# Generative AI and Personalized Education
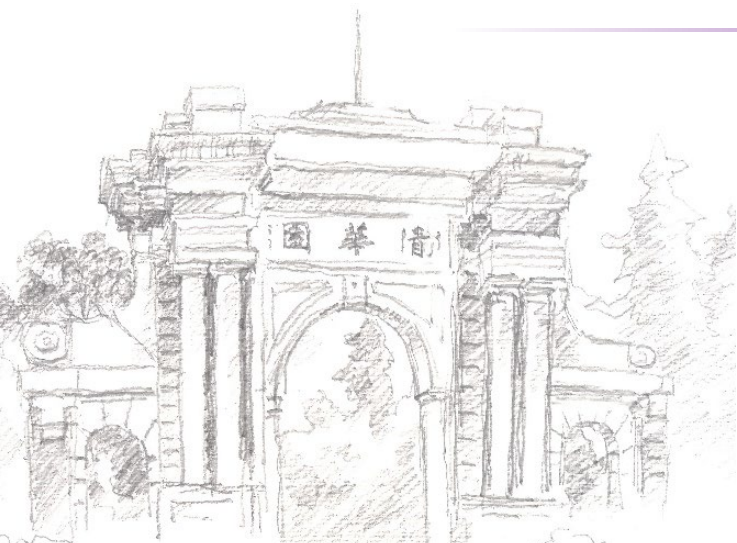
## Hang Su
## Tsinghua University

# Contents

**1**

**Personalized Education**

**2**

Attempts in Tsinghua

**3**

Open Problems

# Personalized Education

● **Teaching according to students' aptitudes** is essential for creating a more effective, engaging, inclusive, and adaptive educational environment that prepares learners for both academic success and real-world challenges

● Enhances Learning Efficiency, Promotes Engagement, Supports Inclusivity, Reduces Frustration and Anxiety……



## Confucius' Philosophy

**因材施教**
**(Teaching students according to their abilities）**

# Personalized Education

- In modern society, the demand for skilled individuals has rapidly increased, placing significant pressures on higher education.

- Universities have responded by adopting **mass and standardized approaches to education,** which efficiently meet the labor market's large-scale needs

- **In remote areas, personalized education faces unique challenges** due to resource scarcity, which can make tailoring education to individual student needs more difficult



- Limited Access to Educational Materials
- Technology Gap
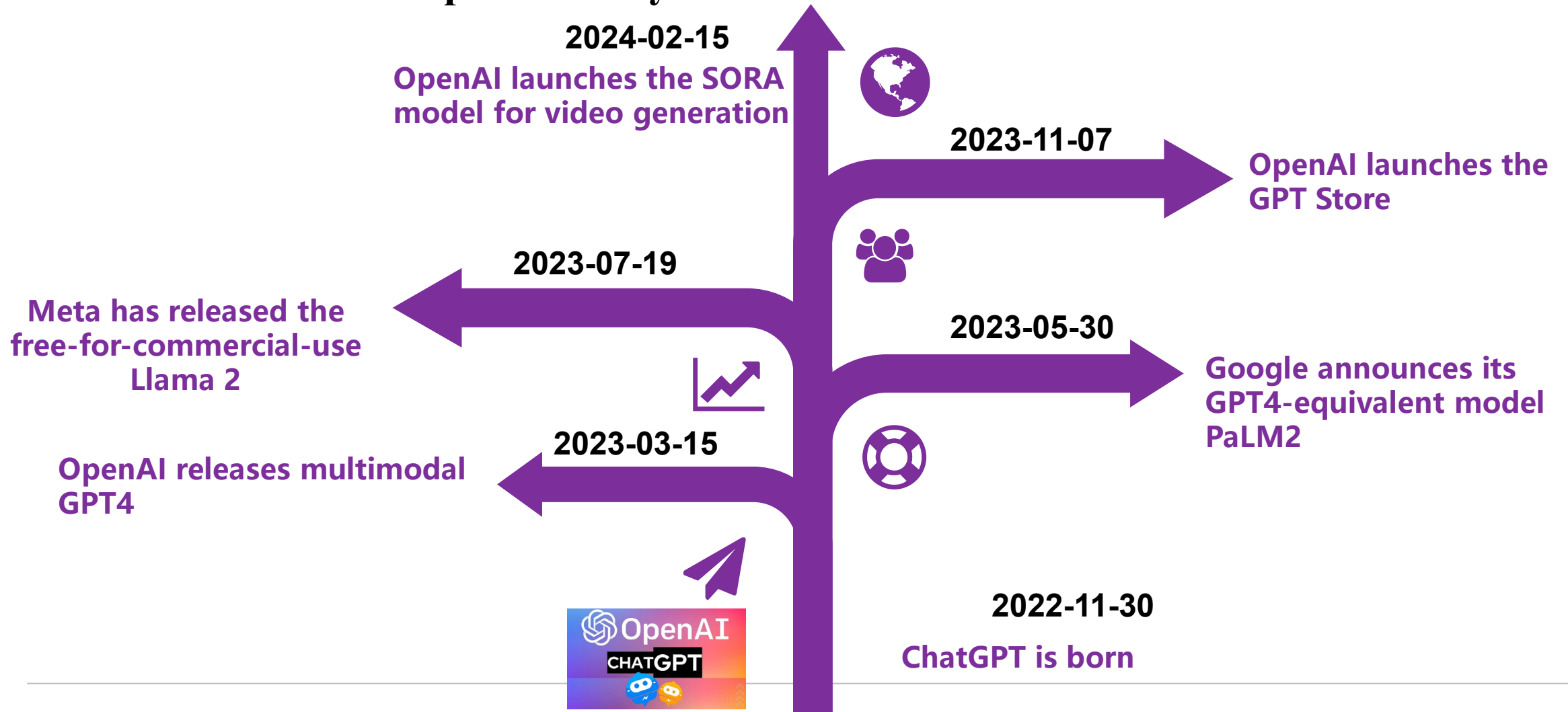- Teacher Shortages and Training
- Infrastructure Issues
- ……

# The issues of standardized education

- **Lack of Personalized Education**: standardized educational models struggle to address the personalized needs of students, potentially limiting the development of their full potential.

- **Suppression of Creativity**: students may be more inclined to complete tasks conventionally rather than exploring new ideas and methodologies.

- **Challenges in Teaching According to Abilities**: teachers often face large classes, making it difficult to attend to the individual needs of each student adequately.

- **Neglect of Societal Diversity**: Different industries and sectors require various types of talent, and education

# GPT is a revolution in AGI

- **AI technology explosion in the Cambrian period, bringing about a huge transformation in productivity.**

**2024-02-15**
OpenAI launches the SORA model for video generation

**2023-11-07**
OpenAI launches the GPT Store

**2023-07-19**
Meta has released the free-for-commercial-use Llama 2

**2023-05-30**
Google announces its GPT4-equivalent model PaLM2

**2023-03-15**
OpenAI releases multimodal GPT4

**2022-11-30**
ChatGPT is born

OpenAI
CHATGPT

# GPT models are much more beyond text generation

- **GPTs are a type of General Purpose Technologies (GPTs).**

  - ✓ There have been **24** general purpose technologies throughout human history, with the **steam engine** regarded as the most important general purpose technology, followed by **electricity**, and **internet**.

- **AGI is Schumpeter's 'creative destruction', which is a technological paradigm revolution, restructuring all industries including education**

- **AGI has revolutionized the education industry by making personalized education increasingly feasible, where educational experiences can be customized to fit individual learning trajectories**

# Contents

**1** Personalized Education
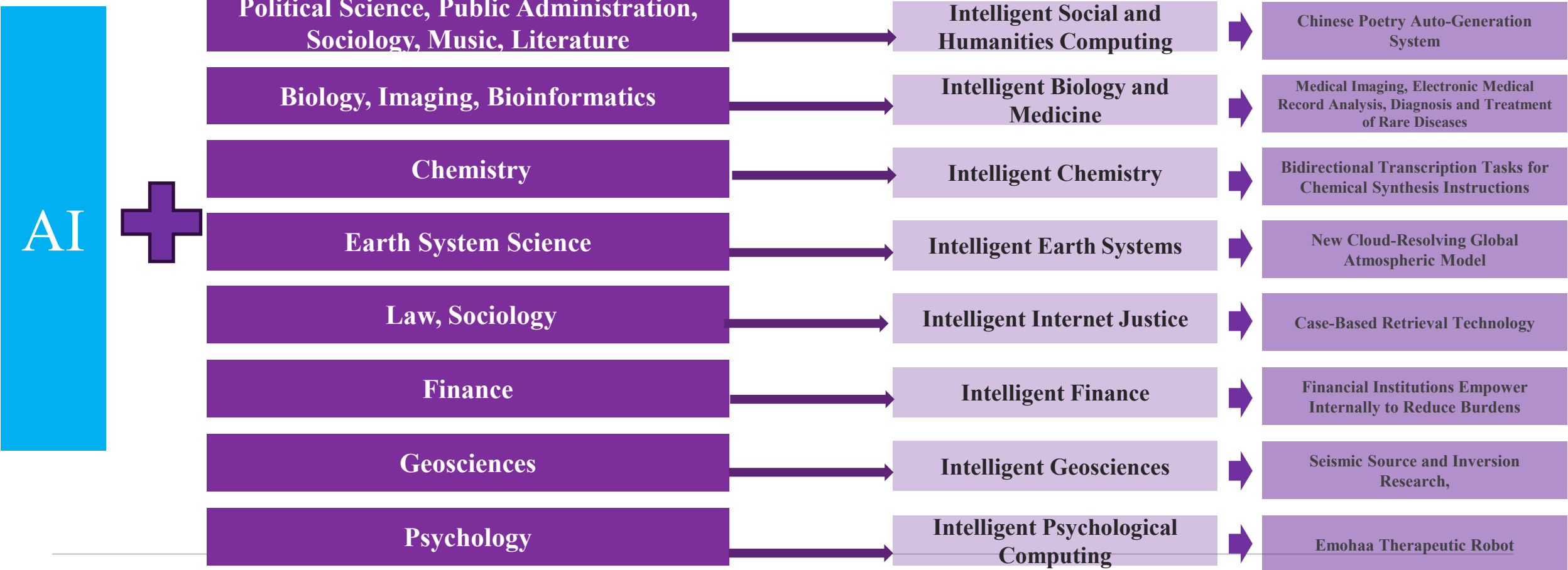
**2** **Attempts in Tsinghua**

**3** Open Problems

# Interdisciplinary Collaboration in Tsinghua

● **Intelligent Integration**： promote interdisciplinary research in artificial intelligence with the arts, sciences, medicine, and engineering

| | | |
|---|---|---|
| **AI** ➕ | **Human-Computer Interaction, Cognitive Psychology, Design Aesthetics** → **Intelligent Interaction Technologies** → | Natural Interaction Interfaces, Interactive Digital Humans, Human-Machine Collaborative Systems |
| | **Political Science, Public Administration, Sociology, Music, Literature** → **Intelligent Social and Humanities Computing** → | Chinese Poetry Auto-Generation System |
| | **Biology, Imaging, Bioinformatics** → **Intelligent Biology and Medicine** → | Medical Imaging, Electronic Medical Record Analysis, Diagnosis and Treatment of Rare Diseases |
| | **Chemistry** → **Intelligent Chemistry** → | Bidirectional Transcription Tasks for Chemical Synthesis Instructions |
| | **Earth System Science** → **Intelligent Earth Systems** → | New Cloud-Resolving Global Atmospheric Model |
| | **Law, Sociology** → **Intelligent Internet Justice** → | Case-Based Retrieval Technology |
| | **Finance** → **Intelligent Finance** → | Financial Institutions Empower Internally to Reduce Burdens |
| | **Geosciences** → **Intelligent Geosciences** → | Seismic Source and Inversion Research, |
| | **Psychology** → **Intelligent Psychological Computing** → | Emohaa Therapeutic Robot |

# AI Supports School Education and Teaching

- **AI courses provide a foundation for nurturing talent in the new era: AI+**

> **Opportunities for digital and intelligent transformation strategies, fully leveraging Tsinghua University's disciplinary**

- **For those with no background in computer science or non-information disciplines, the course content is customized according to the characteristics of their disciplines.**

- **AI + Liberal Arts**: Information Technology Empowerment Type
  - The teaching content involves different combinations of computer principles, digital capabilities, visualization capabilities, and data capabilities.

- **CS + Science and Engineering**: Interdisciplinary Type
  - The teaching content involves different combinations of computer principles, computational thinking, programming skills, and interdisciplinary courses.

AI+ empowerment
**No need to know how to program oneself**
**Can direct others to program**

**To equip every Tsinghua student with the mindset and ability to use computers to solve professional problems**

# AI Supports School Education and Teaching

●**AI supports academic affairs: AI assistant system**

- **Tsinghua University AI Empowerment Teaching and Learning Pilot Course Work Plan**
- **Application of results: Generative AI assists in higher education teaching**
- **Work objective: To use AI to further enhance teachers' teaching abilities and provide students with intelligent assistants to improve their skills development and knowledge acquisition**
- **Expected outcome: Establish a comprehensive AI assistant system for eight pilot courses across the university.**

**New City Science**

**Principles of Electric Circuits**
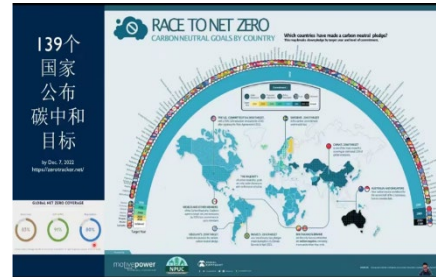
**Environmental Decision-Making Practice**
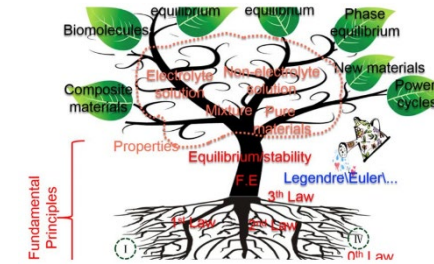
**Chemical Engineering Thermodynamics**

**Fundamentals of Digital Electronic**

**Writing and Communication**

**Mind, Individual, and Culture**

**Physics**

# AI Supports School Education and Teaching

● **AI supports academic affairs: AI assistant system**



**Textbook**

**Lecture**

**Paper**

**Exercise**

**Knowledge Graph**

**Text-Image Pair**

**Knowledge**

**Q&A**

**Problem Solving**

**Finetune**

**Course domain large model**

**Unstructured Data** → **Structured Data** → **Domain Model**
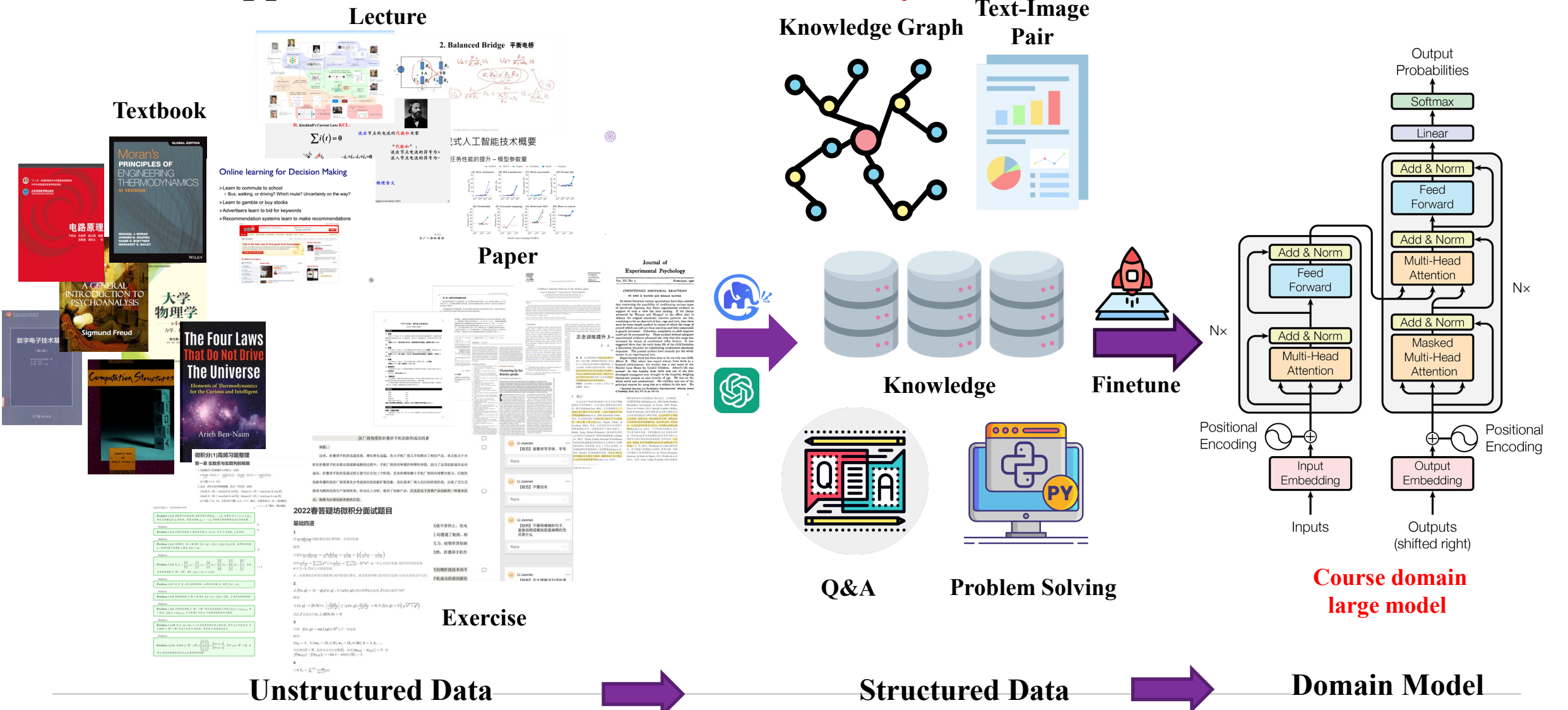
# AI Supports School Education and Teaching

●AI supports academic affairs: **AI assistant system**

Answering questions and resolving doubts

Automatic grading

$E = mc^2$

Proactive problem setting

$\sqrt{x^2}$

Code debugging



历史记录

＋ 创建新对话

请帮我撰写一段关于topic的…
2023-12-18 10:13:44

作为大学化工热力学老师，…
2023-12-18 09:45:01

请帮一道关于知识点的化工…
2023-12-17 23:50:32

请帮一道关于知识点的化工…
2023-12-17 12:03:16

给我画一张人与AI竞争的图…
2023-12-15 21:18:02

假如你作为一位化工热力学…
2023-12-14 22:26:08

请帮一道关于知识点的化工…
2023-12-14 14:19:24

请帮一道关于知识点的化工…
2023-12-14 12:13:39

假如你作为一位化工热力学…
2023-12-13 20:57:20

假如你作为一位大学物理老…
2023-12-13 18:39:53

强化学习对计算机系本科生…

作为大学化工热力学老师，请深入解析以下问题：在化学工程中，详细探讨如何通过热力学原理优化反应条件以提高产物收率。结合 Gibbs 自由能和反应热力学，提供实际案例和优化建议。

试试输入"油画"、"模拟面试"，挑选指令模板

© 2023 ChatGLM2 京公网安备11010802041394号 网信算备110108105858001230019号 用户协议 隐私政策

灵感大全

化工热力学

化工反应条件优化
优化反应条件提高产物收率的化工热力学方法
✦ 2645

化工过程能量分析
利用热力学定律分析化工过程中的能量转化和利用效率的方法
✦ 5402

多组分流体汽液平衡
利用活度系数模型和相平衡关系式计算多组分流体的汽液平衡的方法
✦ 7460

化工热力学概念解释
请解释[焓]这一化工热力学概念
✦ 2268

化工热力学实验设计
请你设计研究[气体吸附过程中的焓变化]的化工实验
✦ 2024

化工热力学题目解答
请你对这一道化工热力学题目进行解答
✦ 5047

自动出题
生成给定知识点的问题
✦ 3110

自动出题
更详细地生成给定知识点的问题
✦ 8033

**KAPWING**

Evaluation guidance

Example generation

Writing improvement

Computational reasoning

$x+y =z$

**Dialogue history**　　　　**Multi-turn dialogue、Multimodal input and output**　　　　**Practical tools**

# AI Supports School Education and Teaching

● **AI supports the construction of psychological centers: Psychological counseling**

**Results**: LLM-based psychological intervention system

**Work objective**: Based on cognitive psychology theory, utilizing LLM to realize AI-based psychological counseling, emotional support, and intervention systems, greatly alleviating the shortage of qualified staff in psychological centers

**Expected outcome**: Utilizing large models to achieve 24/7 psychological counseling and intervention services, enabling access to services anytime and anywhere, with a level reaching that of a junior counselor.

**Emotional Support Framework**: The first modeling of the multi-turn interaction process between the help-seeker and the supporter

**Evaluation Feedback**: The 'Chat Healing' effect surpasses GPT-4

**Hill's Three-Stage Helping Theory**: Incorporating professional helping strategies in the dialogue system, guiding the Agent's behavior and decision-making

**Qingxin Companion**: Collaborating with Tsinghua University Psychological Center to deploy a peer psychological mutual aid platform

不同对话轮次下的被选择数

| 次数 | 0-5轮 | 5-10轮 | 10-15轮 | 15-20轮 |
|---|---|---|---|---|
| Emohaa | 310 | 247 | 275 | 251 |
| GPT-4扮演 | 174 | 226 | 201 | 228 |
| 平手 | 16 | 27 | 24 | 21 |

选择胜出占比

- 54.06%
- 41.41%
- 4.53%

■ Emohaa  ■ GPT-4扮演  ■ 平手

| | | | |
|---|---|---|---|
| Question | | | |
| Restatement or Paraphrasing | | | |
| Reflection of Feelings | | | |
| Self-disclosure | | | |
| Affirmation and Reassurance | | | |
| Providing Suggestions | | | |
| Information | | | |

**② 安抚**
表达共情，安抚求助者
情感映射、自我暴露

**① 探索**
探索、确认求助者问题
询问、复述

**③ 行动**
帮助求助者解决问题
建议、提供信息

来找朋辈
烦恼后退

主题类别

恋爱与性
关于"爱"，关于"性"，可能你有很多疑惑，我们愿陪你聊聊

爱好志趣
并不是所有人都必须成为朋友，It's best only when it fits you.

人际关系
为啥别人的人际关系一片和谐，我却一地鸡毛？也许我们可以聊聊...

学业与职业
考试、升学、毕业...我们或许可以从彼此的经验中汲取养料

其他主题
当一个人懂了了自己的心

# Contents

**1**

Personalized
Education

**2**

Attempts in Tsinghua

**3**

Open Problems

# Broader Impact

- It has the potential to make a significant impact on the development of higher education in the **central and western regions of China** through AI
- AI systems can easily scale to meet the needs of a large number of students across vast geographic areas, **overcoming traditional barriers to education.**
- AI can **augment the abilities of local teachers** by providing them with advanced tools for student assessment, interactive learning
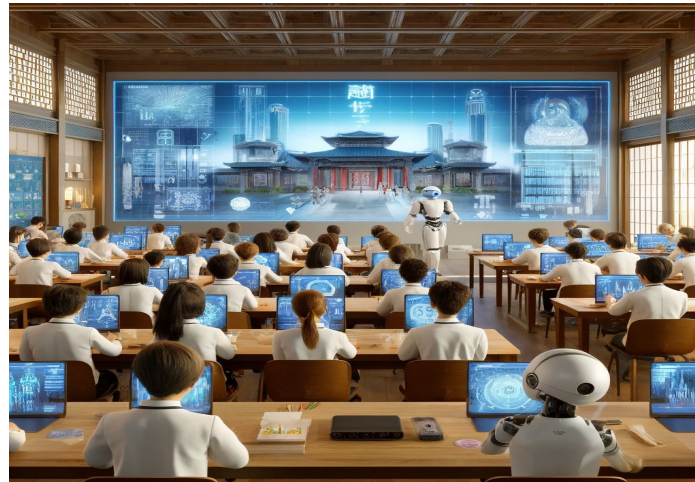


Generated by Dalle

# Challenges: Hallucination

- **Hallucination has been widely recognized to be a significant drawback for large language models (LLMs), where the models generate plausible but factually incorrect or nonsensical information**

- **Addressing hallucinations is particularly critical in education because these tools often play a role in shaping knowledge and learning experiences.**



Who was the first person to walk on the moon?

Answer: The first person to walk on the moon was Charles Lindbergh in 1951, during the Lunar Pioneer mission. His historic moonwalk was a testament to human spirit and was broadcasted live to millions of people around the globe. ✗

Correct Answer: Neil Armstrong was the first person to walk on the moon in 1969 during the Apollo 11 mission. ✓

(a) Factuality Hallucination

Please summarize the following news article:

Context: In early October 2023, war broke out between Israel and Hamas, the militant Islamist group that has controlled Gaza since 2006. Hamas fighters fired rockets ... civilians and taking dozens of hostages.

Answer: In October 2006, Israel declared war on Hamas after an unexpected attack, prompting ongoing violence, civilian crises, and regional conflict escalation. ✗

(b) Faithfulness Hallucination

# Challenges:Security

- **LLMs are vulnerable to exploitation by adversaries who might generate images that could negatively impact ethical, societal, and political landscapes**
- **Security concerns for LLMs in educational settings are critical due to the sensitive nature of the data they often process and the potential impact of security breaches on students and educational institutions**

# Challenges: Digital Divide

- **Artificial intelligence (AI) technology inherently demands high-level infrastructure, which includes robust networking, substantial computational power, and reliable electricity.**

- **The requirement for high-level infrastructure to support AI further deepens the digital divide. While some populations benefit from AI-driven innovations and conveniences, others remain disconnected from such advancements**
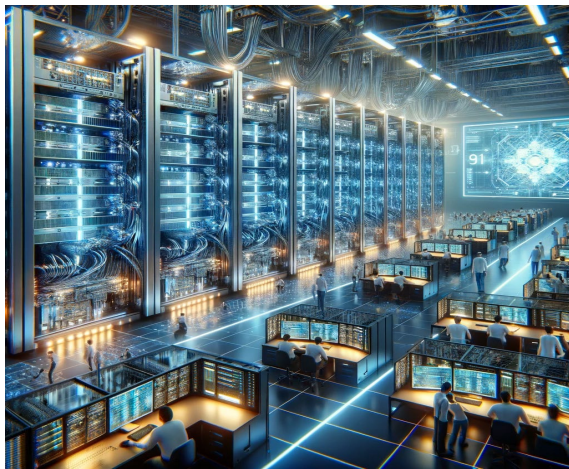


High-level infrastructure

Digital divide

# Conclusion

- *The coming change will center around the most impressive of our capabilities: the phenomenal ability to think, create, understand, and reason.*

- *We will add a fourth: the AI revolution. The technological progress we make in the next 100 years will be far larger than all we've made since we first controlled fire and invented the wheel.*

  —Samuel H. Altman （OpenAI CEO）

- **AI is set to reshape education, presenting entirely new challenges for both students and teachers. This transformation requires a redefinition of what education entails. However, the specifics of what the future holds remain unknown.**

- **This integration also opens up personalized learning pathways that cater to the individual needs and pace of each student, potentially enhancing engagement and efficacy.**