Analytics of Finance: Overview

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Outline

What are the biggest impacts AI have in the finance industry?

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What are the biggest impacts AI have in finance?

The use of artificial intelligence (AI) in finance has the potential to have a significant impact in several areas. Some of the biggest impacts include:

1. Automation of routine tasks: AI can automate repetitive tasks such as data entry and analysis, freeing up time for human employees to focus on more complex tasks.
2. Fraud detection: AI can be used to monitor financial transactions and detect fraudulent activity, which can help reduce losses for financial institutions.
3. Risk assessment: AI can be used to analyze large amounts of data and help financial institutions assess and manage risk.
4. Algo-trading: AI systems can be used in trading algorithms to analyze market data and execute trades at a faster and more efficient rate than humans.
5. Credit scoring and Underwriting: AI can help financial institutions by providing more accurate, reliable, and quicker credit scoring and underwriting services.
6. Intelligent customer service: chatbot, virtual assistants can help financial institution to provide better customer service by handling customer queries, responding to inquiries, and providing support.
7. Personalization of financial products: AI can be used to analyze customer data and help financial institutions create personalized financial products and services.

AP News

McCormick beats Street 3Q forecasts

October 02, 2014

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SPARKS, Md. (AP) — McCormick & Co. (MKC) on Thursday reported profit of $122.9 million in its fiscal third quarter.

The Sparks, Maryland-based company said it had profit of 94 cents per share. Earnings, adjusted for non-recurring costs, came to 95 cents per share.

The results topped Wall Street expectations. The average estimate of analysts surveyed by Zacks Investment Research was for earnings of 81 cents per share.

VIDEO: **Adobe 3Q Sales Miss Estimates Amid Shift to Cloud**

The spices and seasonings company posted revenue of $1.04 billion in the period, which also topped Street forecasts. Analysts expected $1.03 billion, according to Zacks.

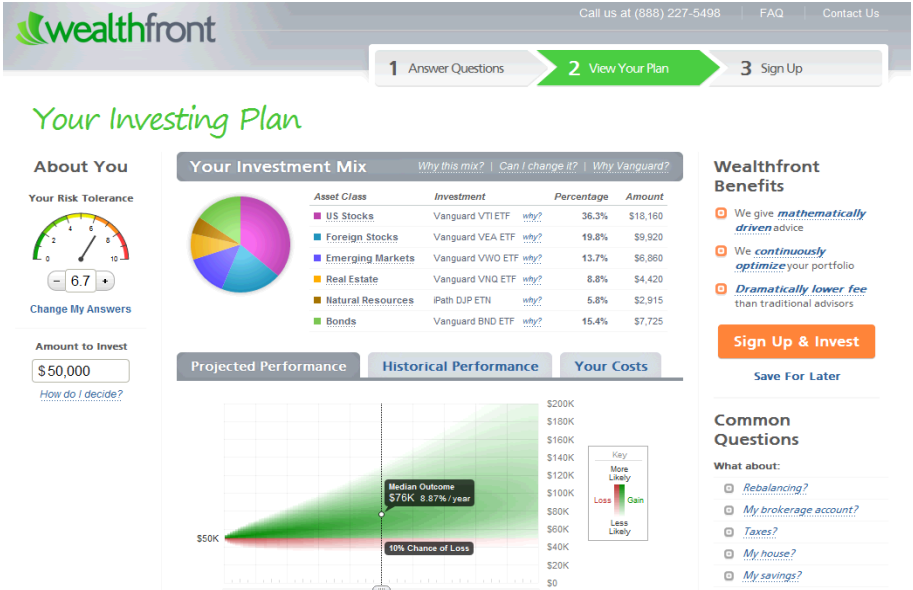
McCormick expects full-year earnings in the range of $3.30 to $3.37 per share.

McCormick shares have declined nearly 5 percent since the beginning of the year, while the Standard & Poor's 500 index has increased slightly more than 5 percent. The stock has increased 1 percent in the last 12 months.

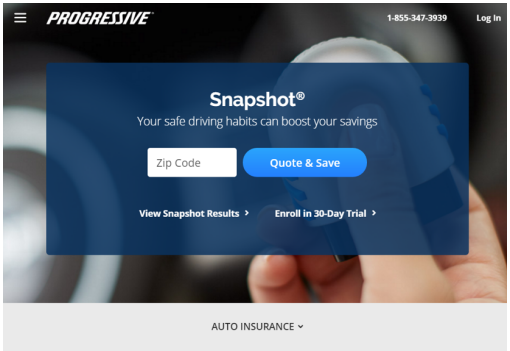
VIDEO: **H&M 3Q Gross Margin 58.3%; Est. 58.4%**

This story was generated automatically by Automated Insights (http://automatedinsights.com/ap) using data from Zacks Investment Research. Full MKC report: http://www.zacks.com/ap/MKC

Robo-advisory



Personalized insurance product

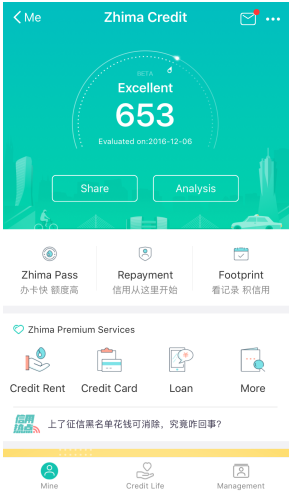


- A usage-based insurance program.
- Uses mobile app or plug-in device to monitor driving habits:
  - ↪ Speed
  - ↪ Hard braking
  - ↪ Rapid acceleration
  - ↪ Distracted driving
  - ↪ Length of driving trips
  - ↪ Time of driving trips
- About 1 in 5 customers see an increase in premium after usage.

Credit scoring

Alibaba's personal credit monitoring system

- Over 3,000 variables collected from across Alibaba's ecosystem.
  - ↪ Consumption / sales data from Alibaba (T-Mall, Taobao ...)
  - ↪ Payment / transaction data from Alipay
  - ↪ Financial data from Ant Financial
  - ↪ Other data from IOT (Wechat, Weibo ...)
- Pre-lending: credit risk assessment
- During-lending: real-time monitoring
- Post-lending: model updating

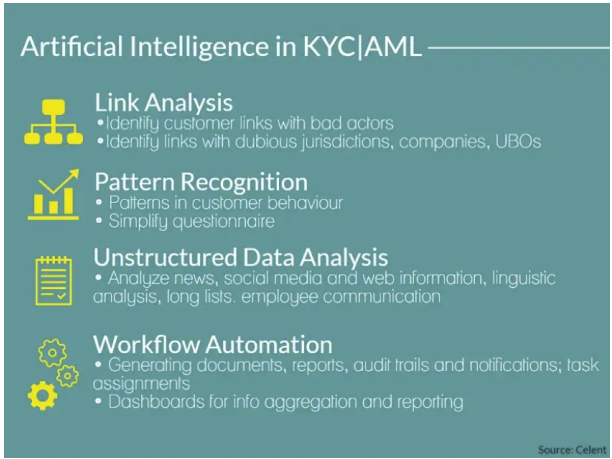


Did Target have a good quarter?

Hey Siri, should I buy Apple stocks each time a new iPhone comes out?

AI and KYC-AML

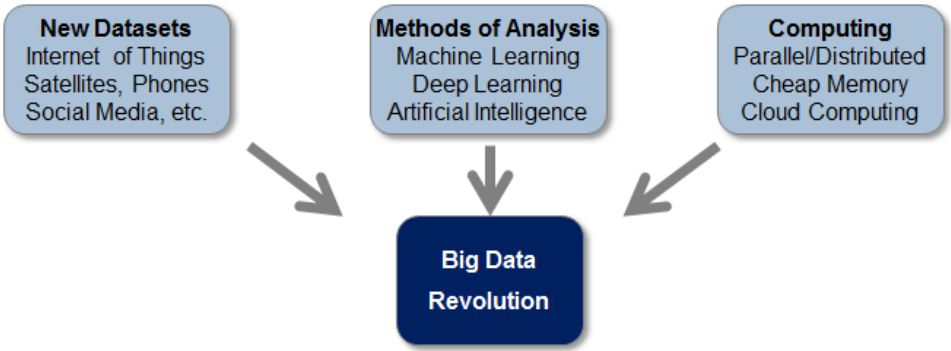
- AI offers great potential in improving the efficiency and effectiveness of regulatory compliance in financial services.



AI is changing finance in many ways

- Automated financial reporting
- Robo-advisors
- Personalized insurance
- Big data credit scoring and lending
- Quantitative investing
- “Siri” for Wall Street
- Fraud detection
- Blockchain and cryptocurrency

What make these innovations feasible?



Source: J.P.Morgan Macro QDS

What make these innovations feasible?

- Technology:
  - ↪ Mobile platforms and data connectivity revolution
    - ★ Volume: data explosion + significantly reduced cost of data storage
    - ★ Velocity: dramatic increase in the speed of data access
  - ↪ Dramatic increases in computing power (CPU, GPU, TPU)
  - ↪ Advances in algorithms to extract insights from “big data”
  - ↪ Example: The deep neural network used in OpenAI’s GPT-3, which ChatGPT builds on top of, has about **175 billion parameters** and is trained on 45 Terabytes of text.

- Regulation:
  - ↪ While traditional financial institutions are grappling with a mountain of new regulations following the Great Financial Crisis of 2008, fintech companies have largely avoided them.
  - ↪ Even fintechs that offer similar services might face different regulation.
    - ★ Example: Coinbase vs. Robinhood
  - ↪ Regulators are still trying to catch up.

How much predictability do we need?

Let's play a game by guessing the outcome of a coin flip.

- Correct: Win $100
- Wrong: Lose $100
- Opportunity to play: 1 time
- End-of-year balance:

$$100, \quad -100$$

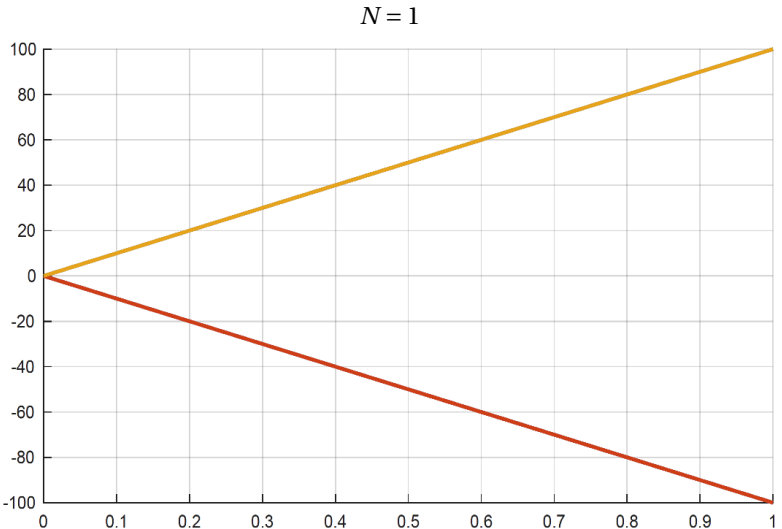
- Would you like to play this game?
- Odds:

$$51/49$$

- Expected end-of-year balance:

$$\$2 = 100 \times 0.51 - 100 \times 0.49$$

A coin-flip game



How much predictability do we need?

New rules:

- Correct: Win \$100/N
- Wrong: Lose \$100/N
- Opportunity to play: N times
- Odds:

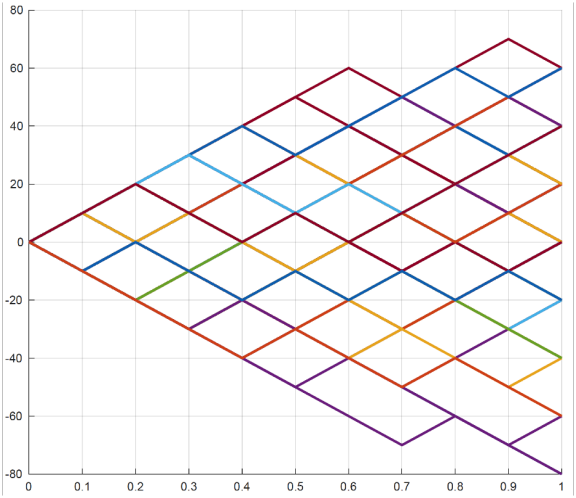
51/49

- Expected end-of-year balance:

$$\$2 = N \times \left(\frac{100}{N} \times 0.51 - \frac{100}{N} \times 0.49 \right)$$

A coin-flip game

$N = 10$



A coin-flip game

$N = 10^6$

Clip

A coin-flip game: The Lesson

- How much predictability one needs depends on the application.
- If there are few opportunities to exploit the predictability, we will need strong signals.
- If there are the opportunities are abundant and independent of each other, even weak signals could be highly valuable.

Fundamental Law of Financial Machine Learning

$$IR = IC \cdot \sqrt{\text{Breadth}}$$

Outline

Challenges for finance analytics

- What if the model is wrong?

> *"All models are wrong, but some are useful."*
>
> — *George E. P. Box*

- How can we still make good decisions when we know the model is wrong?

Correlation $\not\Rightarrow$ Causality

- Correlation can lead to prediction, which is an essential tool for finance.
- Current AI solutions in finance are good at prediction, but not at establishing causality.
- Sometimes causality really matters. The “what if” questions.

Example: option pricing

Option pricing model

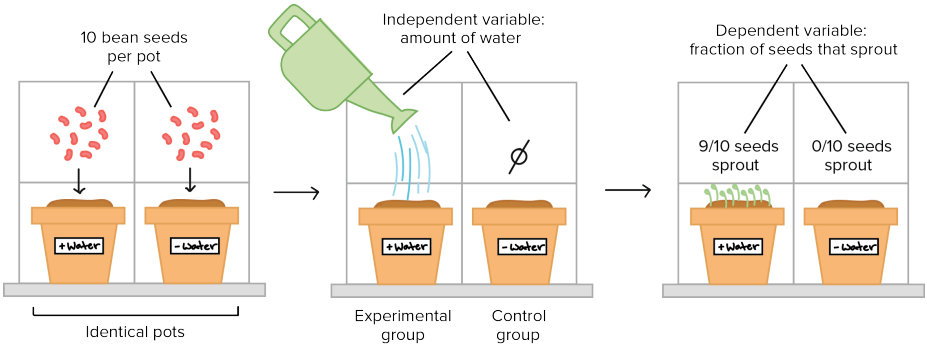
Model I: option price = Neural-Network(stock price, int rate, past return, volatility, volume, $\cdots$)

Model II: option price = $BSM(S_t, K, \sigma, r, T)$

- Which model is better?
  - ↪ What would be the price of the same option tomorrow?
  - ↪ What would be the price of an option with different maturity?
  - ↪ What if a new option product starts trading today?
  - ↪ What if the exchange implements a short-sale ban on the stocks?

How can we establish causality?

- Does water help the bean seeds sprout?



How effective is a new drug?

Y_i^T = average weight change of individuals in the group receiving treatment

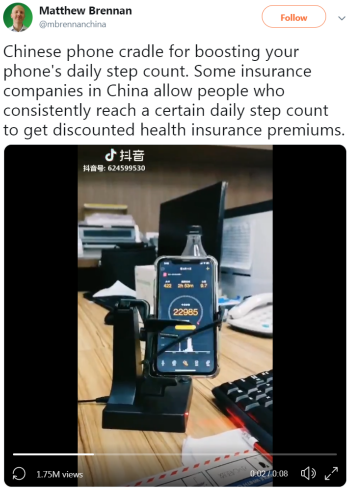
Y_i^C = average weight change of individuals in the group without treatment

$$\text{average treatment effect (ATE)} = E\left[Y_i^T - Y_i^C\right]$$

- Complication: Are those being treated the same as those who are not?

$$\begin{aligned} ATE &= E\left[Y_i^T|T\right] - E\left[Y_i^C|C\right] \\ &= \left(E\left[Y_i^T|T\right] - E\left[Y_i^C|T\right]\right) + \left(E\left[Y_i^C|T\right] - E\left[Y_i^C|C\right]\right) \\ &= \underbrace{E\left[Y_i^T - Y_i^C|T\right]}_{\text{Treatment Effect}} + \underbrace{\left(E\left[Y_i^C|T\right] - E\left[Y_i^C|C\right]\right)}_{\text{Selection Bias}} \end{aligned}$$

Where is your data from?



Link

Outline

Example: CargoMetrics

Strategies based on alternative data

- Maritime data from the global Automatic Identification System (AIS)
  - ↪ Since 2004, vessels with 300 or more gross tonnage are required to flash AIS positioning signals every few seconds to avoid collisions.
  - ↪ CargoMetrics gains access to such signals through satellite companies.

Summary

What should you expect from this course?

1. Techniques for building financial models and analyzing financial data.
   ↪ Get your hands dirty.
2. Intuition based on a deep level of understanding of the theory.
   ↪ “The Grandma Test”
3. Bridge the gap between theory and practice.
   ↪ Think big!

Readings

- Hernandez, et al. (2010): Unleashing the Power of Public Data for Financial Risk Measurement, Regulation, and Governance
- Anderson (2008): The end of theory: The Data Deluge makes the scientific method obsolete
- Harford (2014): Big data: are we making a big mistake?