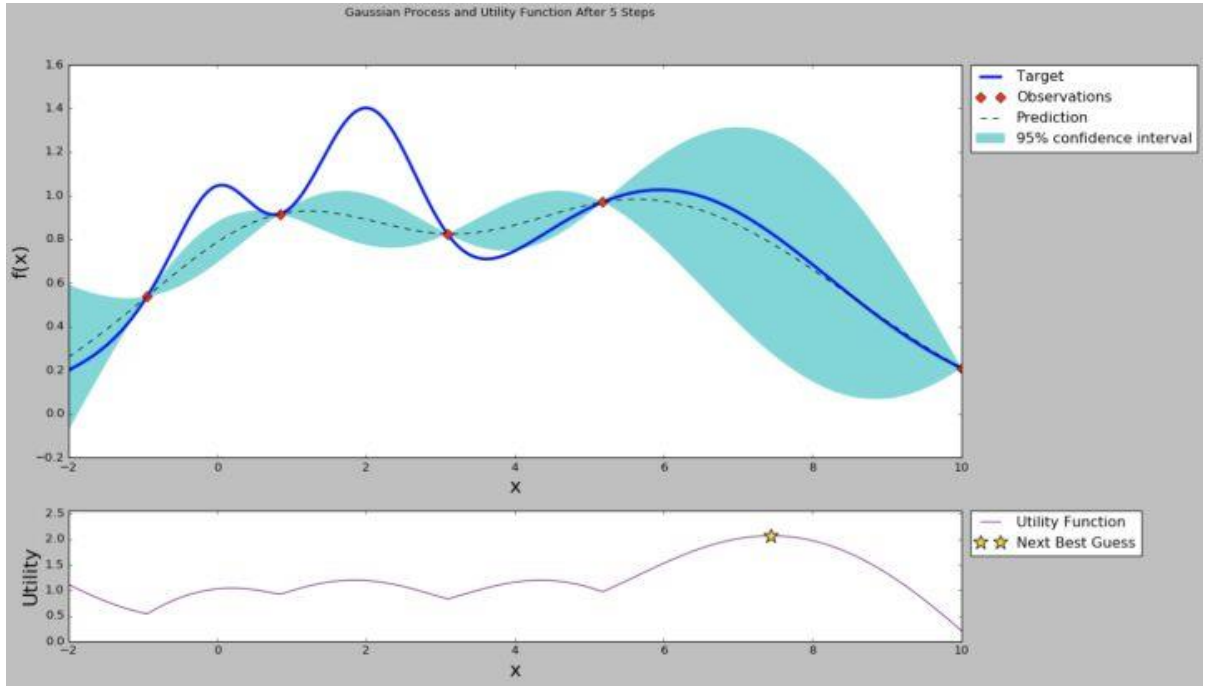
- Tuning methods：
  1. Expert knowledge
  2. Search
  3. Bayesian Optimization



Hyper-Parameters Tuning

- Hyper-Parameters：
  - Model structure： max tree depth, max leaf nodes, etc.
  - Model optimization： learning rate, etc.
  - Sample related： sample weight, etc.

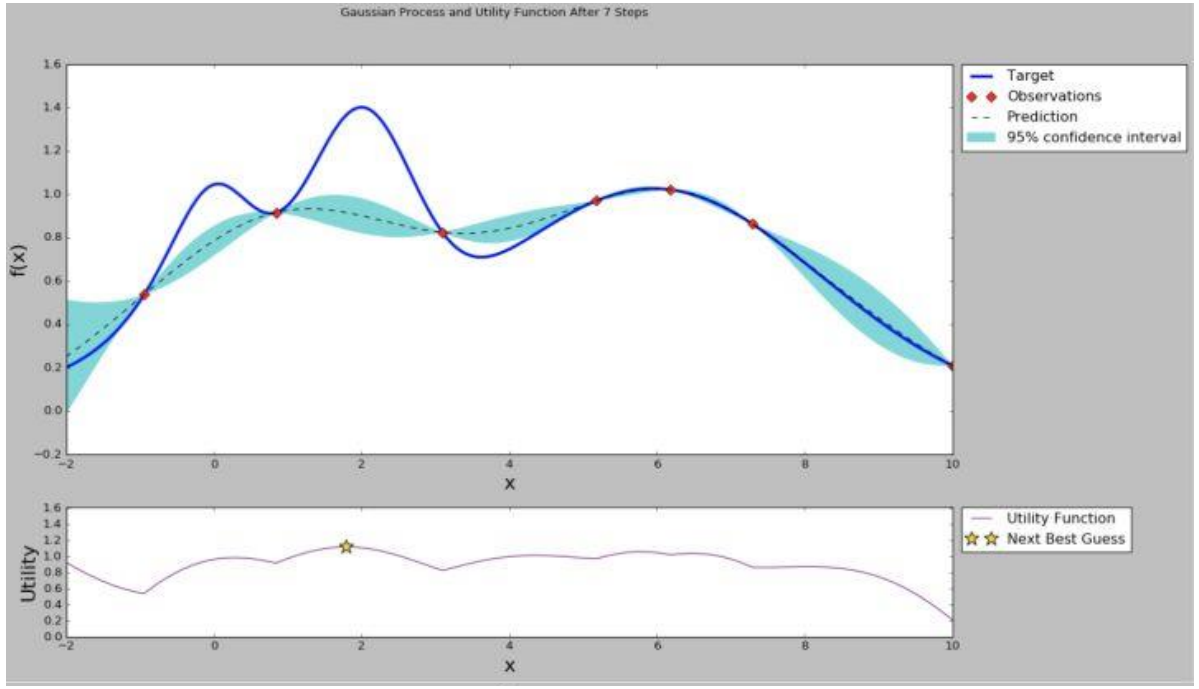
- Tuning methods：
  1. Expert knowledge
  2. Search
  3. Bayesian Optimization



Hyper-Parameters Tuning

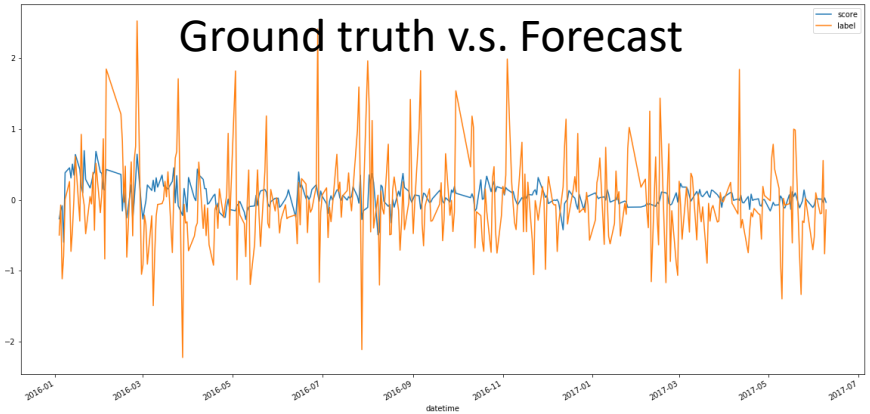
- Hyper-Parameters：
  - Model structure： max tree depth, max leaf nodes, etc.
  - Model optimization： learning rate, etc.
  - Sample related： sample weight, etc.

- Tuning methods：
  1. Expert knowledge
  2. Search
  3. Bayesian Optimization



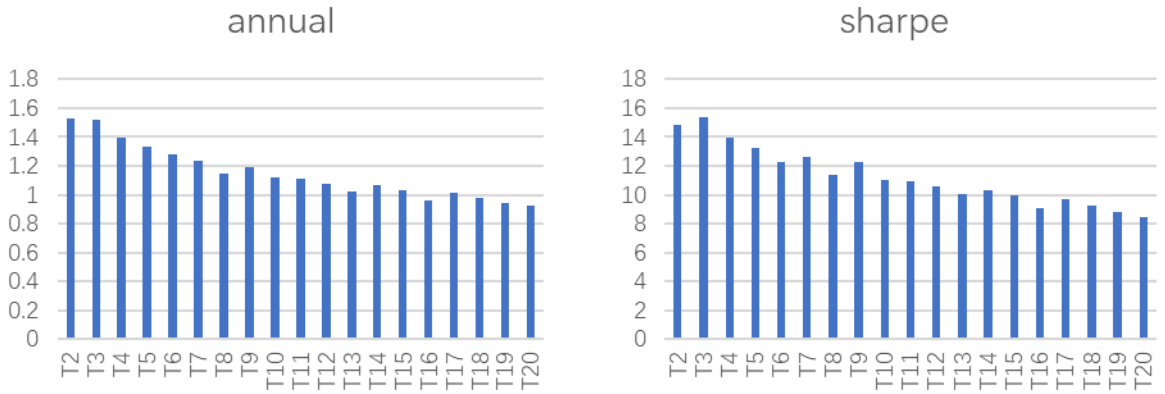
Forecasting Results

The range of model output is smaller



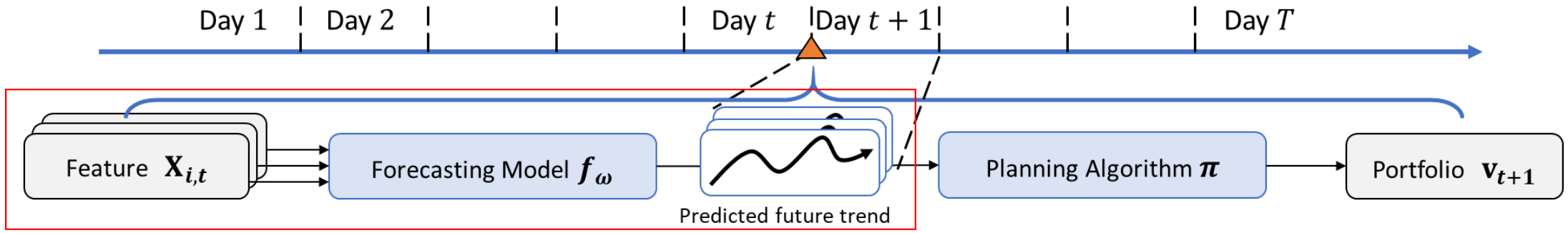
- Why cannot catch outlier points?
- Arbitrary value v.s. ranking?

More difficult to forecast longer return

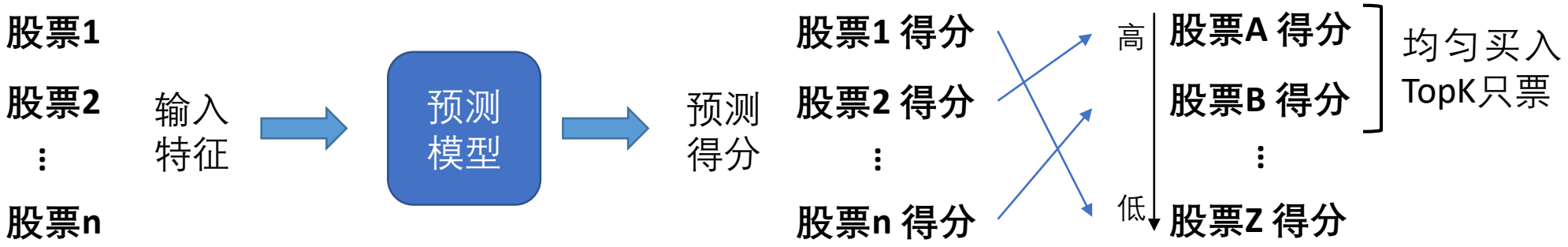


- Why cannot catch longer return?
- Shorter strategies → higher turnover rate?

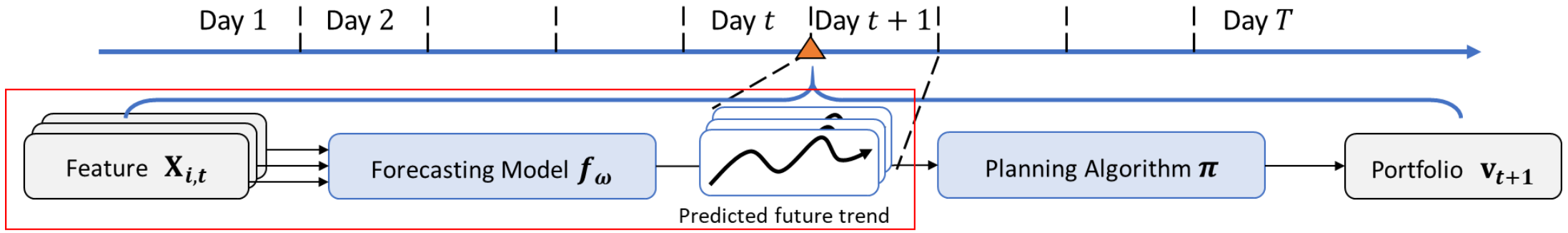
From Forecast to Portfolio



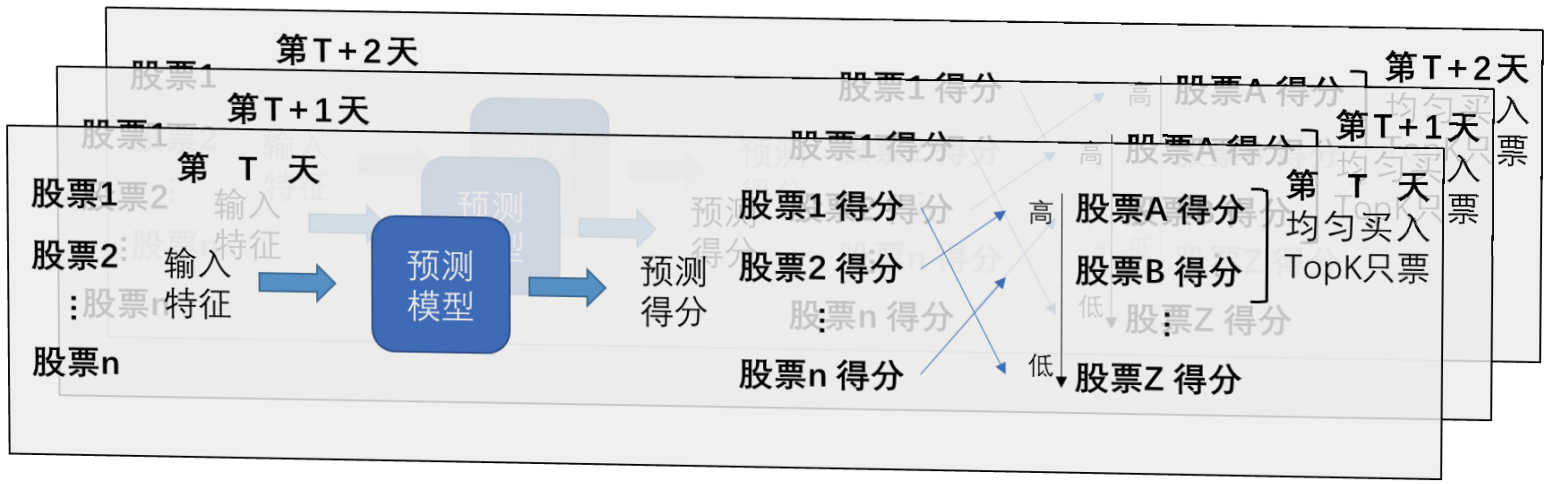
- Invest those stocks with highest forecast scores
- Need to consider turnover rate

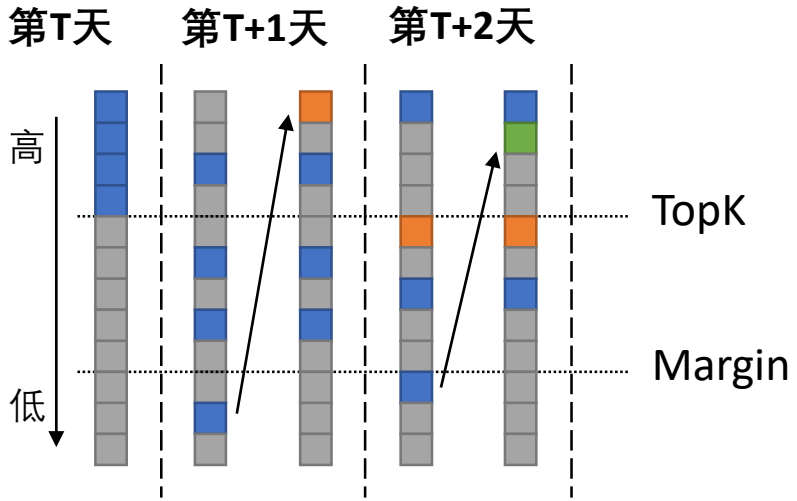


From Forecast to Portfolio

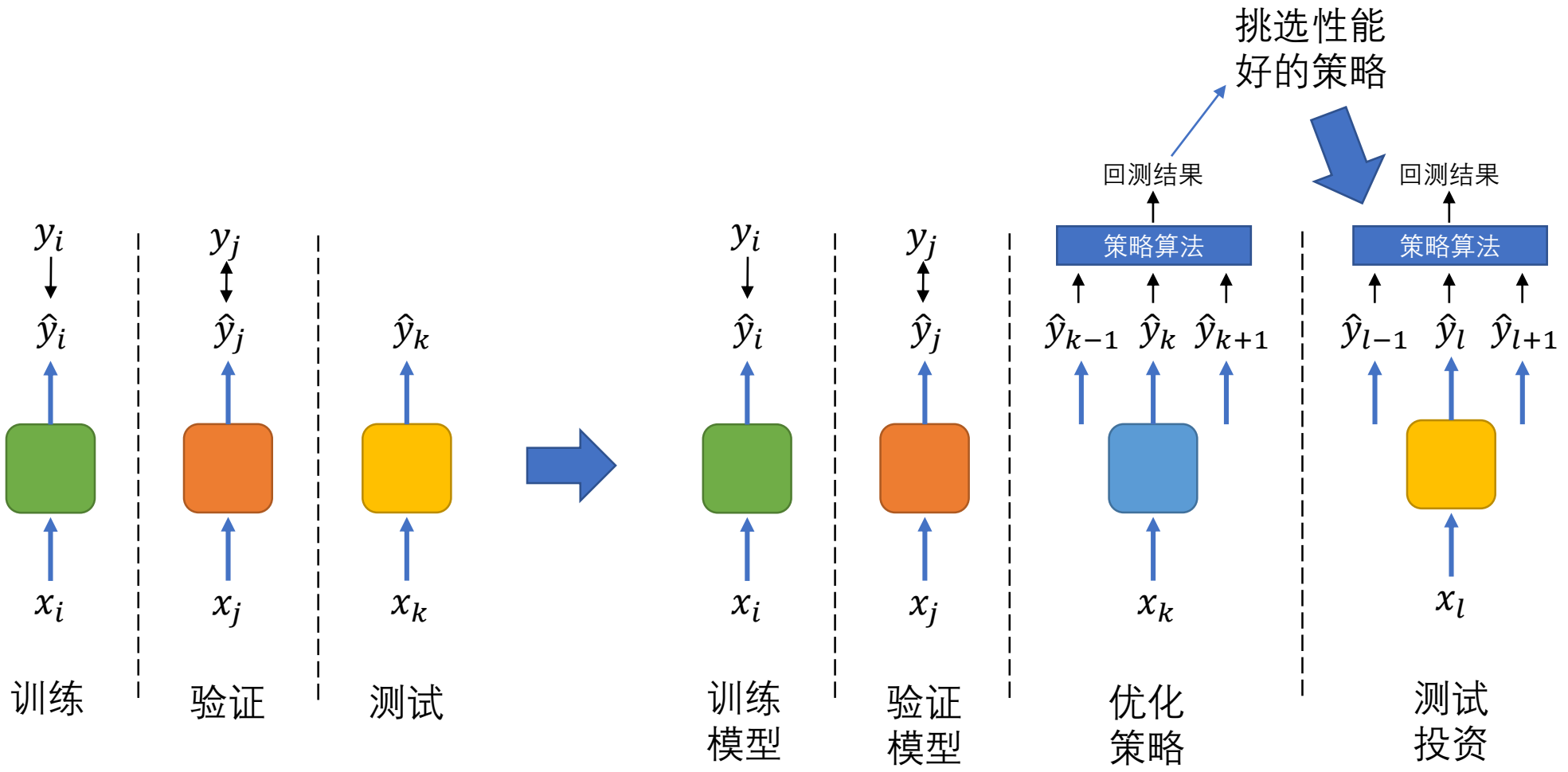


- Invest those stocks with highest forecast scores
- Need to consider turnover rate



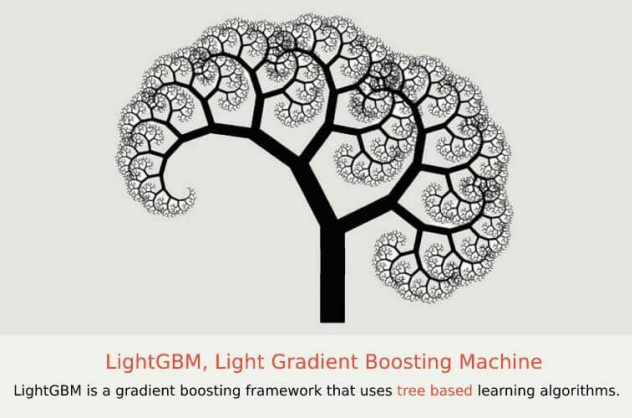


From Forecast to Portfolio



Experimental Setups

- LightGBM



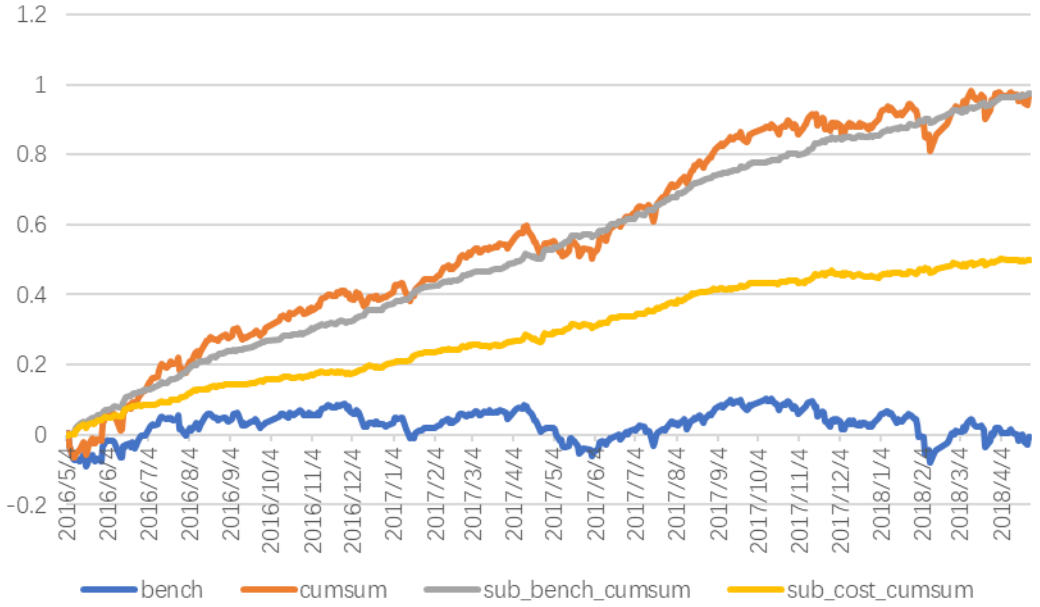
- Training： 2007-01-01~2013-12-31
- Validation： 2014-01-01~2015-12-31
- Strategy-Val： 2016-01-01~2016-04-30
- Backtest： 2016-05-01~2018-04-30

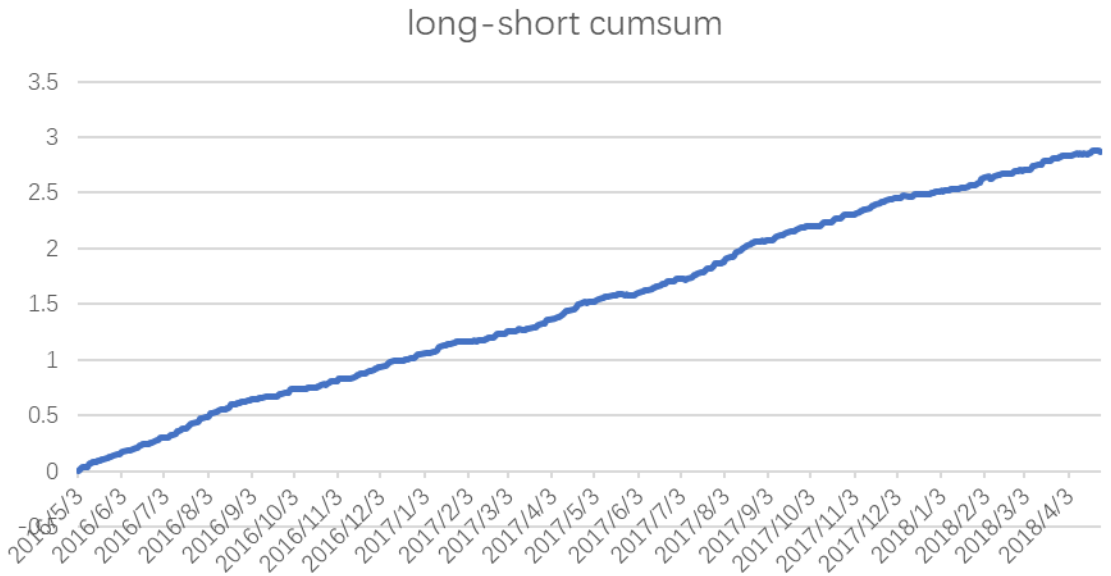
- Features： 360 time series PV, 158 technical indicators
- Label： daily excess return
- Loss： MSE
- Hyper-params： Bayesian Optimization

- Index： CSI500
- Strategy params：
  - TopK： 75
  - Margin: 225

Experimental Results

Metrics	Long-short	Excess	Removing Transaction Fees
Annualized Return	1.488029	50.5%	25.9%
Sharpe Ratio	16.032551	10.570854	5.404145



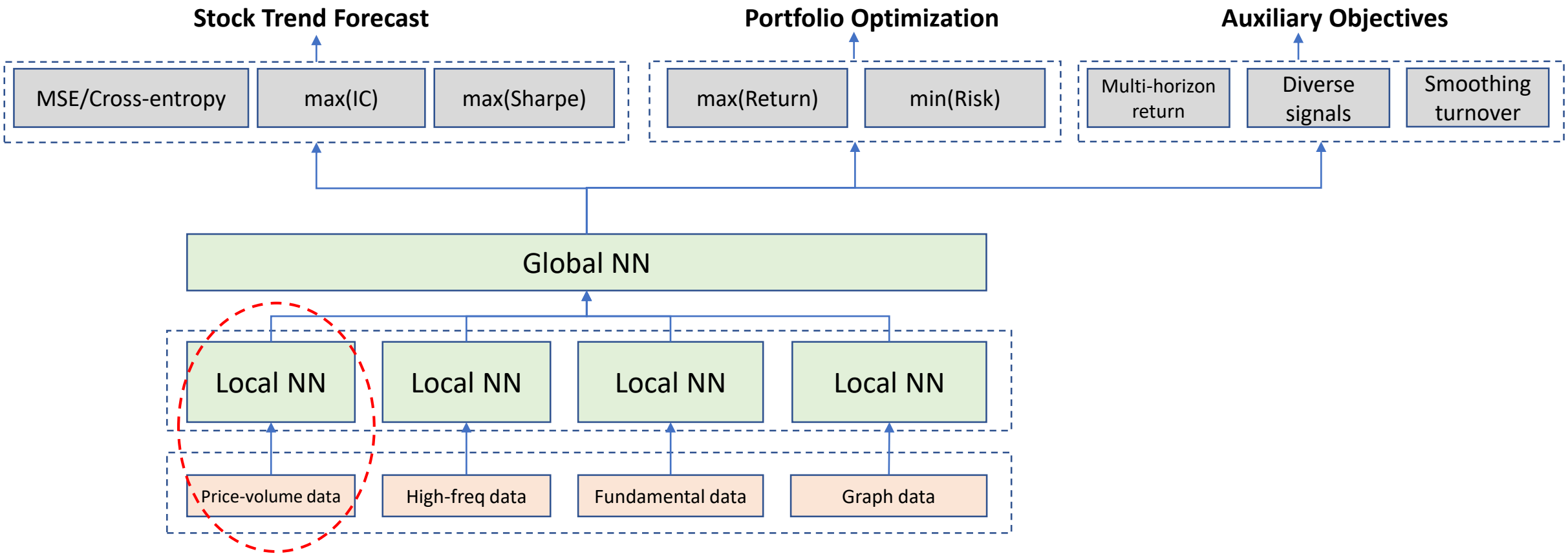


Not the End

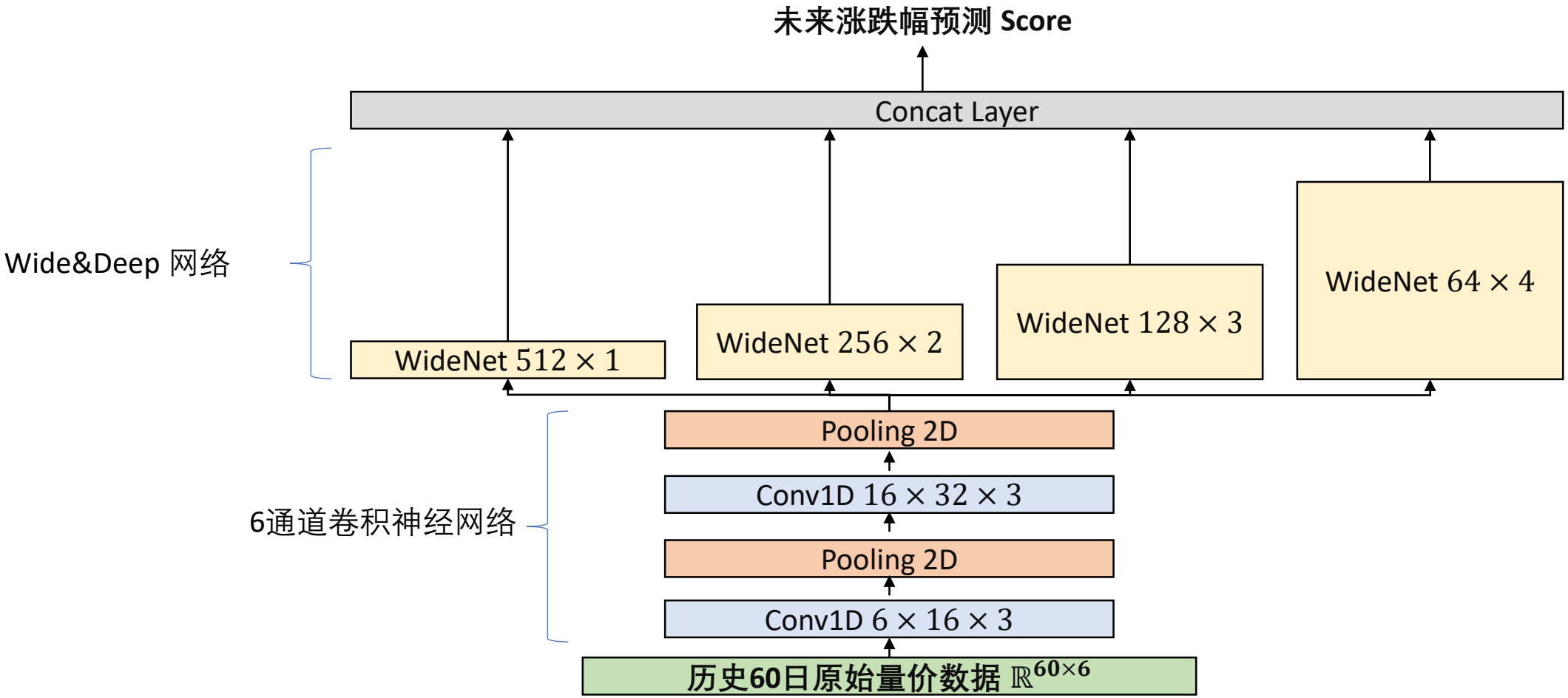
- Limitation of GBDT
  - High dependency on feature engineering
    - More efforts to mine new technical indicators
  - Hard to adapt to the dynamic market
  - Lower flexibility
    - Diverse objectives
    - Heterogeneous Data

Deep Learning

Potential of Deep Learning

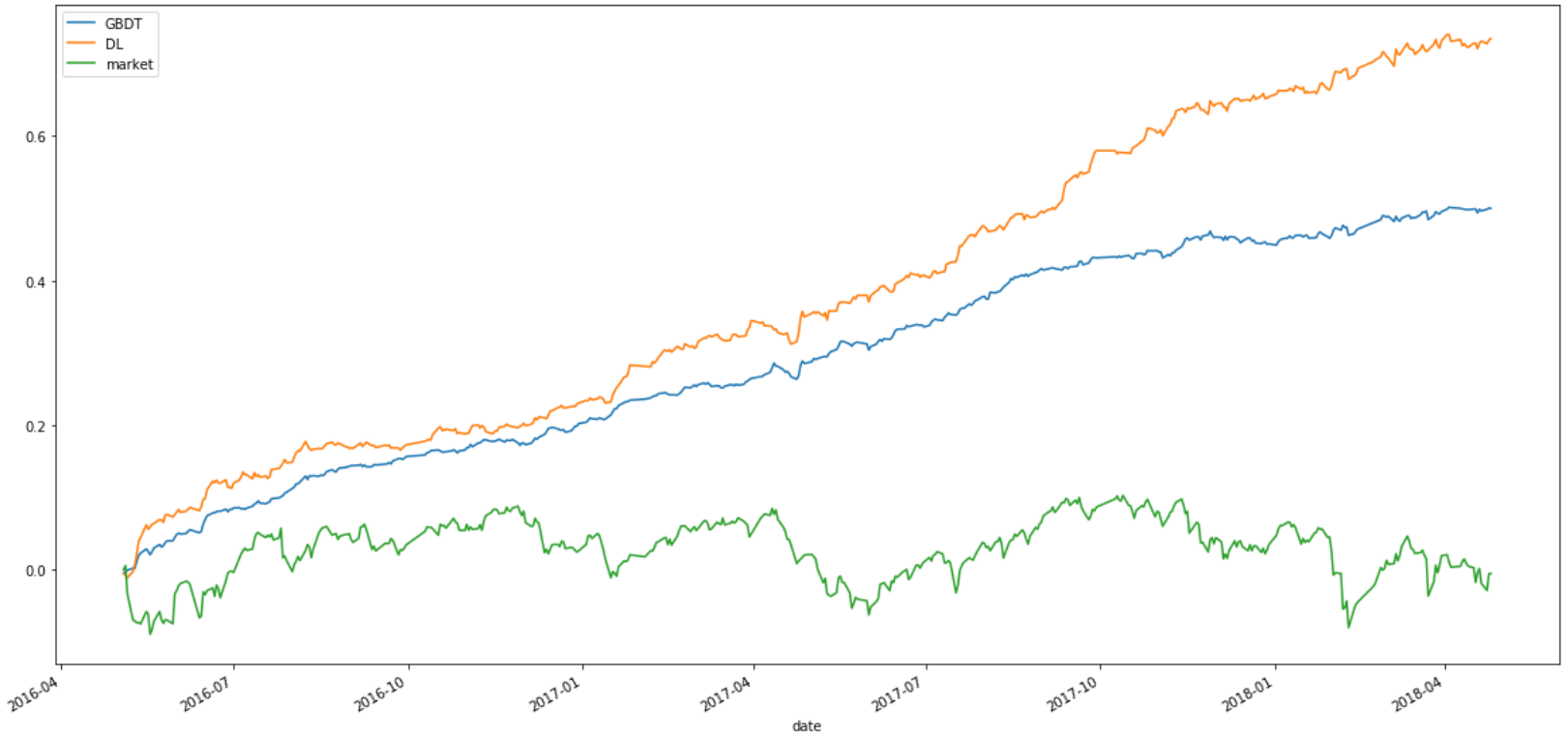


A Specification on DNN

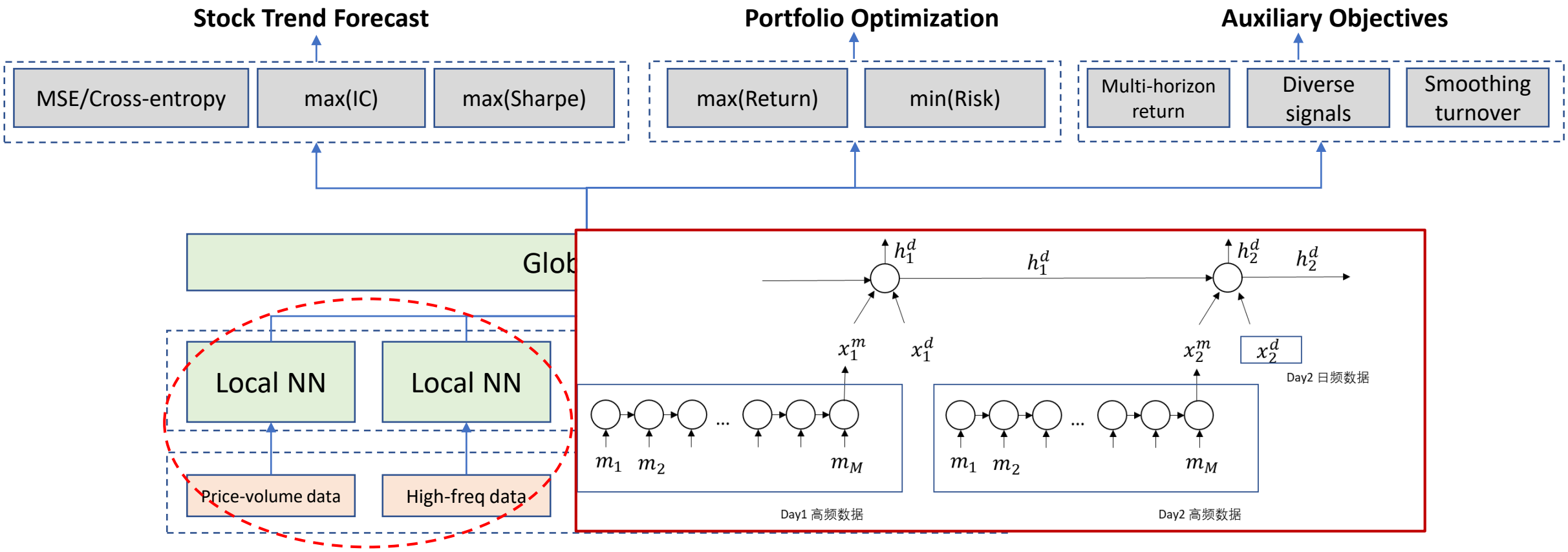


Comparison Results

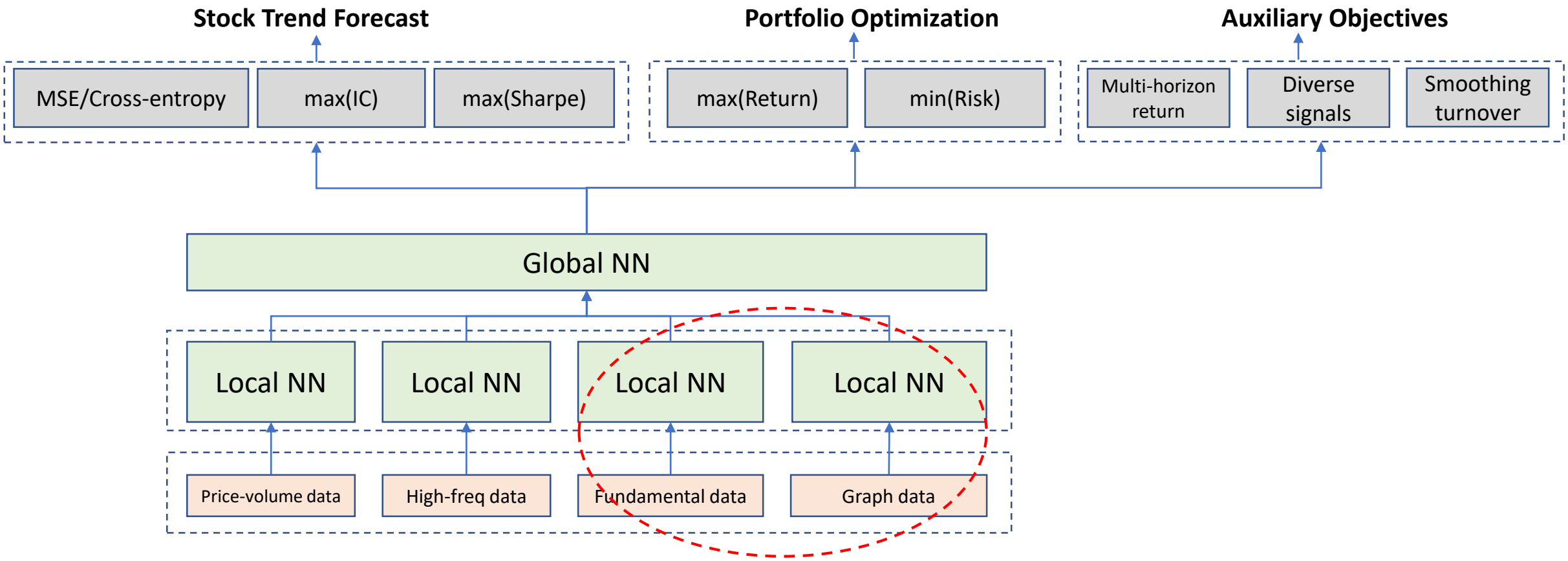
- GBDT + feature engineering vs. DNN + raw data



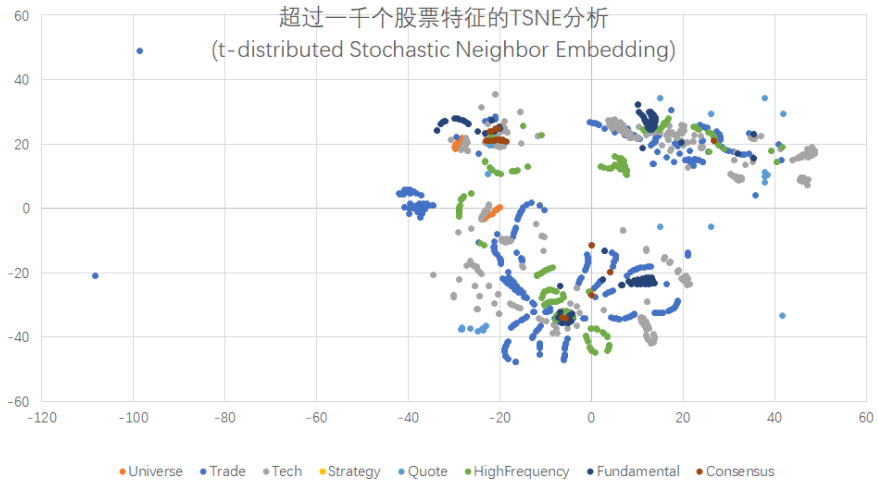
Potential of Deep Learning

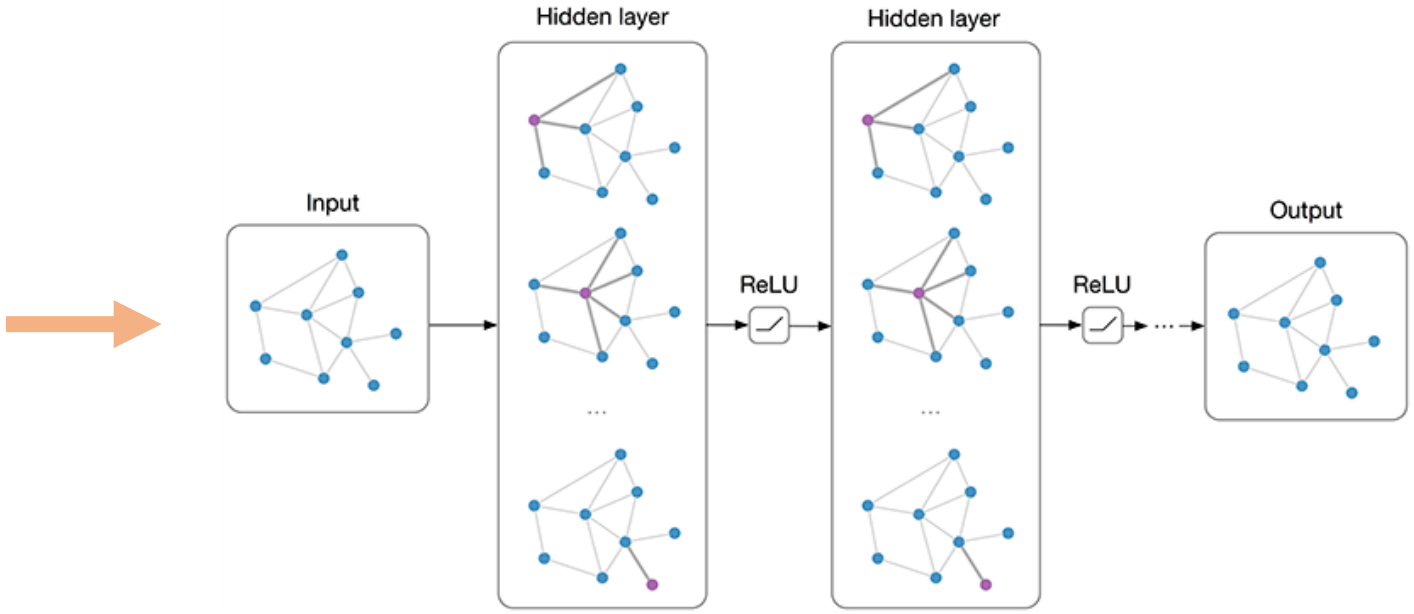


Potential of Deep Learning

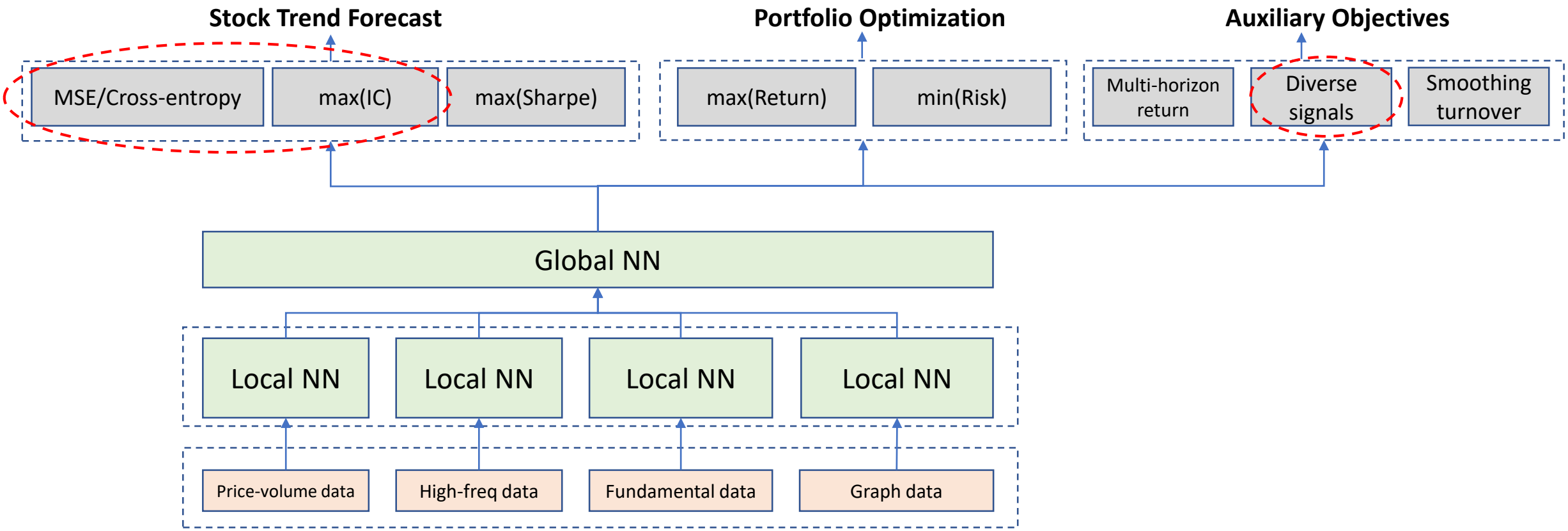


Graph-NN


超过一千个股票特征的TSNE分析
(t-distributed Stochastic Neighbor Embedding)
60
40
20
0
-20
-40
-60
-120
-100
-80
-60
-40
-20
0
20
40
60
Universe
Trade
Tech
Strategy
Quote
HighFrequency
Fundamental
Consensus

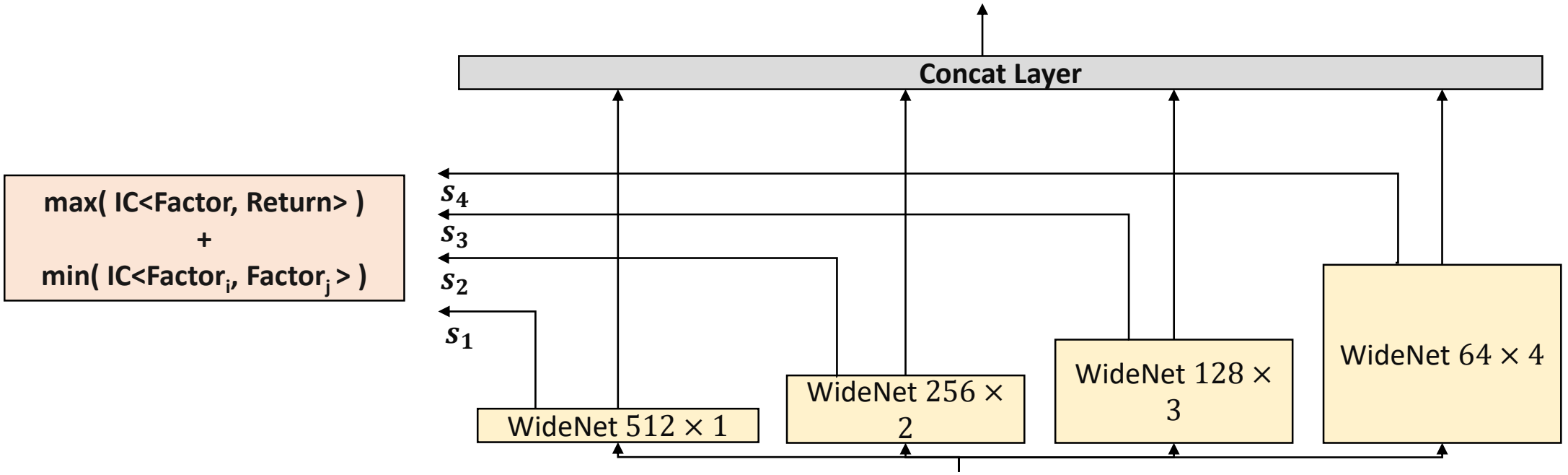

Input
Hidden layer
ReLU
Hidden layer
ReLU
Output

Potential of Deep Learning

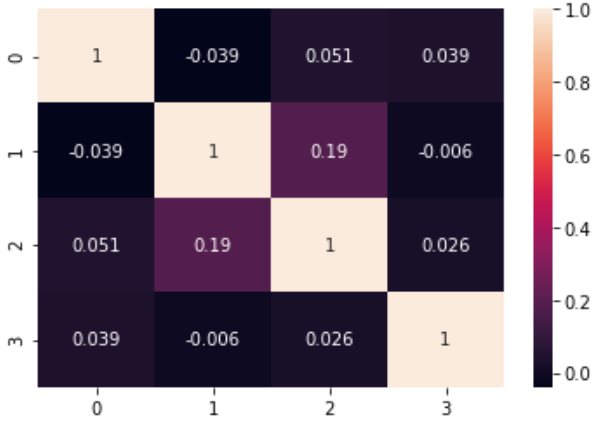


Diverse Signals

$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$$



	Main Results	Factor-1	Factor-2	Factor-3	Factor-4
Annual	1.33	0.82	0.84	0.73	0.79
Sharpe	13.49	7.91	7.68	8.34	7.69



Optional: Advanced Topics

Self-Pace Learning for Filtering Noisy News

噪音新闻

沪指涨0.32% 房地产板块涨幅居前

沪指早盘涨2.25% 房地产板块涨幅居前

沪指大涨4.26% 房地产板块涨幅居前

军工集团改革预期加强 航天军工板块涨幅居前

沪指早盘涨0.69% 煤炭板块涨幅居前

沪指早盘涨2.36% 煤炭板块涨幅居前

沪指涨0.75% 煤炭板块涨幅居前

沪指涨1.25% 煤炭板块涨幅居前

沪指早盘涨1.03% 煤炭板块涨幅居前

沪指早盘涨0.78% 钢铁板块涨幅居前

沪指跌0.26% 钢铁板块涨幅居前remove -1 0.823447 两市涨幅扩大 国防军工板块走强

房地产公司成机构调研重点

沪深两市双双低开 航天军工涨幅居前

非噪音新闻

国际油价频创新低 化工品沦成重灾区

机械行业：结构性行情有望出现

*ST天利与中石油签署《重大资产重组框架协议》

量子通信商业化加速 10股孕育重大机遇

国务院：超前部署基础前沿研究 使北京成"世界创新"新引擎

京东金融等三巨头"厮杀" 瞄准消费金融及消费体验

河北钢铁国际战略谋变：控股德高公司只是一小步

互联网+工程机械 徐工炫动工业4.0时代新"魔方"

我国现代煤化工发展仍面临诸多挑战

"新丝绸之路"蕴藏澳洲基础设施投资机遇 -QIC

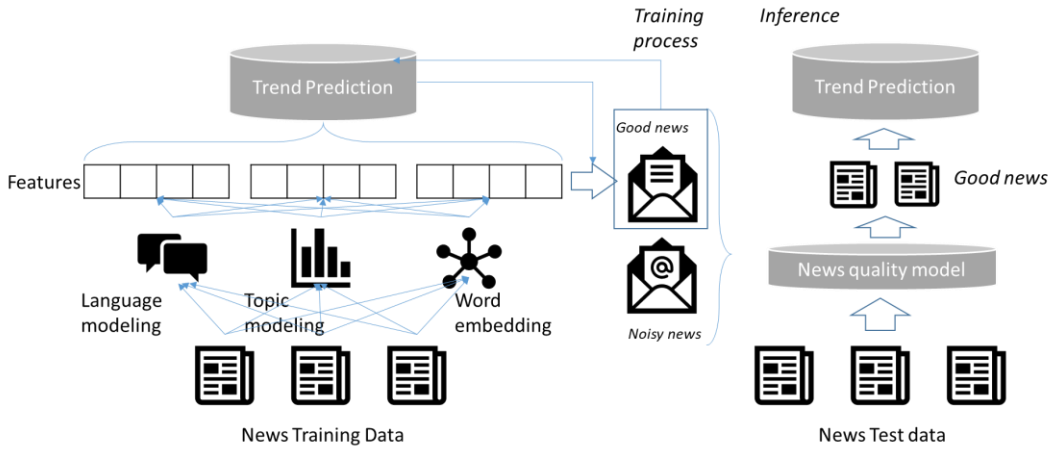
新三板最颠覆！做市比不上协议的 基础层比创新层贵

煤化工遭西部大开发冷落 现代煤化工仍是大势

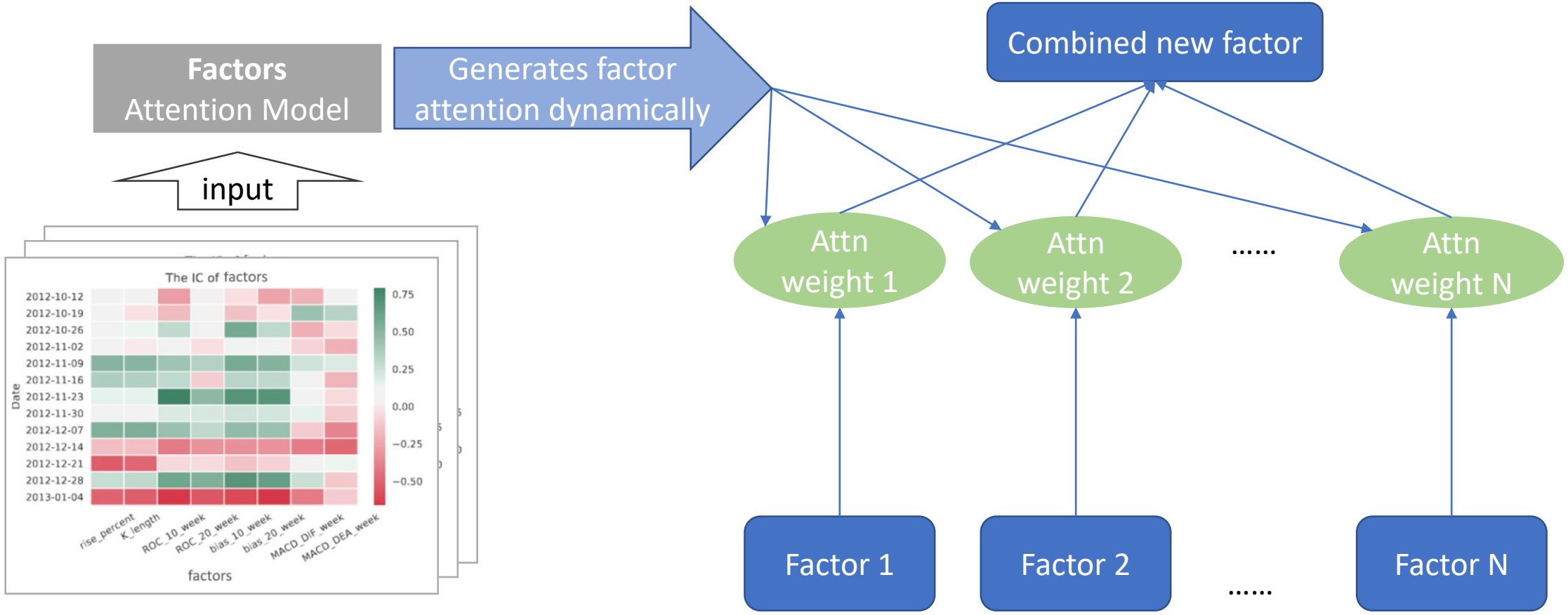
"十三五"电力规划正编制 主推绿色低碳

煤化工遭遇低油价严环保双重夹击

银河电子拟定增23.6亿 发力新能源汽车及国防装备



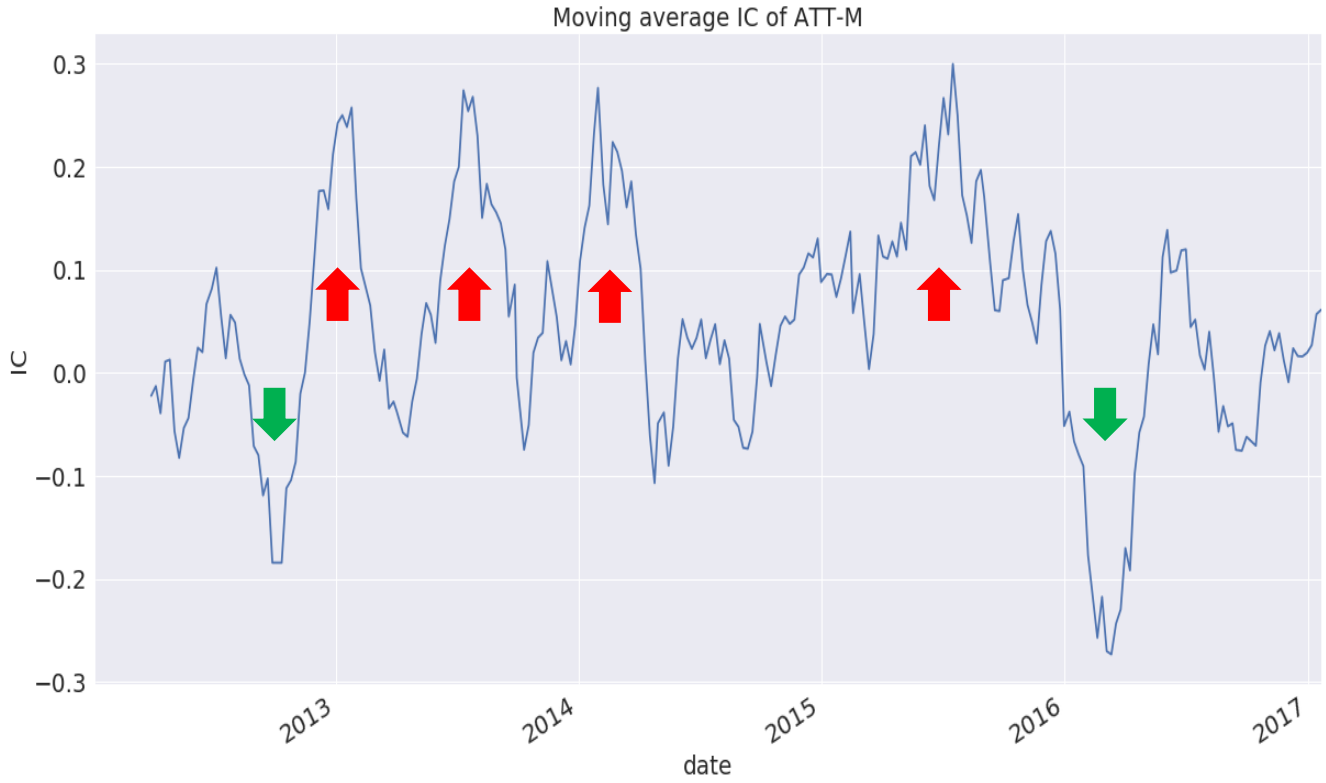
Modeling the dynamics of individual factors

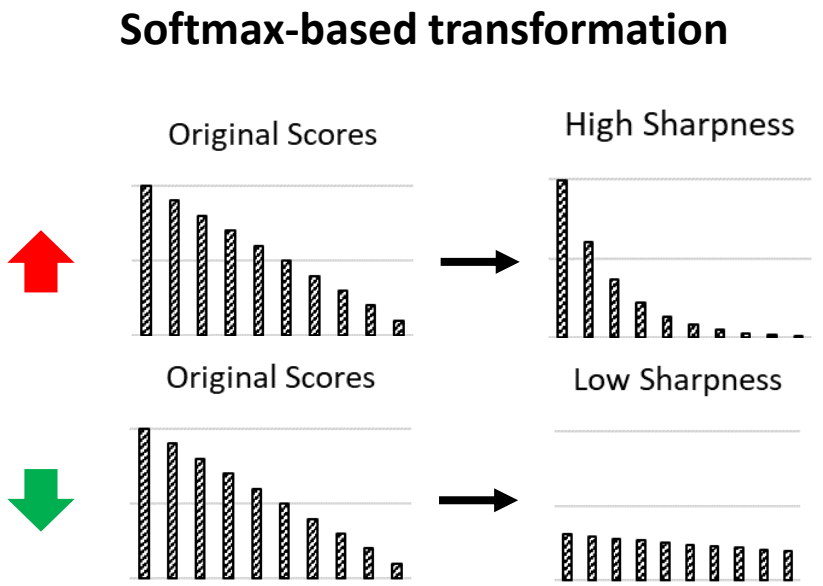


Multiple historical performance metrics of factors
- IC, Return, …….

How to tune the investment concentration?

- High confidence → high investment concentration level
- Low confidence → low investment concentration level



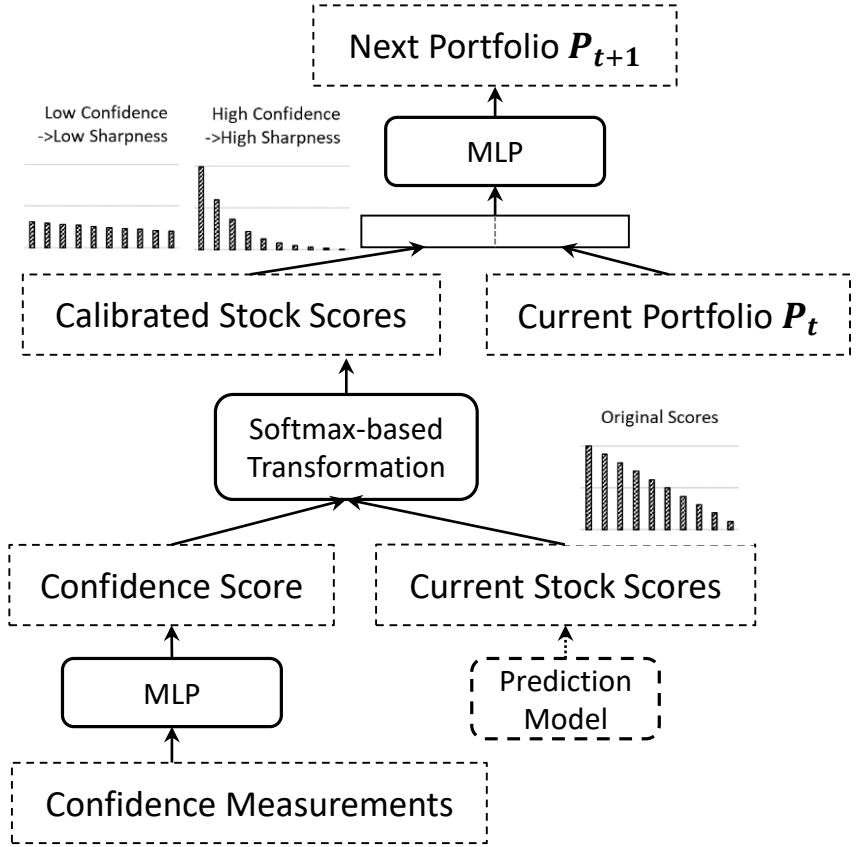


How to determine the current confidence?

- Confidence is end-to-end learned in the portfolio construction model

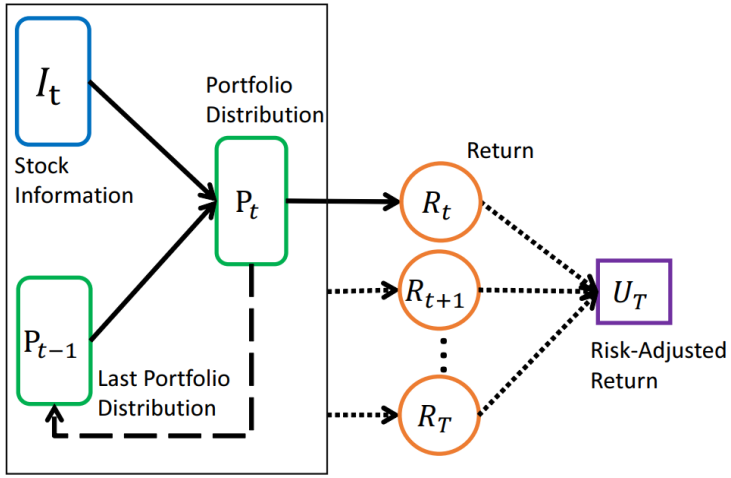
- Objective:

$$\text{maximize} \quad \underbrace{L(P_{t+1})}_{\text{Sharpe Ratio (long-term risk-adjusted return)}} - \lambda \underbrace{\Phi(P_t, P_{t+1})}_{\text{Portfolio distance (transaction cost)}}$$

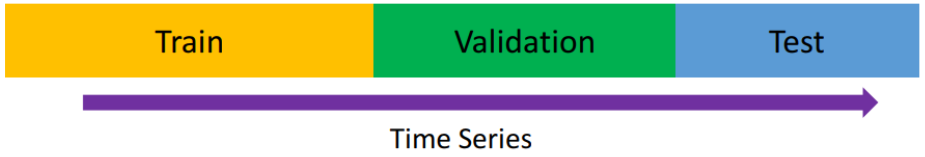


Direct RL for Dynamic Portfolio Construction

- Existing model
  - Input: portfolio P_{t-1} and market information I_t
  - Output: portfolio P_{t}
  - Objective function: risk-adjusted return



- Train policy on training replay data
  - Starts with a uniformly distributed portfolio
  - Run on the whole training time series over and over again
  - Select the model with the best performance on validation data, and test the performance on test data



Looking Forward…

Our Practice in Chinese Stock Market

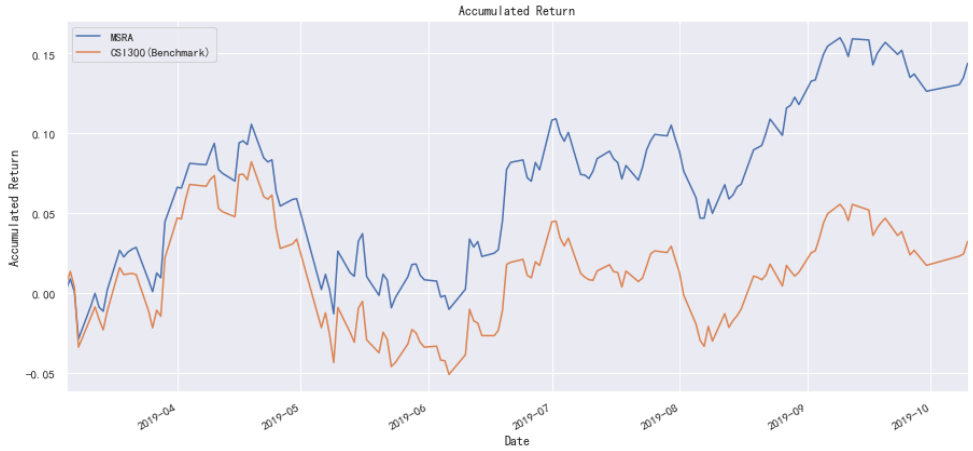
- Collaborating with our customers to run real-market trading – **Enhanced Index Fund**

华夏基金 ChinaAMC

➢ **CSI300 Enhanced Index Fund**

Settings
- size: **0.3 billion**; period: over 7 months

Performance
- **20%** annualized excess return (**top 1**)

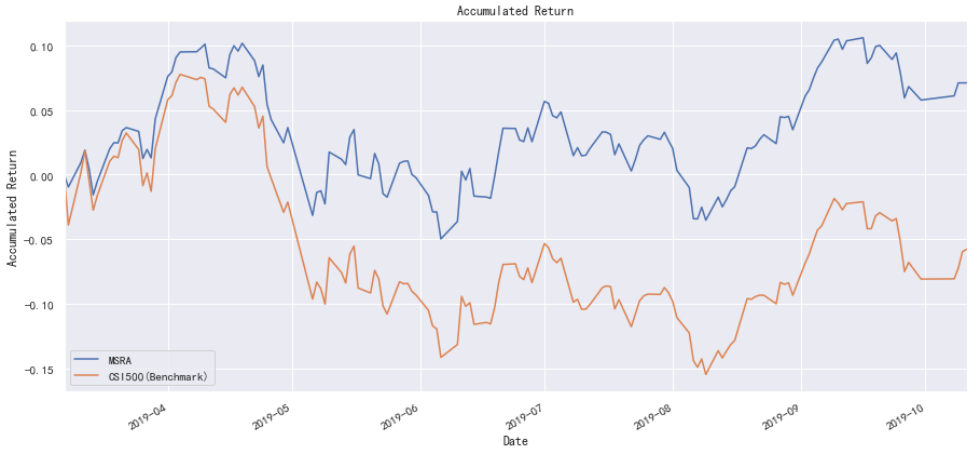


中國太平 CHINA TAIPING

➢ **CSI500 Enhanced Index Fund**

Settings
- size: **1.1 billion**; period: over 7 months

Performance
- **20+%** annualized excess return (**top 1**)



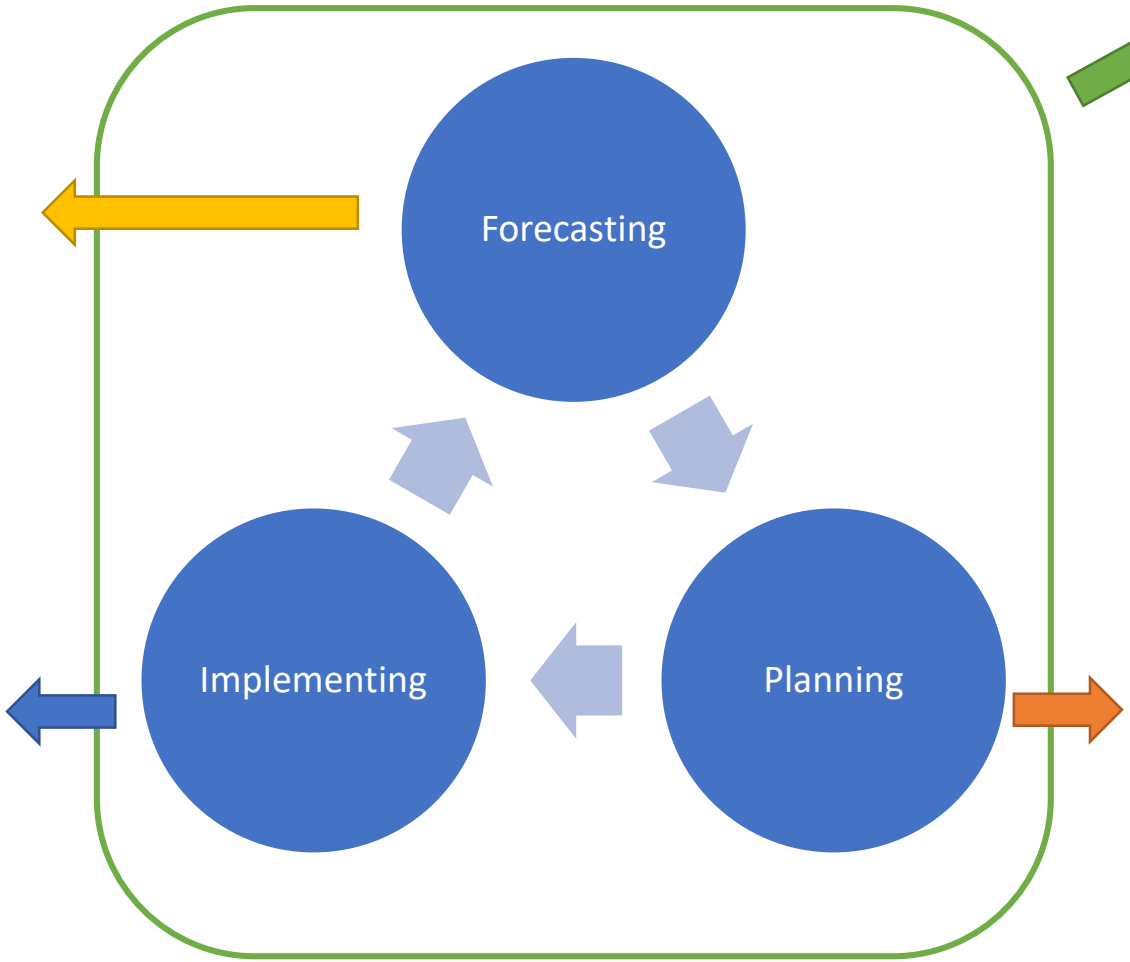
Yet, it is NOT an easy job!

First AI ETF Fund - AIEQ

EQUBOT

Ongoing and Future Works

- Event-driven
- Relation-aware
- Market Status-aware
- Forecast Confidence



- High Frequency
- Interpretability / Explainability
- Imitate the investment style of expert investors

- Algorithmic Trading
- Market Feedback
- Adversarial / Game-theoretic investment

Thanks