Charting the Future:
How Digital, Intelligent & Green Tech are Reshaping Chinese Banking

Chen Sichong

School of Finance, Zhongnan University of Economics and Law

July 8th, 2025

陈思翀

博 文 明 理 · 厚 德 济 世

Instructor's CV

- **Chen Sichong**, Professor, School of Finance, Zhongnan University of Economics and Law; Director of the Finance Department; Executive Head, Virtual Teaching and Research Section for Banking Management Courses of Ministry of Education of China; Executive Director, ESG Research Institute.

- Ph.D. in Finance; Assistant Professor, Graduate School of Commerce and Management, Hitotsubashi University; Visiting Professor, Warrington College of Business, University of Florida; Deputy General Manager of the Personal Credit and Housing Finance Department, China Construction Bank (Hubei).

- Current Research Focus: Banking and financial markets, emerging risk management in International Finance.

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数字技术与
现代银行业导论

AN INTRODUCTION TO
DIGITAL TECHNOLOGY
AND MODERN BANKING

本书具有以下特点：

◎ **全面系统**。对现代银行业经营中数字技术的底层逻辑及其应用场景进行了系统梳理。不仅阐述了数字技术的原理、特性及其应用，还从经济学理论角度揭示出数字技术如何重塑银行业的规模经济和范围经济。此外，书中探讨了数字技术在银行业务的多个关键领域—包括营销、授信和风控等—的全过程应用，并提供了丰富的银行数字化转型实践案例。

◎ **紧跟实践变革**。银行数字化转型中，"人"尤为重要。本书紧跟大数据＋人工智能等数字技术给现代银行业带来的深刻变革，聚焦商业银行数字化经营中复合型人才的培育，旨在培养学生根据银行数字化经营的业务场景，匹配和应用"数字素养"。

◎ **理论与实践并重**。几位作者深耕相关学术领域多年，其深厚的研究功底为分析提供了坚实的理论支撑。同时，他们都具有国有大行的挂职工作经历，并多次开展银行内部培训，对现代银行业数字化经营场景进行了深入的观察和思考，确保本书内容与银行业实践紧密结合。

AN INTRODUCTION TO
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——陈思翀　白小滢　董志华　主编——

陈思翀　白小滢　董志华　主编

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董志华，男，中南财经政法大学金融学院副教授、硕士生导师，路易斯安那大学拉斐特分校数学专业博士；曾就职于美国知名咨询公司任商业数据分析师，挂职于中国建设银行湖北省分行任金融科技部副总经理；主持或参与多项国家级与省部级研究项目，发表多篇论文；曾获全国青教赛二等奖、湖北省青教赛一等奖，湖北省青年教学能手等荣誉。

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An Introduction to Digital Technology and Mordern Banking

1. Comprehensive and Systematic Analysis

It systematically examines the underlying logic, technical principles and application scenarios of digital technologies in modern banking.

It reveals how digitalization reshapes banking economies of scale and scope from an economic theory perspective.

2. Multi-Domain Coverage

Covers digital applications in core banking functions (marketing, credit granting, risk control) with real-world cases.

Explores innovative practices in rural revitalization, ESG, green/low-carbon development, and modernizing social governance.

3. Focus on Human-Centric Transformation

Addresses profound impacts of digital technologies (e.g., big data + AI) on banking.

Emphasizing cultivation of interdisciplinary talent to trains students to apply digital literacy within business contexts of bank digitalization.

4. High Practical Utility

Serves as both an accessible textbook for university economics and finance programs and an essential training reference resource for banking professionals navigating digital transformation.

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ESP

碳金融和碳交易系列丛书

气候变化
与可持续发展银行

CLIMATE CHANGE AND
SUSTAINABLE BANKING

气候变化与可持续发展银行

庄子罐 陈思翀 编著

气候变化
与可持续发展银行

CLIMATE CHANGE AND
SUSTAINABLE BANKING

庄子罐

中南财经政法大学金融学院教授、博士生导师，中南财经政法大学碳交易与碳金融研究中心主任；武汉大学金融学博士、北京大学博士后；主持国家社科基金、国家自然科学基金、教育部人文社科基金等项目，参与国家社会科学基金重大项目和教育部哲学社会科学研究重大课题攻关项目。在宏观经济政策、碳市场与碳金融、低碳转型与绿色发展等领域积累了丰富的学术研究、政策咨询和项目研究经验。

陈思翀

中南财经政法大学金融学院教授，博士生导师，中南财经政法大学碳交易与碳金融研究中心副主任；日本一桥大学商学金融博士；曾任日本一桥大学商学院讲师、美国佛罗里达大学惠灵顿商学院访问教授；挂职中国建设银行湖北省分行住房金融与个人信贷部副总经理；主要研究领域为国际金融、资产定价、金融机构、金融领域的政治经济学以及碳金融。主持国家自然科学基金、国际合作科研基金、教育部留学回国基金等项目；主要成果发表于中英文权威期刊以及《财经》、《经济日报》、《证券日报》等大众传媒

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My working experience in CCB

CCB's Production Park near ZUEL across the south lake

(Direction from Wentai Building to the Park)

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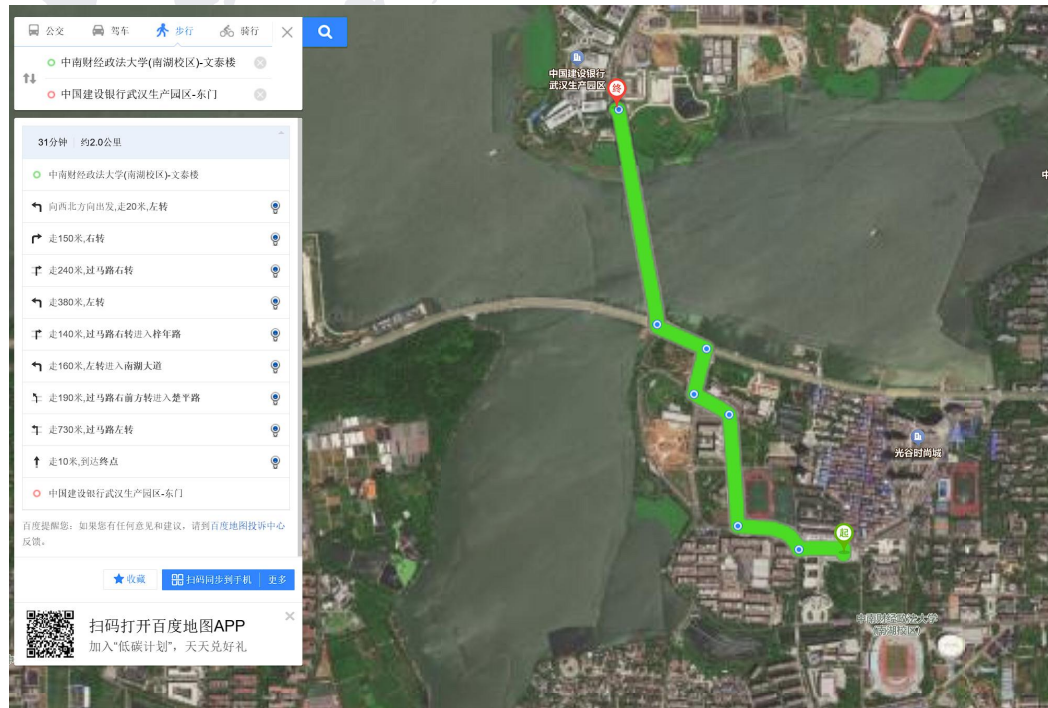
Contents：

1. Understanding the Era's Characteristics and the Wealth Code
    Digital, Intelligent, and Green Transformation

2. New Paradigm, New Tools, and New Framework
   I.   New Paradigm: Digital Technologies & Unstructured Data
   II. New Tool: Fine-Tuned Large Financial Models & AI Agents
   III. New Framework: Green Finance and Sustainabable Development

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Part I

New Paradigm: Digital Technology and Unstructured Data

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Question：

Why did banks traditionally prefer to serve large clients rather than retail and inclusive clients?

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The "impossible trinity" in the traditional business model of banks

Cost

Quantity

Quality

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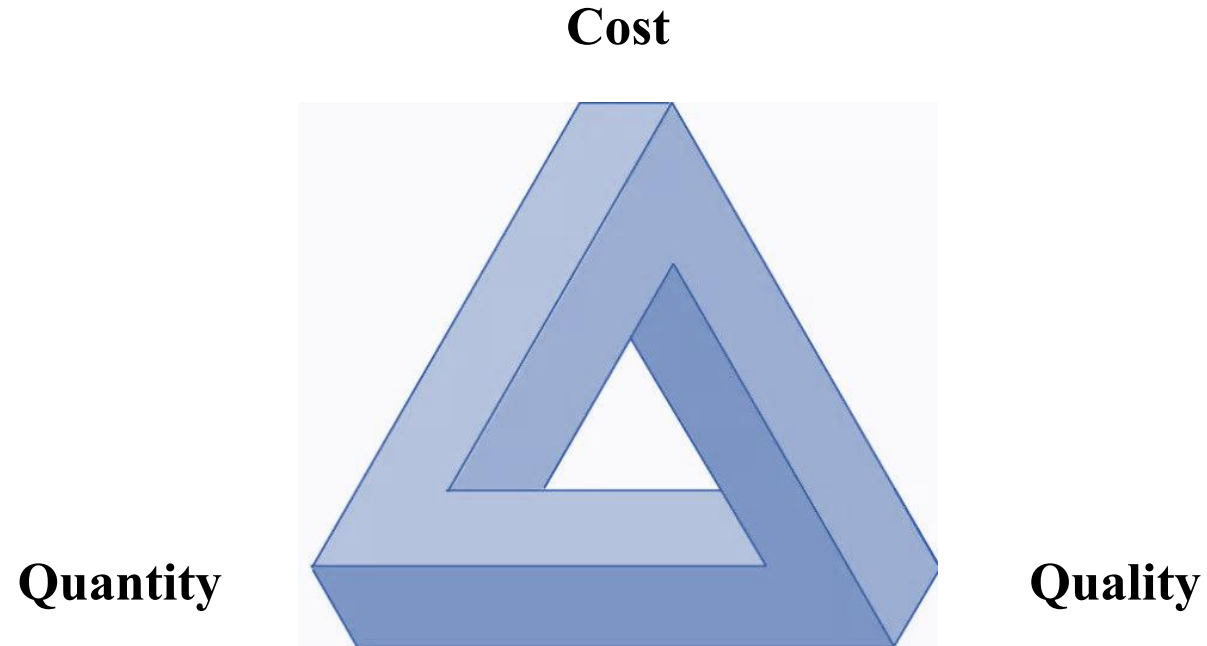
Question：

Why are banks shifting toward retail businesses and wealth management while undergoing digital transformation?

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Big Data + AI

**Economies of scale and scope
under digital technologies**

Digital platform

Economies of Scope: Connecing (G)overnment, (B)usiness and (C)onsumer.

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Question:

How should banks conduct digital transformation?

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Transformation of Service Mode and Target

MOde

Open

Private

Changing model

||

Increasing efficiency

|

Expanding customer segments

|||

Large clients   Retail clients

Target

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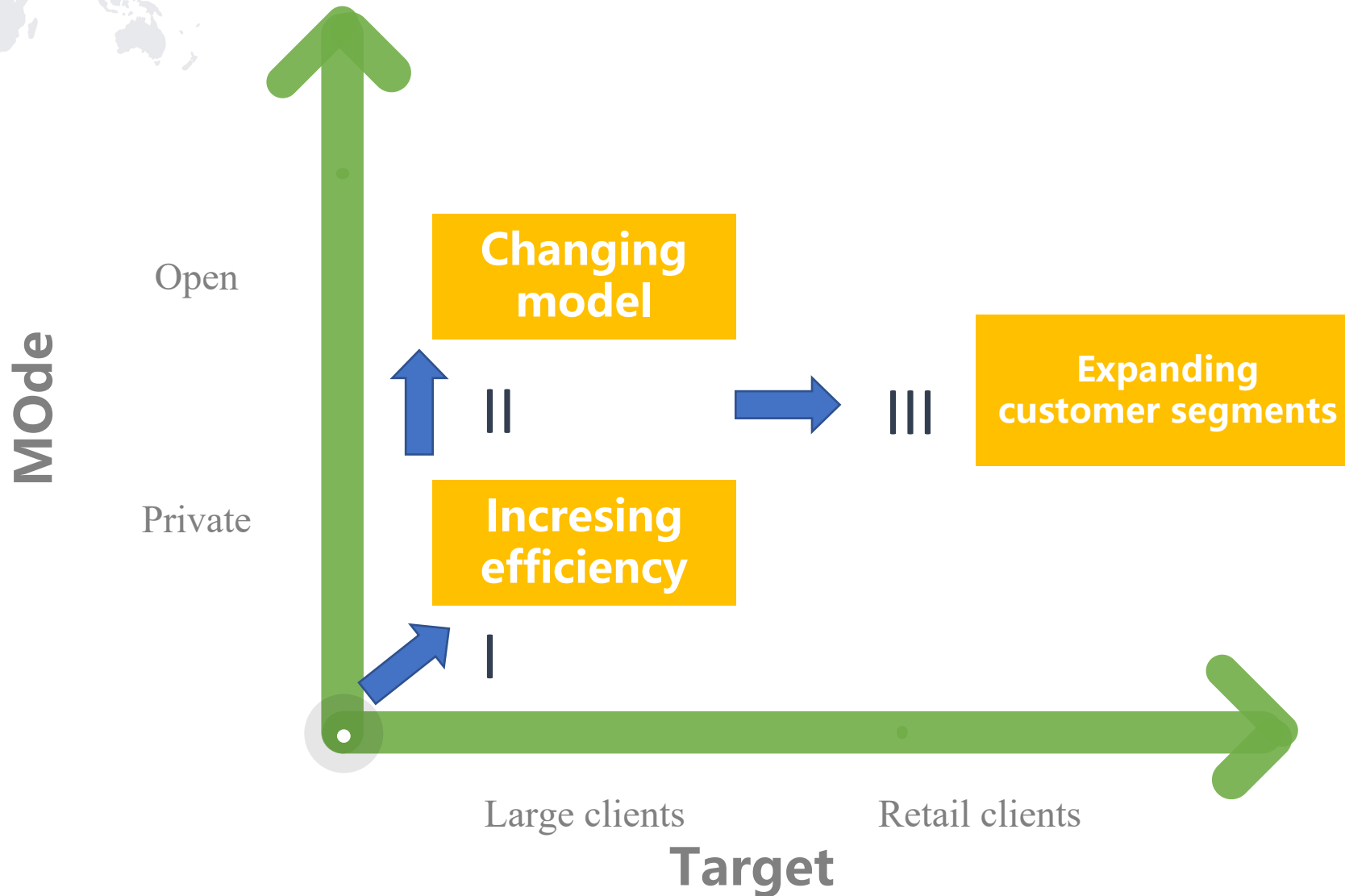
The New Paradigm of "Big Data + Artificial Intelligence"

- What is the new paradigm of "Big Data + Artificial Intelligence" good at?

- 1. Prediction (e.g., whether marketing campaigns will succeed, the probability of corporate default, etc.)

- 2. Data generation (e.g., customer emotions in text and voice, etc.)

- Example: PDD

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EDITED TRANSCRIPT

CORPORATE PARTICIPANTS

- Lei Chen - PDD Holdings Inc -Chairman of the Board, Co-Chief Executive Officer ⊖

- Jiazhen Zhao - PDD Holdings Inc -Co-Chief Executive Officer, Director ⊕

- Jun Liu - PDD Holdings Inc -Vice President - Finance ⊕

CONFERENCE CALL PARTICIPANTS

- Joyce Ju - BofA Global Research -Analyst ⊖

- Yang Bai - China International Capital Corporation (Hong Kong) Limited - Analyst

PRESENTATION

Operator

Ladies and gentlemen, thank you for standing by, and welcome to PDD Holdings Inc., second-quarter 2024 earnings conference call. (Operator Instructions) Please be advised that today's conference is

I would now like to hand the conference over to your host today. Sir, please go ahead.

Unidentified Company Representative

Thank you, operator. Hello, everyone, and thank you for joining us today. PDD Holdings' earnings release was distributed earlier and is available on our website at investors.pddholdings.com, as well as

Before we begin, I would like to refer you to our Safe Harbor statement in earnings press release, which applies to this call, as we will make certain forward-looking statements. Also, this call includes dis measures.

Joining us today on the call are Mr. Chen Lei, our Chairman and Co-Chief Executive Officer; Mr. Zhao Jiazhen, our Executive Director and Co-Chief Executive Officer; as well as Ms. Liu Jun, our VP of Fina financial results for the second quarter ended June 30, 2024.

During the Q&A session, Lei and Jiazhen will answer questions in Chinese that will help translate. Please kindly note that the English translation is for reference only. And in case of any discrepancy, stat

2025-7-8   陈思翀   17

"Over the past few quarter, the competition has been intensifying, which is natural to the e-commerce sector. In such a competitive environment, our revenue growth may slow down. For instance, in the second quarter, our revenue growth declined indicating that high revenue growth is *not sustainable*."

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What is new about the "Big Data + Artificial Intelligence" paradigm?

The new AI paradigm of machine learning focuses more on whether conclusions can be extrapolated—the model's **generalization** ability.

Take an example: Chang'e-6 has successfully collected soil samples from the far side of the Moon—a region never before visited by any spacecraft.

Similarly, banks hope algorithms trained on existing customers' big data will help them acquire new customers and manage unknown risks.

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Basic Principles of the New Paradiam

- If you have a background in economics, management, or finance: Knowledge graphs must include Econometrics.

- Or, if you have a background in other social sciences or natural sciences: Statistics.

- The focus of econometric analysis: *Estimation* and *Inference*.

- For example, you often see or hear like this: $\beta = 1.5$; β is significant at the 5% level.

- Linear regression： $Y_i = \beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki} + \varepsilon_i$

- Parameter estimation： $\boxed{\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i} + \cdots + \hat{\beta}_{ki} X_{ki}}$.

- Minimization based on the following formula： $\sum (Y_i - \hat{Y}_i)^2$.

- After estimating the parameters, for brand-new X (data), it is the prediction of $\hat{Y}_i$.

- Econometrics focuses on parameter estimation $,\hat{\beta}$ while machine learning focuses on $\hat{y}$.

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Procedures to conduct the new paradiam

- **Three steps：**

Representation → Training → Testing
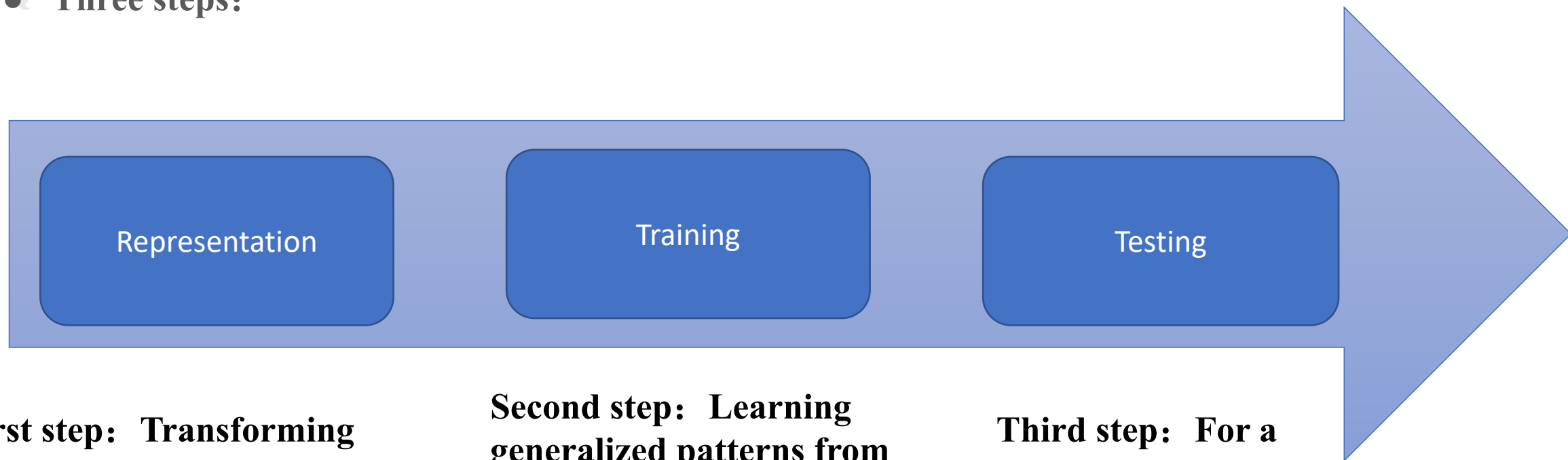
First step：Transforming data objects into feature vectors (feature learning)

Second step：Learning generalized patterns from sample datasets
Objective: This pattern applies not only to training data but also to unknown data (hence called generalization ability)

Third step：For a new data sample, use the learned model to make predictions.

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Features

Objective: In machine learning for image recognition, identify cat images from a dataset.

Method: Extract features from these images, such as leg length, nose size, ear size, etc. (these are equivalent to explanatory variables in econometric analysis or features in machine learning)

Features:

Selection: Determine which features best represent the data.

Representation: Decide how to encode these features.

Example: A two-dimensional feature vector: [Head shape: round, Color: gray-scale].

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If the test sample is this cat, is it a cat?

Suppose all images in the training samples are of the aforementioned cat breed. After multiple rounds of iterative training, the model is well-trained and performs well on the training set. Essentially, all characteristics of this cat are incorporated, even the cat's color.

It is very likely that the model's output

 will be: This is not a cat!
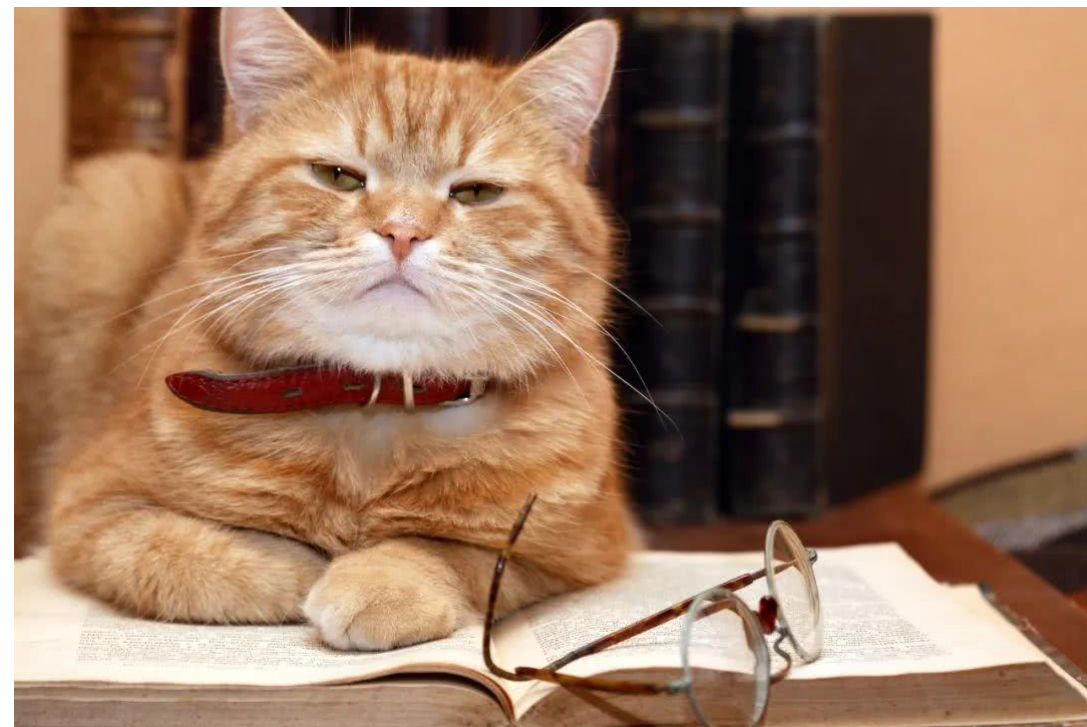
Felids exhibit medium to large-sized bodies with uniform torsos, moderately long limbs, digitigrade posture, large rounded heads, and relatively short snouts.

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Is it a cat?

Felids exhibit medium to large-sized bodies with uniform torsos, moderately long limbs, digitigrade posture, large rounded heads, and relatively short snouts.

VSM

Following feature engineering, it is often necessary to construct a **Vector Space Model (VSM).**

This is because computers can process numerical values, not unstructured data such as images or text. However, in the modern era of big data, unstructured data is the most abundant.

VSM is typically responsible for converting various formats of **(un)structured data** (numbers, text, images, audio, video) into vectors. These vectors are then input into machine learning programs for processing. Once the data is transformed into VSM, the machine learning program feeds it into algorithms to generate models through computation.

Example: Pixels are converted into a matrix, and then into a vector.

Labeling in supervised learning

Labeling images, which are divided into two categories: cat or not a cat.

data   label

⟶ **cat !**

⟶ **Not a cat !**
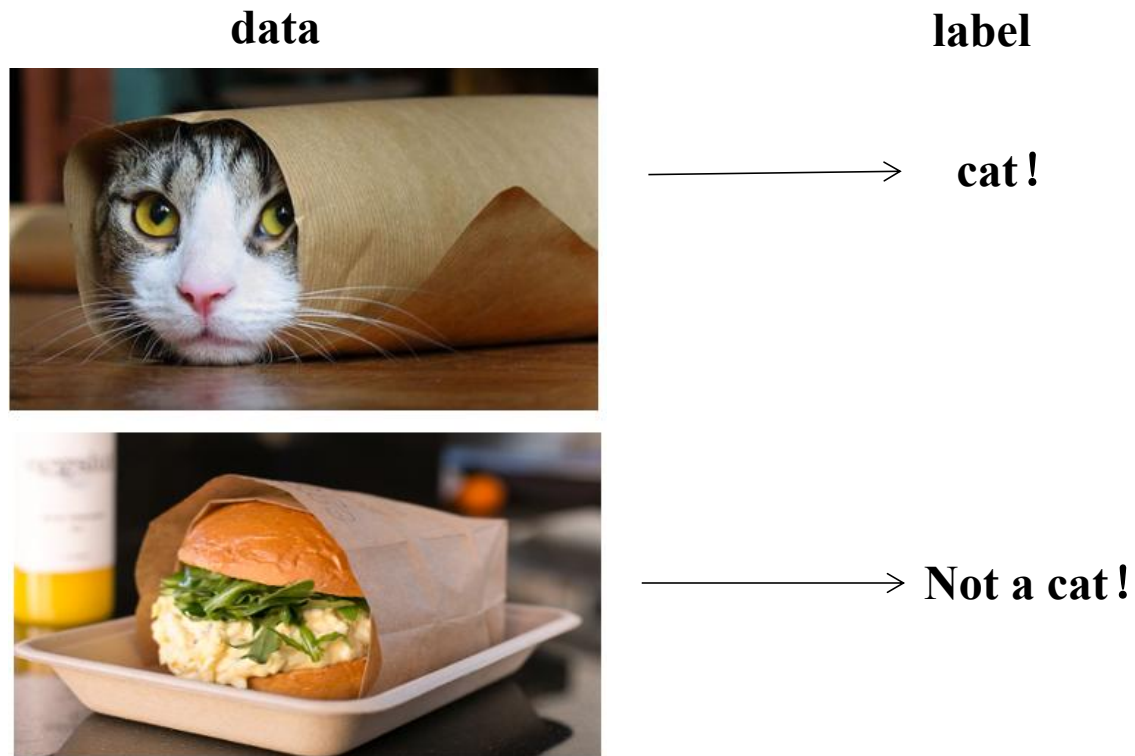
(Manual) data annotation: labeling

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Ready, let's train to get the model
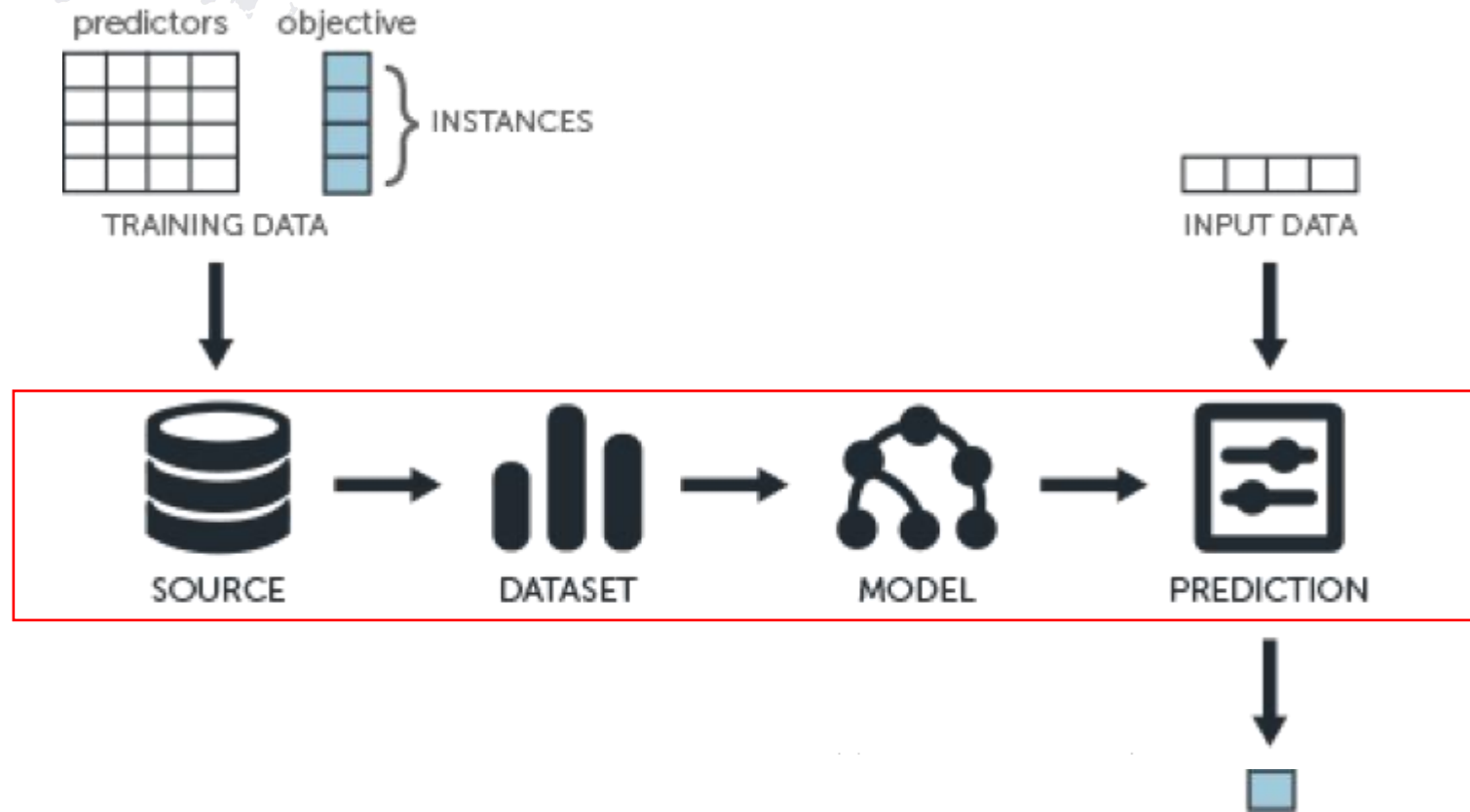
A model (Model) is the function y=f(x) and the outcome of machine learning.

This learning process is called training (Train). Training refers to the process of calculating the specific values of each parameter based on the specified specific type of f(x) and combined with training data.

The training process requires computation based on certain rules. These rules are what we call algorithms.

Three elements of machine learning: big data, algorithms, models.
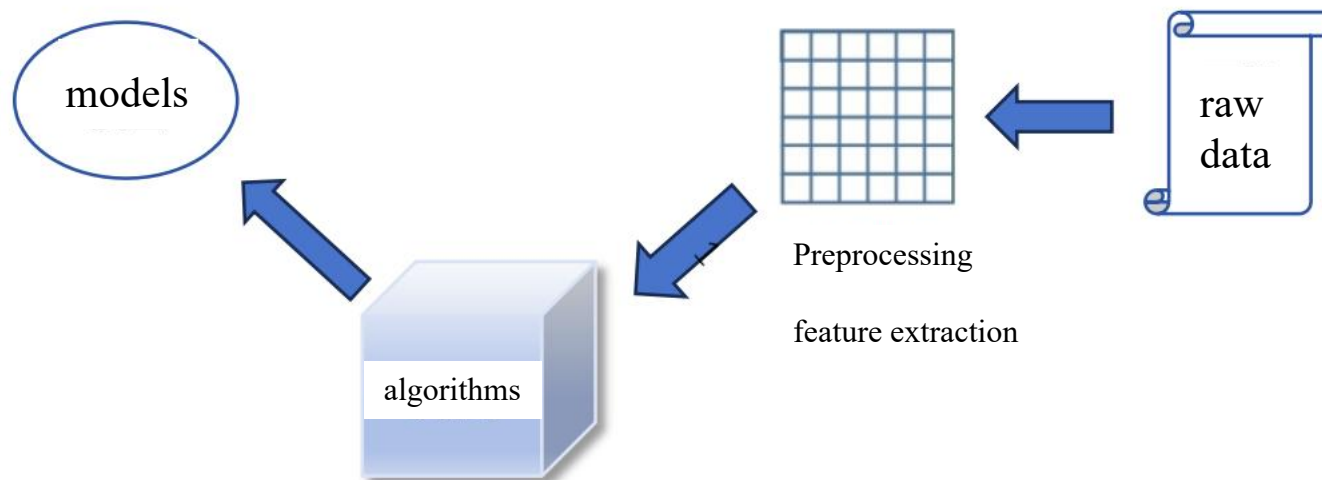
Algorithms generate models by performing computations (computing power and electric power) on big data .

- To achieve better prediction, machine learning will do whatever it takes—even abandoning interpretability.

- For example, instead of using full-sample regression (classification), it randomly samples from raw samples and features, obtains regression (classification) results from N samplings, and then takes the average (or voting).
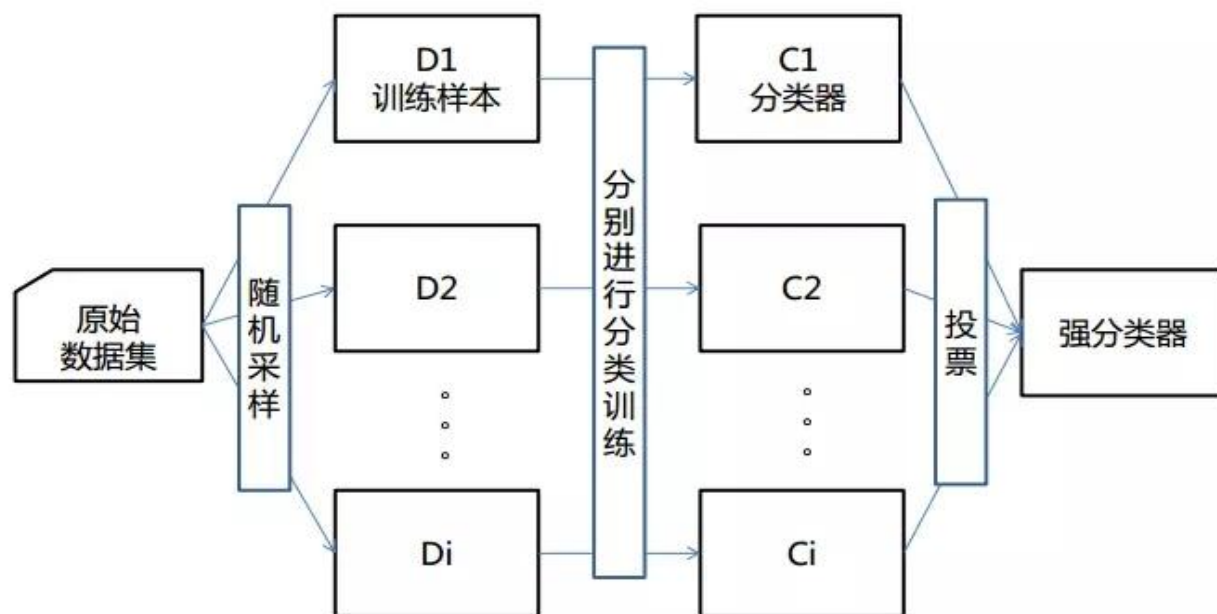
- This is the so-called "ensemble algorithm", with the representative algorithm being Random Forest.

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- To automatically extract features and enhance generalization ability, machine learning algorithms can also adopt multi-layer nesting of algorithms.
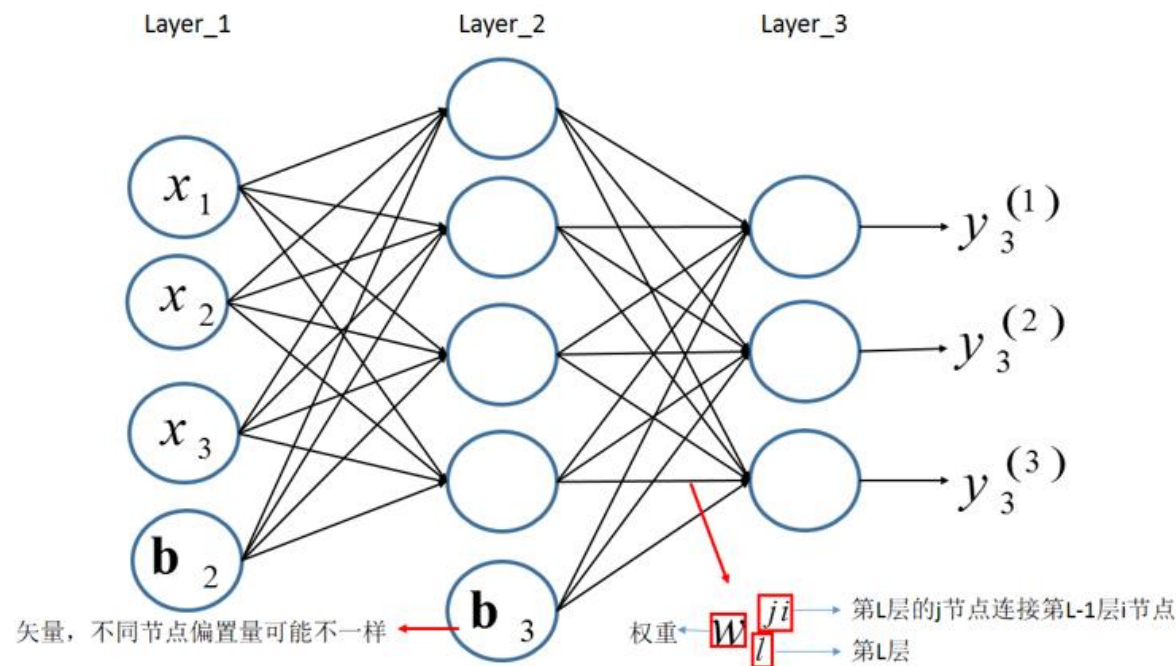
- This is what is known as "deep learning" algorithms, with representative ones including "Deep Neural Networks" (DNN) and "Recurrent Neural Networks" (RNN).
- Abstraction, iteration, and layering: raw signals → preliminary processing → abstraction → further abstraction

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Deep learning

$[a_1, ..., a_{64}] = [0, 0, ..., 0, \mathbf{0.8}, 0, ..., 0, \mathbf{0.3}, 0, ..., 0, \mathbf{0.5}, 0]$
(feature representation)

Features learned from training on different object classes.

Faces　Cars　Elephants　Chairs
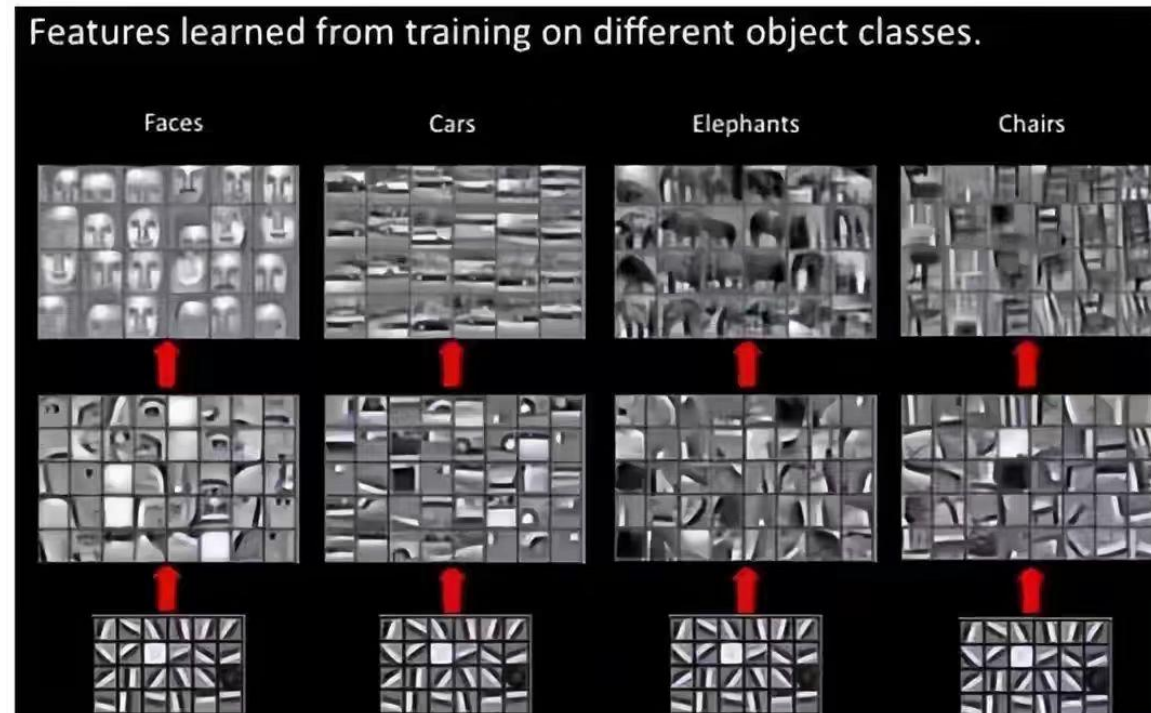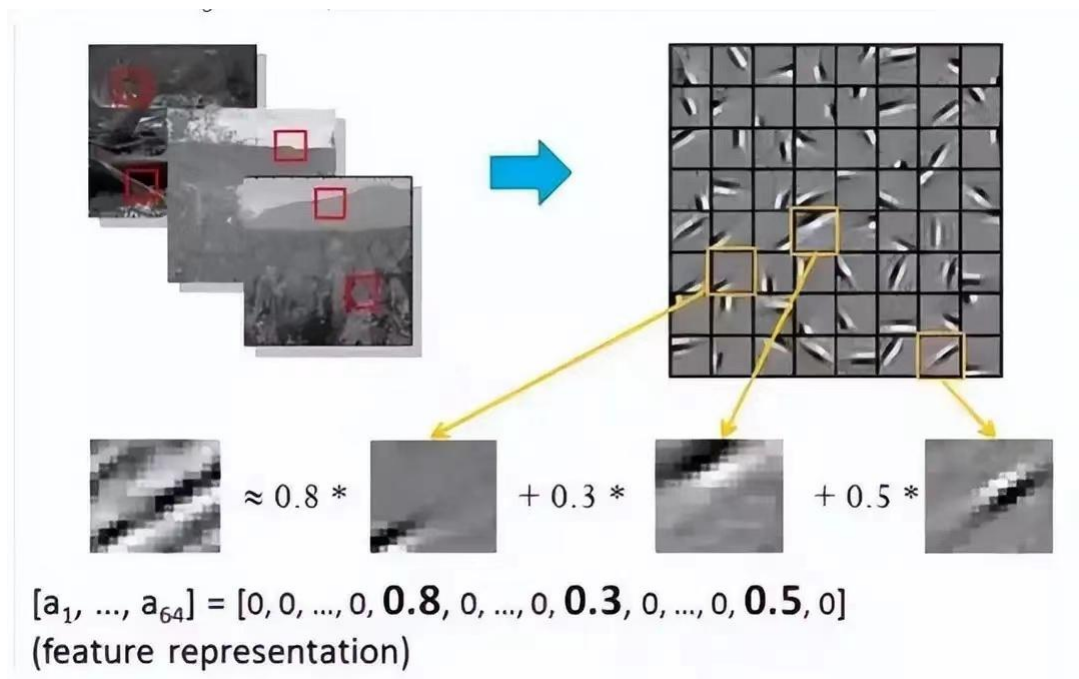
From Deep Learning to Large Language Models

Deep learning models are the means; feature learning is the purpose!

By constructing multi-layer machine learning models and utilizing vast amounts of training data, we can learn meaningful representations to ultimately enhance classification or prediction accuracy. For instance: character → word → sentence → topic → document.

1. For unlabeled data, employ unsupervised learning to extract features；

2. Generate hierarchical features via encoders, train each subsequent layer progressively；

3. Apply supervised fine-tuning；

However, word-by-word translation yields suboptimal results and is computationally inefficient.

The advent of the self-attention mechanism ("Attention Is All You Need") gave rise to Transformer-based large language models (e.g., DeepSeek, ChatGPT, BERT).

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For the banking industry

Although developing new algorithms is technically demanding and well-compensated, pre-built machine learning models are often available, eliminating the need for custom coding.

For instance, programming languages like Python enable even non-experts to execute algorithms effortlessly.

The key for banks to survive in the digital era lies in big data（including collecting and governing data, feature learning and labeling）

Machine learning is often applied to unstructured data.

Data acquisition, parsing, and cleaning consume the majority of time (up to 99%).

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Where does big data come from?

1. Behavioral Frequency Analysis

 When was the last time you:Visited a bank branch? Purchased movie tickets?Bought coffee? Opened WeChat?Used Taobao?Scrolled through Douyin?

2. Traditional Banking Services Low-frequency interactions inherently limit big data generation.

3. High-Frequency Scenarios Only recurrent user interactions create viable big data ecosystems.

4. Non-Financial Contexts True big data emerges predominantly from non-banking domains.

Where is the big data?

- As early as 2019, CMB was China's largest coffee retailer, selling 80,000 cups daily (Wu Gang).Additionally, it ranked as:China's 2nd-largest travel booking platform China's 3rd-largest movie ticketing platform.

- CMB's Strategy: From Finance to Lifestyle, From Low-Frequency to High-Frequency，Expanding and enriching non-financial scenarios to create a vibrant bankingecosystem。

- Ping An：Integrated Tech & Data-Driven Operations Headquarters-led tech support Internal data connectivity & collaboration Directly managed dedicated managers

- WeChat: Social platform ByteDance: Douyin (TikTok) platform Ant Group: Taobao platform JD.com: E-commerce platform；

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Why do banks provide lifestyle services?

CMB

CCB

Meituan

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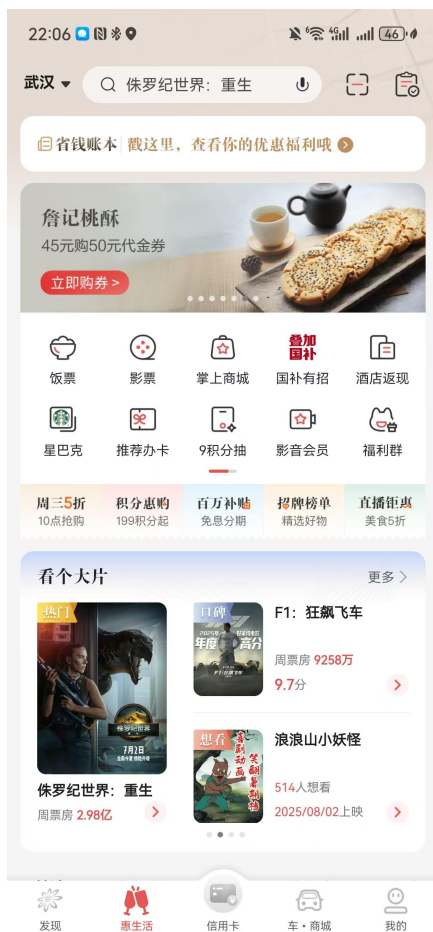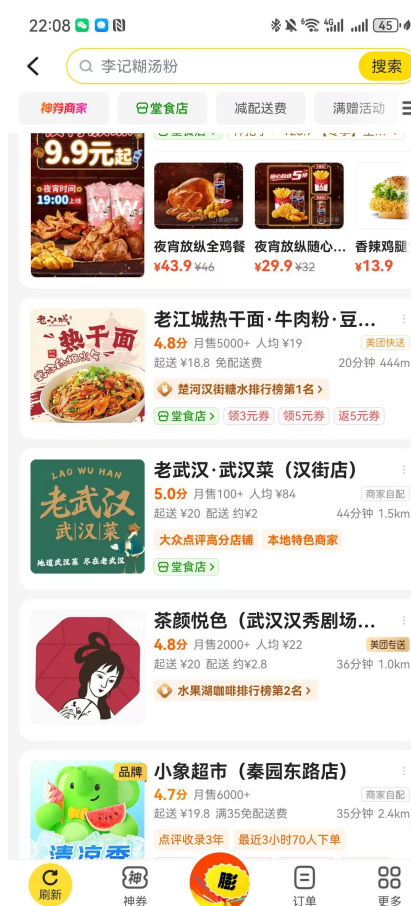
Ant Group's prospectus

- Ant Group positions itself as a **technology company** that provides platforms and tools for its financial institution partners. Supported by intelligent business decision-making solutions, dynamic risk management solutions, and technological infrastructure, financial institutions offer credit, wealth management, and insurance services through Ant Group's platform。

- Leveraging the extensive reach of the Alipay platform, Ant Group is committed to building the "capillaries" of financial services, serving as a strong complement to the "aorta" of financial institutions' operations. Through its platform model, it helps financial institutions expand user reach, gain technical support, achieve more efficient resource allocation, and fulfill the social goals of inclusive and sustainable development.。

Ant Group's Letter to Investors

- Ant Group is neither a financial institution nor merely a mobile payment company, but a technology firm determined to leverage today's best technologies and resources to empower banks and financial institutions to better serve every consumer and every small and micro enterprise。

- Ant Group has now evolved into a technology company with three core pillars: digital payment, digital financial technology platform, and digital life services... Going forward, it will continue to invest in technology, allocate 0.3% of its annual operating revenue to public welfare initiatives, plant an additional 1 billion trees within 10 years to promote green development, and collaborate with more partners to continuously solve problems and create greater markets and opportunities through technological innovation。

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Customer experience represents a goldmine of unstructured big data

Structured data, also known as row data, is suitable for logical expression and implementation through a two-dimensional table structure.

Unstructured data includes documents, images, audio, videos, etc., which are not suitable for representation in a two-dimensional table.。

Unstructured data related to customer experience includes:

(1) Internal bank texts from WeChat, online banking, mobile banking, intelligent customer service, questionnaires, etc.;

(2) Texts converted from voice recordings of bank hotlines via machine transcription;

(3) External media such as WeChat, Weibo, Toutiao, Douyin, and online forums.。

A goldmine of unstructured big data

Unstructured big data empowers the digitalized full-lifecycle management of customers: （Who,When,Where,What,Why, How.）

- （1) Customer group tagging enables precise marketing for customer acquisition (e.g., mortgage and rental services).
- (2) Online-offline integration helps maintain active customers (focusing on high-frequency daily scenarios).
- (3) Emotional data generation facilitates identification and retention of customers (those at risk of churning).
- (4) Optimizing the experience loop and listening to the voice of customers. （Optimize the experience closed-loop）

The goldmine of unstructured big data

Leverage big data from Voice of Customer (VoC) to enhance customer experience, establish a closed-loop feedback mechanism, and end the mentality of "launching is the finish line."

1. Product Improvement: Refine products, services, and processes based on customer suggestions and pain points related to our own offerings.

2. Competitive Innovation: Draw inspiration from customer reviews of competitors' trending or newly launched products to drive R&D, formulate requirements, and execute targeted marketing strategies

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Large Language Models and their applications and impacts in finance

Model Architecture: Parallel processing for long texts and self-attention mechanisms.
Training Data: Vast amounts of unstructured data (e.g., text) covering diverse domains.
Applications: Language generation and understanding.

Customer Service: Enhance query resolution, save time and labor, and improve user experience.
Robo-Advisory: Provide personalized investment advice based on user preferences; leverage text understanding and generative dialogue for better engagement.
Risk Management: Analyze financial texts to identify risks and provide insights, assisting professionals in decision-making.

Real-time Updates: How to ensure continuous learning?
Corpus Limitations: Address data biases and coverage gaps.
Ethics & Security: Navigate data privacy and ethical AI challenges.

From general-purpose models to specific domain models?

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