投资组合优化简述

从马科维兹的均值-方差模型到深度强化学习

汇报人：蔡明师

THE AI IN FINTECH MARKET MAP

CREDIT SCORING / DIRECT LENDING

affirm · AVANT · zestfinance · argon · ADF · habito · CREAM FINANCE · aire · float · naborly · Upstart · creditvidya · james · Wecash闪银

ASSISTANTS / PERSONAL FINANCE

digit · MoneyLion · personetics · Kasisto · clinc · Penny · TRIM · claritymoney · cleo. · homebot · Active.Ai · change

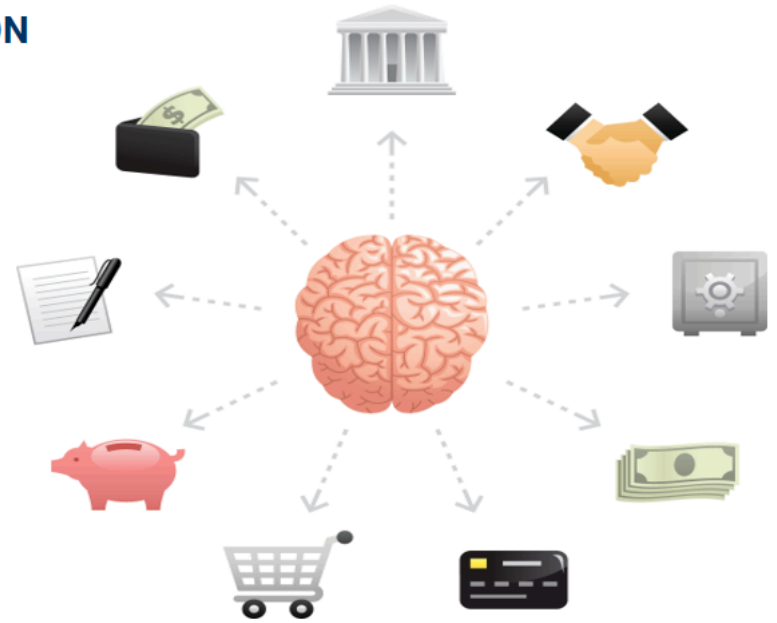
QUANTITATIVE & ASSET MANAGEMENT

wealthfront · sentient technologies · SIGOPT · ALPINE DATA · Clone Algo · NUMERAI · WALNUT ALGORITHMS · fount · domeyard LP · Alpaca · AIM · ForwardLane · TRUMID · ALGORIZ

Alpha & Beta?

REGULATORY, COMPLIANCE, & FRAUD DETECTION

TRIFACTA · Digital Reasoning · WorkFusion · Paxata · DataRobot · siftscience · onfido · feedzai · SKYTREE · SOCURE · bigstream · trooly · BehavioSec · ComplyAdvantage · cortical.io · Dimebox · Fraugster · neurensic · PredicSis · Jewel Paymentech · CheckRecipient · Fortia



INSURANCE

CAPE ANALYTICS · captricity · TRACTABLE · riskgenius · CYENCE · Shift Technology · Zendrive · Lemonade · UNDERSTORY

MARKET RESEARCH / SENTIMENT ANALYIS

Dataminr · alphasense · Orbital Insight · Descartes Labs · iSENTIUM · indico · acuity TRADING · SIGNAL · FeedStock Intelligent Information Management

GENERAL PURPOSE / PREDICTIVE ANALYTICS

OPERA SOLUTIONS · AYASDI · KENSHO · NarrativeScience · context relevant · H2O.ai · smartzip predictive marketing · CognitiveScale · Anodot · Lucena Quantitative Analytics · Numenta

DEBT COLLECTION

TrueAccord · collectAI

BUSINESS FINANCE & EXPENSE REPORTING

fyle · NetChain² · AppZen · ZEITGOLD. · WINT

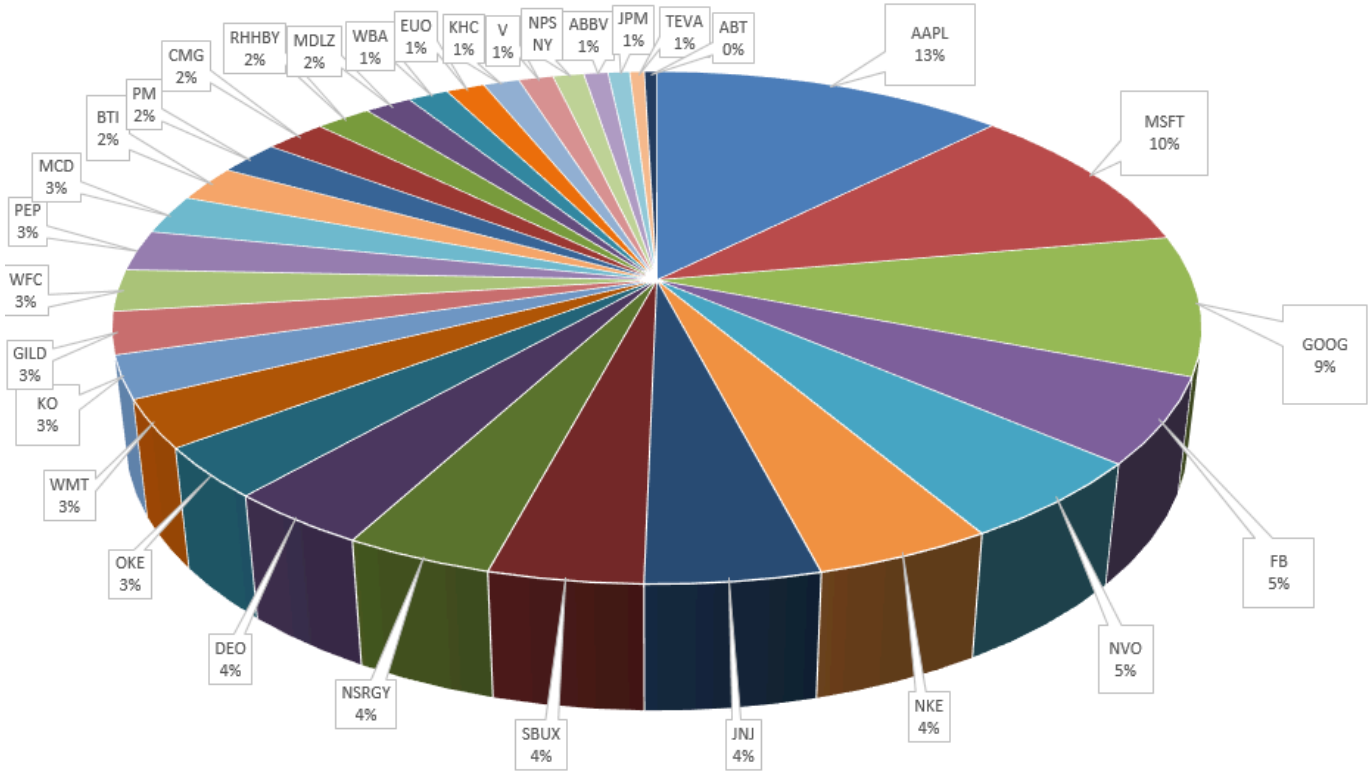
CBINSIGHTS

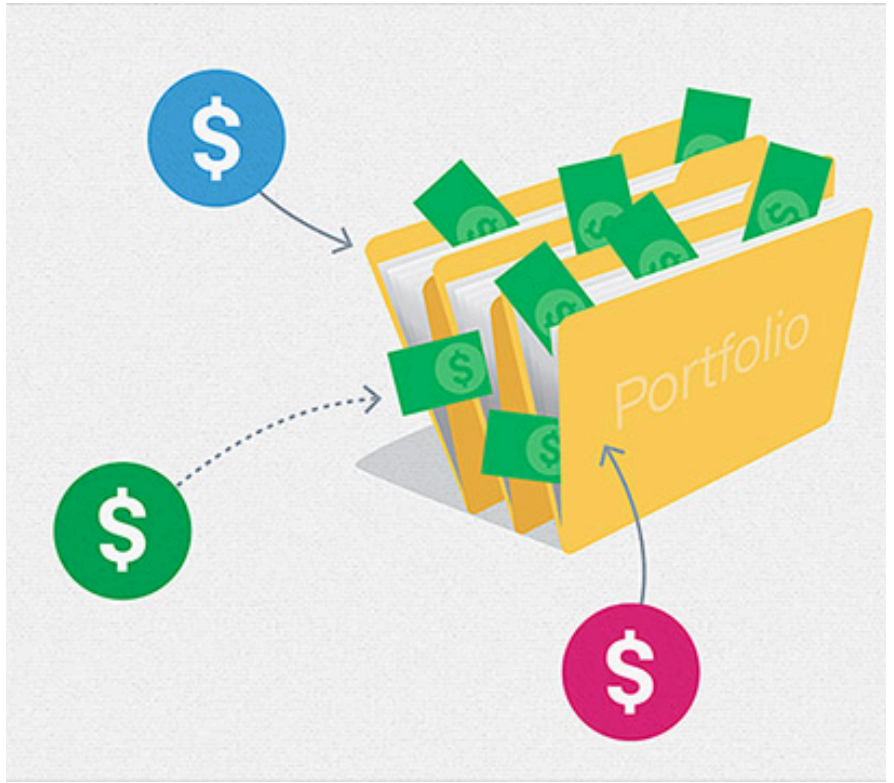
CBINSIGHTS

主要内容

1. 背景
2. 投资组合优化简介
3. 经典方法：马科维兹均值-方差模型
4. 无监督学习
5. 有监督学习
6. 强化学习

投资组合优化



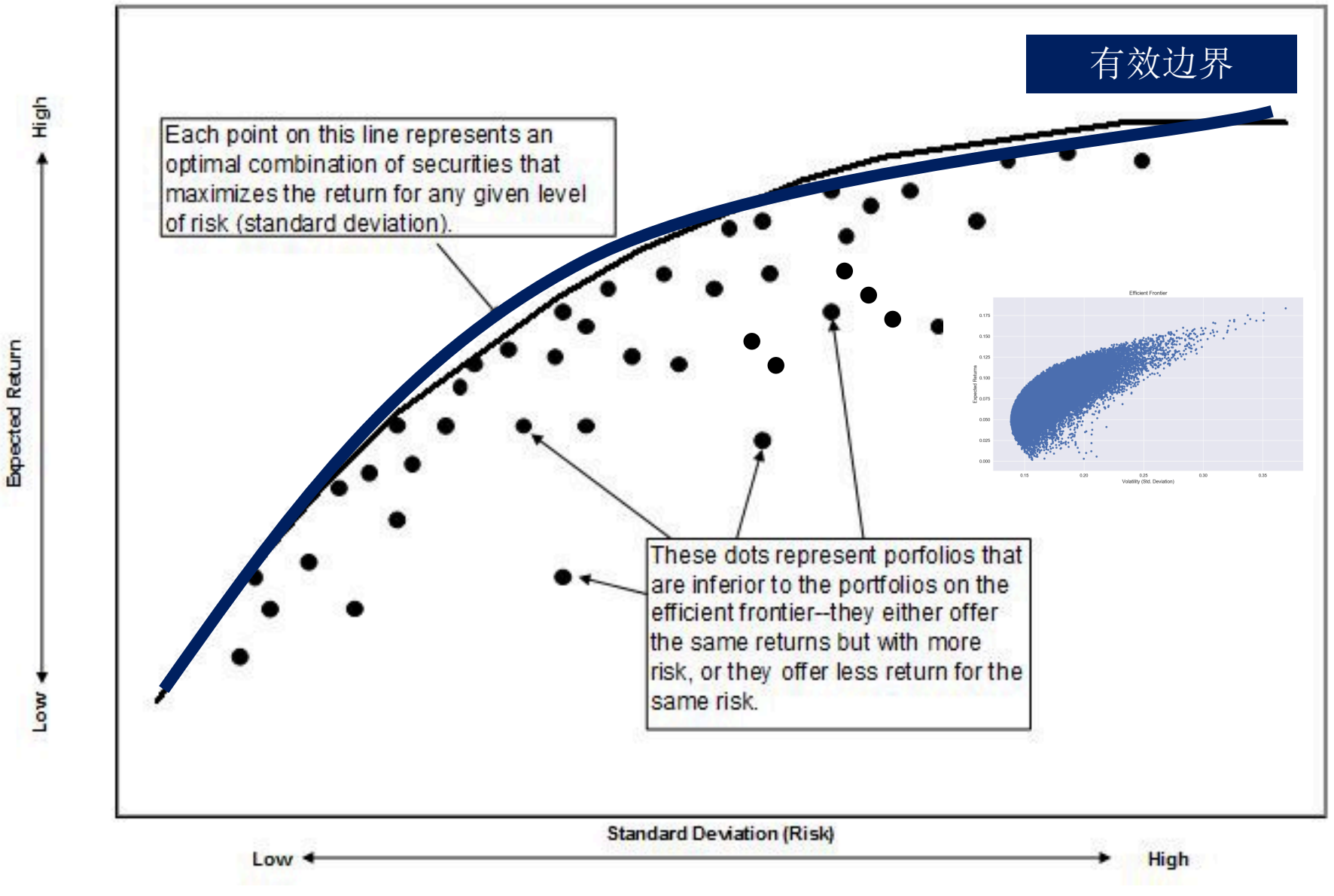


如何合理分配投资，让钱“生”更多的钱？

马科维兹均值-方差模型（Modern Portfolio Theory）

1. 投资者必须将每一种投资选择视为投资期限内预期收益的概率分布
2. 预期收益遵循的是正态概率分布
3. 投资者的效用曲线只是风险和收益的函数
4. 投资人是理性的

Black-Litterman, 高阶矩等度量



Portfolio Selection

优化目标

最小风险

$$w^{MV} = \arg\min w^T \cdot \Sigma \cdot w$$

分散投资组合

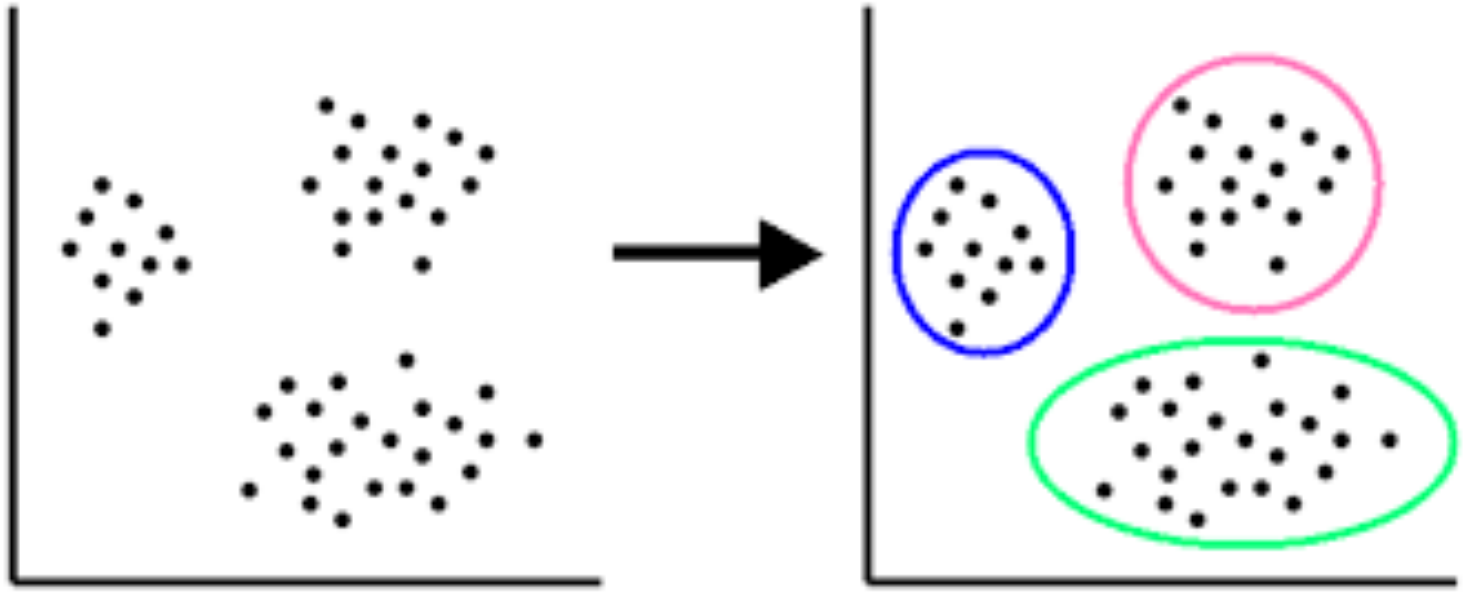
$$w^{MD} = \arg\max \frac{w \times \sigma}{\sqrt{w^T \cdot \Sigma \cdot w}}$$

每个风险资产风险均等

$$w^{ERC} = \arg\min \frac{1}{2} w^T \cdot \Sigma \cdot w - \frac{1}{n} \sum_{i=1}^{n} \ln(w_i)$$

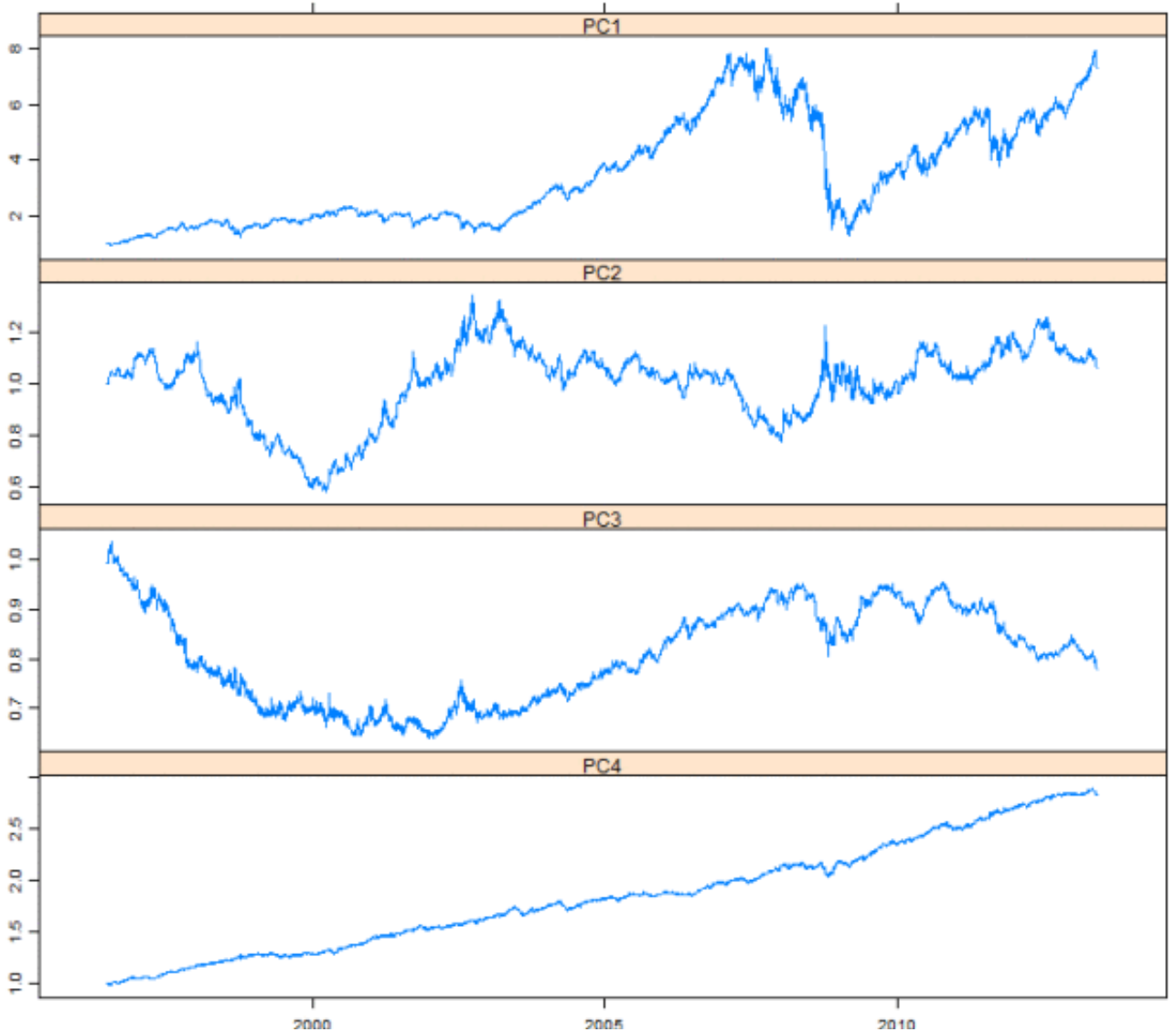
根据实际风险和收益目标

无监督学习方法



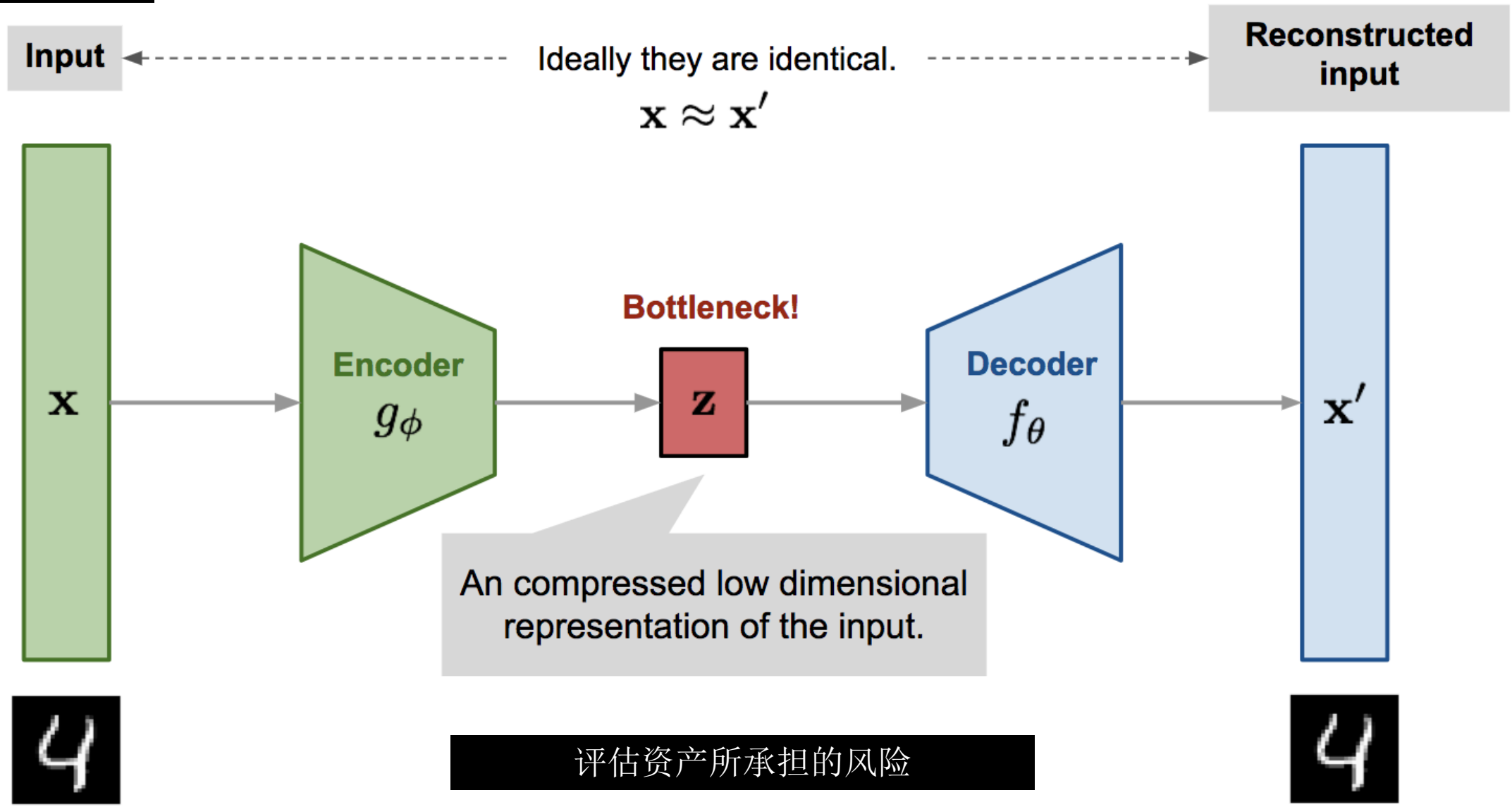
将资产尽可能地分配给表现较好的资产

主成分分析（PCA）



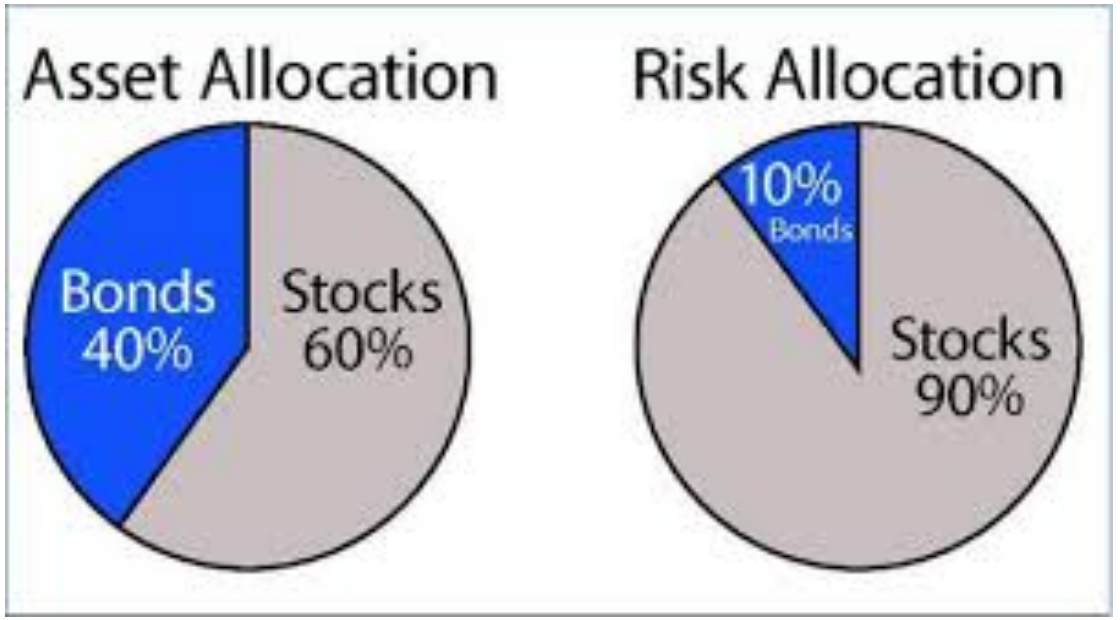
主成分：市场近似值；第二、三成分：与市场策略不相关的策略

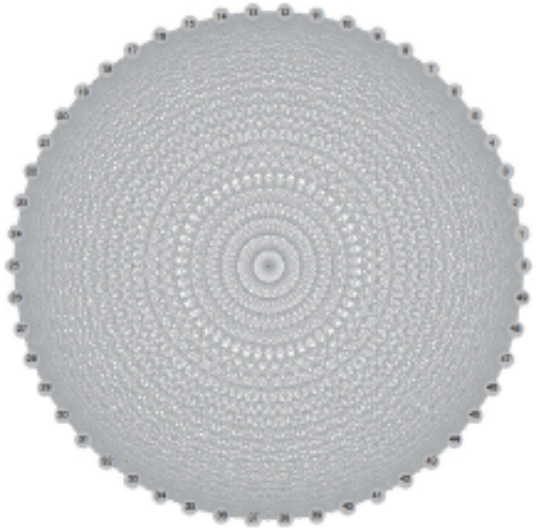
自动编码器



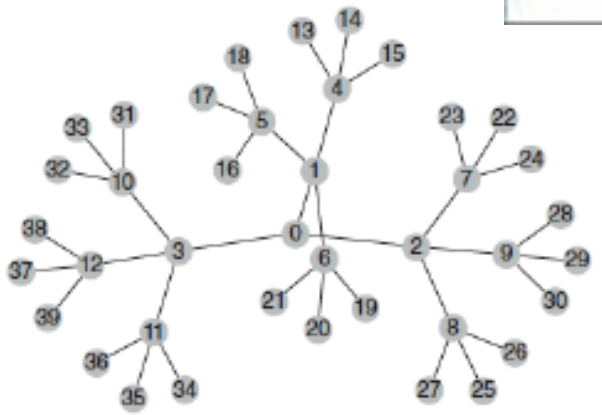
评估资产所承担的风险

分层风险平价（Hierarchical Risk Parity）





Complete graph

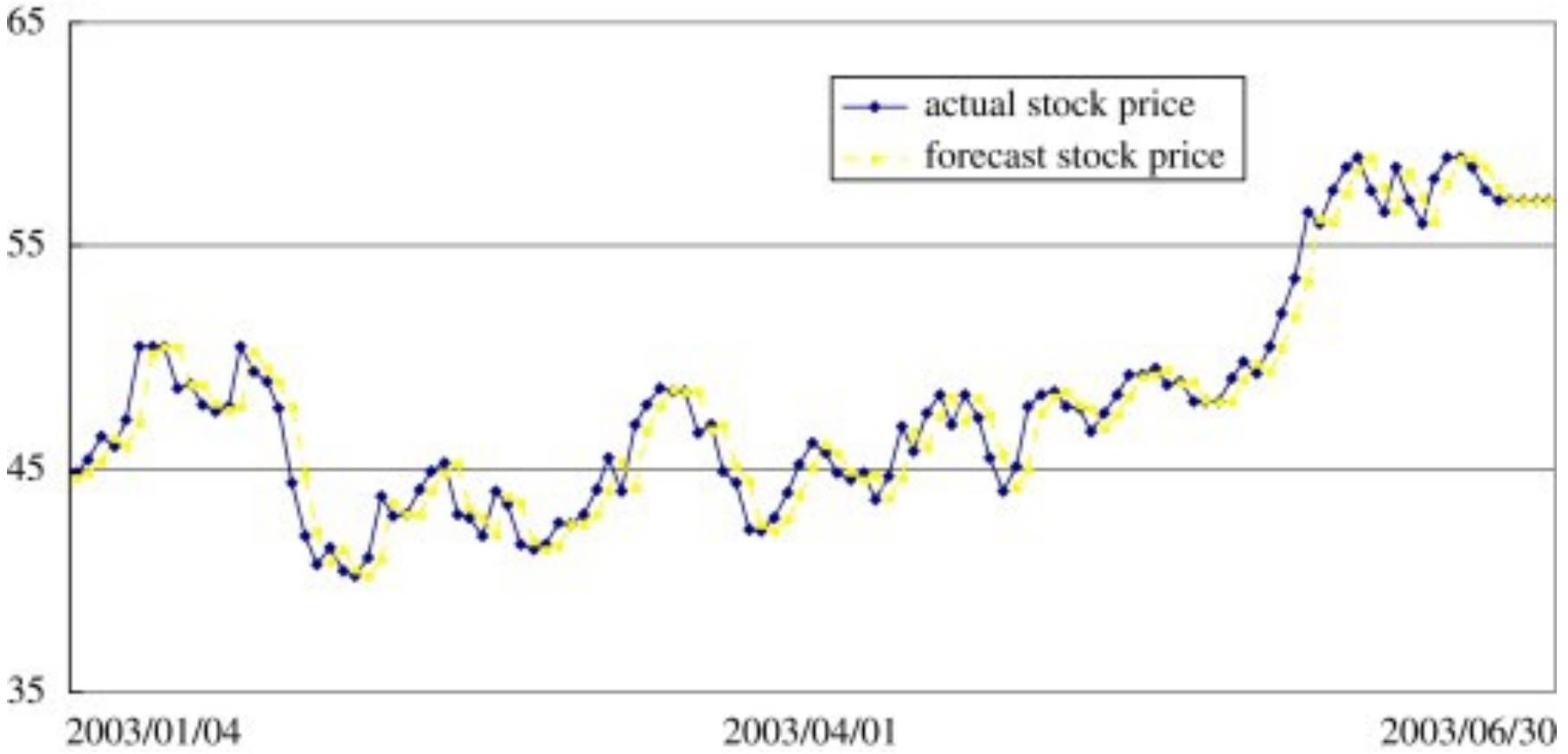


Hierarchical tree

找到最优风险权重分配树

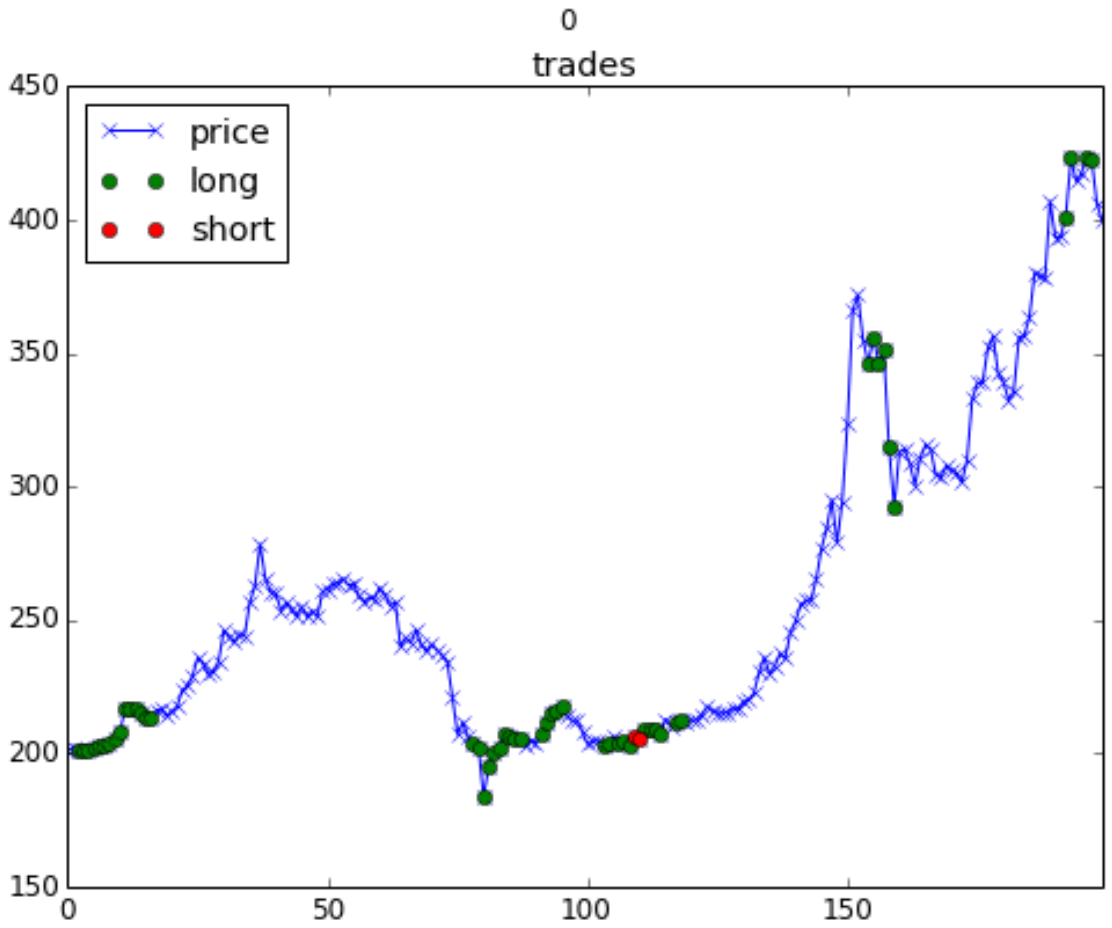
Building Diversified Portfolios that Outperform Out-of-Sample

有监督学习方法： 基于预测分配权重



使用资产价格的预测作为资产权重分配的依据

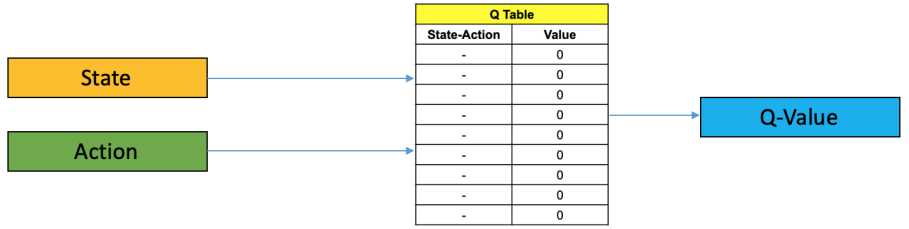
强化学习：直接学习动态改变权重的策略



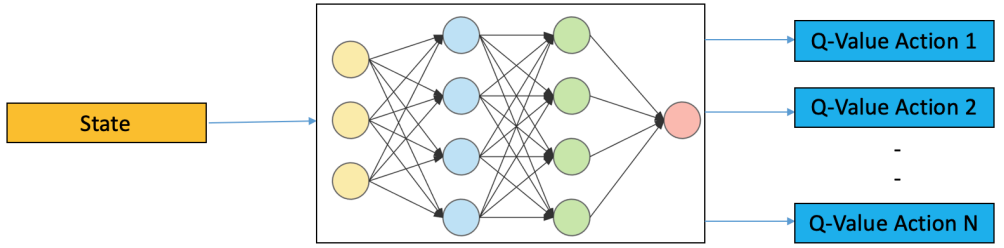
持续控制而非一次优化

Sharp ratio: $\frac{E(Rp)-Rf}{\sigma p}$

$Q(s,a)$ s_t $s_{\{t+1\}}$



Q Learning



Deep Q Learning

Reinforcement Learning for Portfolio Management

感谢聆听！