

# AI as a Technology Bridge for Families: Practical Pathways and Challenges

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## Abstract:

Traditional AI focused on embedding human thinking to achieve intelligence, while modern AI prioritizes acquiring knowledge from data and making independent judgments. It processes data from daily life and generates outputs to realize intelligent applications. Currently, with the national policy promoting the Internet of Everything and fostering an intelligent product ecosystem, household AI has already occupied a partial position in families and brought significant convenience. This paper explores the specific paths such as technology implementation, product ecosystem construction, and user adaptation, supplemented by specific cases. Additionally, the paper analyzes potential challenges including intergenerational cognitive differences, data privacy risks, economic inequality, and dependence issues. The research aims to provide reference for accelerating the practical implementation of household AI and balancing technological development with risk mitigation.

**Keywords:** AI; Families; Pathways; Challenges

## 1. Introduction

In the era of technological iteration, family-related technologies are evolving rapidly. Innovative products such as Apple Vision Pro, combined with advanced AI technologies developed by Butow and Hoque, have created new interaction modes for people's daily lives. Families now leverage AI-driven voice recognition, intelligent control, and other functions to significantly improve life efficiency and convenience. For example, simply uttering a request like „prepare a bath“ triggers the AI system to adjust the water temperature to the desired level automatically. Beyond family life, AI has made breakthroughs in professional fields—military applications of virtual

reality, powered by AI, present real-time information such as soldiers' current positions and enemy numbers directly in their field of vision, greatly enhancing survival rates. However, while AI brings unprecedented convenience, it also hides potential risks. Currently, the industry lacks sound standards for data storage and privacy protection mechanisms [1]. If Artificial General Intelligence (AGI) is successfully developed, a large number of household service jobs, such as in-home valets, may be replaced, leading to rising unemployment rates that low-skilled workers struggle to cope with. Moreover, AI's pursuit of user experience sometimes comes at the cost of accuracy—for instance, when users input math problems,

AI may modify correct answers to align with user expectations, which can cause disputes among family members and even damage relationships.

The article adopts a literature research method to explore practical pathways for household AI development and analyze potential challenges, aiming to provide valuable references for the healthy popularization of family AI technologies.

## **2. AI as the Core Function and Application Scenarios of the Family Technology Bridge**

AI exerts a multi-faceted impact on family life, with the core goal of meeting people's needs anytime and anywhere [2]. In the past, communication was restricted by physical distance, with mail relying on horse-drawn carriages for delivery. Today, AI-integrated communication tools such as Zoom, Facebook, ClassIn, and WeChat Video enable instant interaction—all that is needed is a smartphone and internet access.

### **2.1 Improving Family Safety and Management**

AI's connection to the Internet of Things (IoT) not only enhances life convenience but also provides parental control functions to prevent potential risks. AI prioritizes data security through algorithm design, such as intelligent home scenario management. Bashynska's research shows that AI can collect and manage data independently, optimizing resource allocation without human intervention [3]. The "technical logic of home automation", data-driven + algorithm optimization, operates through three key steps: first, collecting data via various sensors; second, processing and analyzing the collected data; third, continuously optimizing the system through adaptive algorithms to improve responsiveness and accuracy [1].

### **2.2 Enhancing User Experience**

A core dimension of AI's positive impact on human communication lies in language translation. Natural Language Processing (NLP) has revolutionized this field. Traditional AI required human coding for interaction, but NLP enables machines to recognize and understand human language, providing immediate feedback and significantly improving communication efficiency. Furthermore, AI can quickly learn human cultural contexts, adapting to the unique needs and habits of different users. For example,

for families with members from different linguistic backgrounds, AI translation devices such as iFLYTEK Translator can achieve real-time bidirectional translation with high accuracy, breaking down language barriers during family conversations, travel, and daily interactions. For elderly users unfamiliar with smart devices, AI voice assistants like Xiaomi's Xiaoai can adjust their response speed and language style according to the user's speech rhythm, providing more user-friendly interaction experiences.

### **2.3 Promoting Interaction between Families Members**

AI's "AI agent automatic framework" (from CSDN) includes five levels, with levels 3 and above capable of interacting with multiple devices to create a coordinated intelligent family environment. For instance, when a family member returns home, the AI system can automatically adjust the room temperature, turn on the lights, and play favorite music based on their historical preferences—all without manual operation. Such intelligent coordination not only enhances life comfort but also creates shared experiences for family members. A typical example is the intelligent home system developed by Haier: when parents are busy in the kitchen, children can use voice commands to request the AI to play educational cartoons with appropriate volume, avoiding disturbing parents while enjoying entertainment. When the whole family watches movies, the AI can synchronously dim the lights, close the curtains, and adjust the air conditioning temperature, creating a cinema-like atmosphere that strengthens family bonding.

### **2.4 Artificial Intelligence in Family Education**

The application of AI in family education has proven highly practical, serving as an effective auxiliary tool for subjects such as mathematics and physics. AI algorithms can analyze individual learning styles and progress to customize targeted exercise plans. For example, the online education platform Yuanfudao uses AI to identify students' weak areas through their homework and test data, generating personalized practice questions. For primary school students struggling with arithmetic, the AI system provides step-by-step guidance and adjusts the difficulty level based on their mastery. For high school students learning physics, it simulates experimental scenarios to help deepen understanding. Another example is the AI tutoring robot "Xiaobai"—it can interact with children through voice and images, answering academic questions, telling educational stories, and even conducting foreign

language conversations. For families where parents lack time to tutor homework, such AI tools effectively supplement family education resources, ensuring continuous learning support for children.

### 3. Pathways

#### 3.1 Technology Implementation Pathways

Reducing technical barriers is key to addressing diverse family needs. By breaking down technological monopolies and encouraging small and medium-sized enterprises (SMEs) to participate in innovation, the market can offer more diversified products tailored to specific demands. The foundation of natural language processing—including audio, gesture, and visual recognition—serves as the technical basis for household AI interaction [4]. Small company can use private cloud storage solutions like Apple’s iCloud Private Relay to protect user data, using encryption models to encapsulate private information and prevent external intrusions.

A notable case is the Chinese SME “Smart Home Tech”. Faced with the high cost of developing independent AI systems, the company adopted open-source AI frameworks such as TensorFlow and collaborated with cloud service providers to build a lightweight intelligent home control platform. The platform integrates voice recognition, gesture control, and other functions, supporting customization according to family needs—for example, adding medication reminders for elderly families or designing homework supervision modules for families with school-age children. To address data security concerns, the company uses end-to-end encryption technology, ensuring that user data (such as voice commands and behavioral preferences) is encrypted during transmission and storage, with only the user holding the decryption key. This approach not only reduces R&D costs but also win user trust, achieving rapid market penetration.

#### 3.2 Product Ecosystem Construction Pathways

Building a connected ecosystem of AI devices and adapting products to specific family types (such as empty-nest elderly families and two-child families) requires collaboration among enterprises, governments, and universities. Enterprises are responsible for product R&D and production, governments formulate policies to promote popularization, and universities provide technological support through scientific research.

A successful example is the “Smart Elderly Care Ecosystem” jointly constructed by Huawei, the local government of Hangzhou, and Zhejiang University. Huawei developed intelligent wearable devices (such as heart rate monitors and fall detectors), smart home sensors, and a cloud management platform. These devices are interconnected—for instance, if the fall detector worn by an elderly person detects a fall, it immediately sends an alert to the cloud platform, which notifies family members via WeChat and connects to the community health service center. The Hangzhou government provided subsidies for elderly families to purchase these devices, covering 50% of the cost, and established community service stations to offer technical guidance. Zhejiang University’s research team optimized the AI algorithm for the system, improving the accuracy of fall detection and health data analysis. This ecosystem effectively addresses the safety and health monitoring needs of empty-nest elderly families, with over 10,000 households adopting the system within a year of its launch [5].

#### 3.3 User Adaptation

Promoting user adaptation, especially among the elderly, is crucial for the popularization of household AI. The elderly often face difficulties in using smart technologies due to limited digital literacy, so targeted training and simplified operation designs are essential.

A typical case is the “Intelligent Companion Robot for the Elderly” developed by JD.com. The robot features a simple physical design with large buttons and a voice interaction function that supports dialects (such as Cantonese and Sichuanese) to accommodate elderly users unfamiliar with Mandarin. It provides services such as medication reminders, health data monitoring, and entertainment (such as singing and storytelling). JD.com collaborated with senior care institutions to conduct user testing and optimization, simplifying operations based on feedback—for example, reducing the number of steps to initiate a video call from three to one. The robot also includes a remote assistance function, allowing children to remotely control the device to help their parents solve operational issues, significantly improving user adaptation. The design of the robot’s interaction function also refers to the research on Human-AI interaction, ensuring that the interaction between the elderly and the robot is more in line with human habits [6].

## 4. Potential Challenges

### 4.1 Different Recognition

As AI becomes increasingly intelligent, it can handle most household tasks, which may shape the worldviews of children born in the AI era. They may take for granted that AI will meet all their needs. This can lead to intergenerational conflicts, as parents often hold the view that excessive reliance on AI hinders children's critical thinking and problem-solving abilities.

### 4.2 Data Privacy

Although artificial intelligence plays an increasingly important role in the circular economy and family life, data privacy and security protection remain inadequately addressed [3]. Household AI devices collect a large amount of sensitive information, including family relationships, daily routines, and even private activities captured by cameras. Without sound protection mechanisms, this data is at risk of leakage, leading to serious consequences.

### 4.3 Economic challenges

The significant income gap between different social groups poses a major obstacle to the popularization of household AI. The development of high-end AI products requires substantial investment—for example, Meta spent \$1 billion hiring top technical talent to develop the “Beat” intelligent home system. When such products enter the market, their high prices make them accessible only to wealthy families, while low-income families may consider them unnecessary or unaffordable. This can widen the digital divide and exacerbate social inequality, as measured by the Gini coefficient.

### 4.4 Dependence Risk

Excessive reliance on AI can erode people's independent living skills and decision-making abilities, while the storage of personal data by AI systems increases the risk of security breaches [7]. The privacy of data need to protect properly. Even in today, the language AI like Deepseek is trying to improve the data store property so that AI can remember information which user mentions for a long time. However, this may face a challenge because it involve in store data of personal information. For instance, famous businesses ask AI to remember the day they need to hold a conference on 12.2. His hostility wants to find an opportunity to kill it to eliminate the competition. Such data will

store in his personal server, or in public server. To address such risks, research on AI-Powered Data Security and Intelligent Management in Home Automation provides valuable solutions, emphasizing the importance of strengthening data security management in AI applications [8].

## 5. Conclusion

In conclusion, AI, as a technology bridge for families, has demonstrated significant potential in enhancing home automation, optimizing user experience, promoting family interaction, and supporting education. Through practical pathways such as technological innovation, ecosystem construction, and user adaptation, household AI has gradually integrated into daily life, bringing unprecedented convenience. However, the development of family AI also faces multiple challenges, including intergenerational cognitive differences, data privacy risks, economic inequality, and dependence issues. These challenges not only affect the user experience but also pose potential threats to social harmony and individual development.

To address these issues, multi-stakeholder collaboration is essential. Enterprises should prioritize data security and privacy protection in product development, while continuously optimizing technologies to reduce costs and improve accessibility. Governments need to formulate and implement relevant policies and regulations to standardize the development of the AI industry, narrow the digital divide through subsidies and public services, and resolve intergenerational conflicts through publicity and education. Academic institutions should strengthen research on core AI technologies and ethical issues, providing theoretical support for the healthy development of household AI. Users also need to maintain a rational attitude toward AI, leveraging its advantages while avoiding excessive dependence.

Looking ahead, with the joint efforts of all sectors of society, household AI is expected to overcome existing challenges, achieving a better balance between technological progress and risk mitigation. In the future, AI will not only be a tool for improving quality of life but also a bridge for enhancing family harmony and social equity, contributing to the construction of a more intelligent, inclusive, and secure society.

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