Cover Story
封面故事

AI Applications in the Communication Industries

人工智能在通訊領域中的應用

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COVER STORY
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A brief history of AI
The Birth of Artificial Intelligence: From Turing to Deep Learning

The foundations of modern artificial intelligence (AI) can be traced back to the groundbreaking work of Alan Turing in the 1940s and 1950s. Turing, a brilliant English mathematician and computer scientist, made significant contributions that laid the groundwork for the field of AI.

One of Turing's most famous accomplishments was his pivotal role in cracking the Enigma code used by the German military during World War II. The Enigma code, generated by a complex electromechanical device, was thought to be unbreakable. However, Turing and his team at Bletchley Park were able to crack the code by designing a machine called the Bombe, which systematically tried different settings to decipher the encrypted messages. This remarkable achievement allowed the Allies to gain a strategic advantage during the war.

Turing's work on the Enigma code showcased his innovative thinking and problem-solving abilities, which would later inform the development of AI. In 1950, he published the seminal paper "Computing Machinery and Intelligence," where he proposed the Turing test as a way to evaluate a machine's ability to exhibit intelligent behavior.

In the 1950s, the term "artificial intelligence" was coined, and early AI research focused on problems such as game playing, problem-solving, and theorem proving. Pioneers like John McCarthy, Marvin Minsky, Allen Newell, and Herbert Simon built on Turing's foundational work, leading to advancements in areas like knowledge representation and natural language processing.

As the field of AI progressed, the 1980s saw the emergence of machine learning, with the development of neural networks and algorithms like backpropagation. This paved the way for breakthroughs in computer vision and speech processing.

In the 2010s, the rise of deep learning techniques like convolutional neural networks and long short-term memory revolutionized fields such as natural language processing, computer vision, and robotics. Today, AI is ubiquitous, with applications ranging from healthcare and finance to transportation and entertainment.

The story of AI is inextricably linked to the visionary work of Alan Turing, whose groundbreaking achievements in cracking the Enigma code and laying the theoretical foundations for the field continue to inspire and shape the ongoing advancements in this dynamic and ever-evolving discipline.

Several researchers are making significant contributions to AI in telecommunications. The notable ones are Yuan Zhang, Daitian Li, Elena Fersman, Mischa Dohler, Anil K. Jain, Amitava Ghosh, and Thomas Wiegand. These researchers are at the forefront of integrating AI into telecommunications, driving innovations that enhance network performance, security, and user experience.

人工智能的簡史
人工智能的誕生：從圖靈到深度學習

現代人工智能（AI）的基礎可以追溯到 1940 年代和 1950 年代艾倫·圖靈（Alan Turing）的開創性工作。圖靈是英國著名的數學家和計算機科學家，他的貢獻為人工智能領域奠定了基礎。

圖靈最著名的成就之一，是在第二次世界大戰期間幫助破解德國軍方使用的恩尼格瑪（Enigma）密碼。恩尼格瑪密碼由一種複雜的電動機械設備生成，當時被認為是無法破解的。然而，圖靈和他在布萊切利園（Bletchley Park）的團隊設計了一台名為「Bombe」的機器，通過系統地嘗試不同的設置來解密加密信息。這一非凡的成就讓盟軍在戰爭中獲得了戰略優勢。

圖靈破解恩尼格瑪密碼的工作展示了他創新的思維和解決問題的能力，這些能力後來成為人工智能發展的啟發。1950 年，他發表了開創性的論文《計算機機械與智能》，並在其中提出了圖靈測試，作為評估機器是否具備智能行為的一種方法。

在 1950 年代，「人工智能」這個術語首次被提出，早期的 AI 研究集中於遊戲對戰、問題解決和定理證明等問題。像約翰·麥卡錫（John McCarthy）、馬文·明斯基（Marvin Minsky）、艾倫·紐厄爾（Allen Newell）和赫伯特·西蒙（Herbert Simon）等先驅者在圖靈的基礎上繼續研究，推動了知識表示和自然語言處理等領域的進展。

隨著人工智能領域的進步，1980 年代出現了機器學習，神經網絡和反向傳播等演算法的發展為計算機視覺和語音處理的突破鋪平了道路。

到了 2010 年代，卷積神經網絡（CNN）和長短期記憶（LSTM）等深度學習技術的崛起，徹底改變了自然語言處理、計算機視覺和機械人技術等領域。如今，人工智能無處不在，應用範圍從醫療保健、金融到交通運輸和娛樂業。

人工智能的發展歷程與艾倫·圖靈的遠見卓識密不可分，他在破解恩尼格瑪密碼和奠定該領域理論基礎方面的突破性成就，繼續激勵著這個不斷發展、充滿活力的學科的進步。
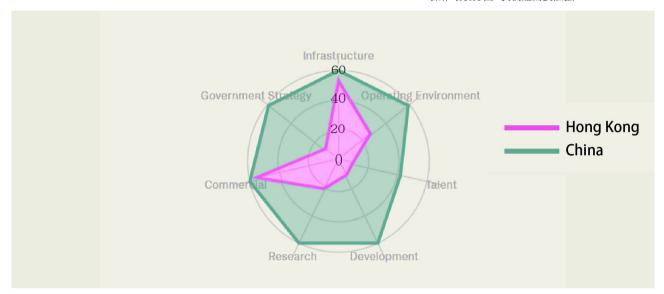
在電訊領域，多位研究者在推動人工智能的發展方面做出貢獻。值得注意的有張元、李代天、艾琳娜·費爾斯曼（Elena Fersman）、米莎·多勒（Mischa Dohler）、阿尼爾·K·賈恩（Anil K. Jain）、阿米塔瓦·戈什（Amitava Ghosh）和托馬斯·維甘德（Thomas Wiegand）。這些研究者站在將人工智能整合到電訊領域前沿，推動了提升網絡性能、安全性和用戶體驗的創新。

Our current AI adaption status:

The Global AI Index, published by Tortoise Media, serves as a benchmark for AI investment (https://www.tortoisemedia.com/intelligence/global-ai/#pillars). It aims to make sense of artificial intelligence in 62 countries that have chosen to invest in it. It's the first ever ranking of countries based on three pillars of analysis; investment, innovation and implementation. It is underpinned by 111 indicators, collected from 28 different public and private data sources, and 62 governments. These are split across seven sub-pillars: Talent, Infrastructure, Operating Environment, Research, Development, Government Strategy and Commercial. In the fourth iteration of the Global AI Index, published on 28 June 2023, the top 5 countries are United States, China, Singapore, UK, and Canade while Hong Kong was ranked 32nd. The markings of HK against each of these pillars compared with our Mother Land is shown below. I am afraid that we have to catch up in terms of Government Strategy, R&D, talent, and Operating Environment.

我們當前的人工智能適應狀況：

根據 Tortoise Media 發表的《全球人工智能指數》（The Global AI Index），該指數是人工智能投資的基準（https://www.tortoisemedia.com/intelligence/global-ai/#pillars）。它旨在解析 62 個選擇投資人工智能的國家。這是第一個基於投資、創新和實施三個支柱進行分析的國家排名。該指數包含 111 項指標，這些指標來自 28 個不同的公共和私人數據來源，並涵蓋 62 個國家政府。這些指標分為七個子支柱：人才、基礎設施、操作環境、研究、開發、政府策略和商業。根據 2023 年 6 月 28 日發表的《全球人工智能指數》第四版，排名前五的國家分別是美國、中國、新加坡、英國和加拿大，而香港排名第 32 位。香港在各個支柱中的表現，與我們的母國相比，尤其在政府策略、研發、人才和操作環境方面，我們還需要加強。

Nonetheless, Hong Kong's government has embraced a comprehensive strategy to foster an AI ecosystem, encompassing policies, regulations, infrastructure, talent development, industry adoption, and monitoring. Key elements include:

1. Policies and Regulations:

• Formulated the Ethical AI Framework to provide guidelines for government agencies on developing AI applications

• Published the Guidance on the Ethical Development and Use of Artificial Intelligence by the Office of the Privacy Commissioner for Personal Data

• Issued the Policy Statement on Facilitating Data Flow and Safeguarding Data Security to coordinate AI development and security

儘管如此，香港政府已經採取了全面的策略來培育人工智能生態系統，涵蓋政策、法規、基礎設施、人才發展、行業採用和監控。主要元素包括：

1. 政策和法規：

• 制定了人工智能框架，為政府機構開發人工智能應用提供指引

• 個人資料私隱專員公署發佈了《開發及使用人工智能道德標準指引》

• 發布了《促進數據流通和保障數據安全的政策聲明》，以協調人工智能的發展和安全

2. Infrastructure:
 •Cyberport is establishing an AI Supercomputing Centre to support R&D and industrial development
 •Implementing measures to promote data center development

3. Talent Development:
 •Nurturing AI scholars and enterprises through the AIR@InnoHK research cluster
 •Providing talent education, retraining and skill upgrading programs
 •Attracting local and overseas tech talents through initiatives like the Research Talent Hub and Technology Talent Admission Scheme

4. Industry Adoption:
 •Assisting different sectors to upgrade and transform through technology adoption, including the Technology Voucher Programme

5. Monitoring and Adjusting:
 •Closely monitoring AI technology trends and developments globally
 •Exploring further enhancements to copyright protections for AI-generated content
 •Conducting a new round of Manpower Projection to understand future talent needs

6. The establishment of Digital Policy Office (DPO):
 •The DPO was set up in July 2024 by merging the Office of the Government Chief Information Officer and the Efficiency Office. This is an important step in enhancing governance and driving the development of digital government by bolstering the Government's capabilities in addressing long-term and strategic issues. the Government has allocated $3 billion for the launch of a three-year AI Subsidy Scheme to support local universities, R&D centers, government departments and AI-related enterprises in leveraging the computing power of Cyberport's AI Supercomputing Centre (AISC).

The government seeks to balance promoting AI development with implementing suitable regulations to harness the opportunities and address the challenges of AI technology. Progress in AI relies not only on capital and computing power but also on having the right talent and a thriving ecosystem. While the Greater Bay Area can enhance our ecosystem, we must also nurture local talent and attract international experts to remain competitive in the AI arena.

AI Applications in the Communication Industries
Our overall AI ranking may not be leading according to recent evaluations. However, there is a significant amount of ongoing development and applications in our industry. Below is a summary of key findings from leader interviews, with detailed discussions provided in subsequent chapters.

Content Creation and Optimization
 •**Current Limitation**
While Generative AI has advanced significantly, creating content that is truly original and emotionally resonant remains a challenge. These AI systems primarily recombine pre-existing human-created snippets,

2. 基礎設施：
 • 數碼港正在建立人工智能超級計算中心，支持研發和產業發展
 • 實施促進數據中心發展的措施

3. 人才發展：
 • 通過 AIR@InnoHK 研究集群培育人工智能學者和企業
 • 提供人才培訓、再培訓和技能提升計劃
 • 通過「科研人才匯」和「科技人才入境計劃」吸引本地和海外科技人才

4. 行業採用：
 • 通過「科技券計劃」協助各行各業通過技術採用進行升級轉型

5. 監控與調整：
 • 密切監測全球人工智能技術趨勢和發展
 • 探索進一步加強對人工智能生成內容的版權保護
 • 開展新一輪人力資源預測，以了解未來的人才需求

6. 數字政策辦公室的設立（DPO）：
 •DPO 於 2024 年 7 月成立，是通過合併政府資訊科技總監辦公室和效率促進辦公室成立的。這是提升治理能力和推動數字政府發展的重要一步，增強了政府應對長期和戰略性問題的能力。政府已撥款 30 億港元，推出為期三年的人工智能補貼計劃，支持本地大學、研發中心、政府部門和人工智能相關企業利用數碼港人工智能超級計算中心（AISC）的計算能力。

政府致力於在促進人工智能發展與實施適當規管之間取得平衡，從而利用人工智能技術帶來的機遇，並解決其所面臨的挑戰。人工智能的進步不僅取決於資本和運算能力，亦需要合適的人才和繁榮的生態系統。大灣區可以促進我們的生態系統發展，但我們同樣需要培育本地人才並吸引國際專家，從而在人工智能領域保持競爭力。

人工智能在通訊產業中的應用
根據最近的評估，我們的整體人工智能排名可能並不領先。然而，我們產業內正在進行大量的開發和應用。以下是來自領導者訪談的關鍵發現的摘要，詳細討論將在後續章節中提供。

內容創作與優化
 • **目前的限制**
雖然生成式人工智能（Generative AI）有了顯著的進步，但創作真正原創且情感共鳴的內容仍然是一個挑戰。這些 AI 系統主要是重新組合先前

limiting their ability to generate content that fully captures the nuances of human emotion and creativity.

• Personalized Marketing
AI's ability to analyze customer data allows it to craft highly personalized content and recommendations. This personalization increases customer engagement and conversion rates by aligning marketing strategies closely with individual consumer preferences and behaviors.

• Data Analysis
AI processes vast quantities of data, offering managers a clearer understanding of customer behavior and market trends. This capability facilitates more informed decision-making, allowing companies to adapt their strategies based on comprehensive insights.

• AI in Content Recommendations
AI enhances the delivery of news and other content by recommending relevant articles and combatting clickbait. By streamlining content with concise summaries, AI ensures that users remain informed about topics that genuinely interest them.

• Sorting Content
AI greatly aids in filtering through millions of articles and videos to present the most relevant content to consumers. This efficiency boosts company profits by ensuring that consumers are consistently engaged with high-quality, pertinent content.

• Advertising Campaigns
AI enhances advertising campaigns by leveraging key features and tools to reach the right audience effectively. This targeted approach ensures that advertising efforts are optimized for maximum impact and efficiency.

• AI in Policing
Development of chatbots for generating and managing information.

Network Management and Optimization
• AI in Telecommunications
Telecommunications companies employ AI to uncover valuable insights, leading to optimized network performance and predictive maintenance. This proactive approach helps in preventing potential issues before they impact service delivery.

• AI in Network Optimization
AI plays a crucial role in managing and optimizing network performance. By efficiently storing and analyzing vast amounts of data generated by end-users, AI enables the quick identification and resolution of network issues.

• Hybrid Cloud AI
The use of Hybrid Cloud AI solutions provides flexible and scalable computing resources. By integrating on-premises infrastructure with public cloud services, companies can balance workloads, optimize costs, and maintain network performance.

• AI Energy Saving Solutions
AI solutions deployed at base stations help improve network performance by analyzing usage patterns. By switching to energy-saving modes

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的人工創造片段，因此難以生成完全捕捉人類情感與創造力細微之處的內容。

• 個性化營銷
AI 能夠分析客戶數據，從而創建高度個性化的內容和推薦。這種個性化提高了客戶的參與度和轉化率，通過與消費者的偏好和行為密切對齊來優化營銷策略。

• 數據分析
AI 處理大量數據，幫助管理者更清晰地了解客戶行為和市場趨勢。這一能力促進了更明智的決策，讓公司能夠根據全面的洞察力調整策略。

• 內容推薦中的 AI
AI 提升了新聞及其他內容的傳遞效果，通過推薦相關文章並對抗誘餌內容。AI 通過簡明的摘要優化內容，確保用戶能了解真正感興趣的話題。

• 內容分類
AI 大大幫助篩選數百萬篇文章和視頻，為消費者呈現最相關的內容。這種效率提升了公司的盈利能力，確保消費者持續與高質量、相關的內容互動。

• 廣告活動
AI 通過利用關鍵功能和工具來有效觸達目標受眾，優化廣告活動的效果，確保廣告的最大影響力與效率。

• AI 在警務中的應用
開發聊天機械人生成和管理信息。

網絡管理與優化
• 人工智能在電訊中的應用
電訊公司運用 AI 挖掘有價值的洞察力，從而優化網絡性能並進行預測性維護。這種主動的方法有助於在服務交付受影響之前防止潛在問題發生。

• 網絡優化中的 AI
AI 在管理和優化網絡性能中發揮了關鍵作用。通過高效存儲和分析用戶生成的大量數據，AI 能夠快速識別和解決網絡問題。

• 混合雲 AI
混合雲 AI 解決方案提供靈活且可擴展的計算資源。通過整合本地基礎設施與公共雲服務，公司能夠平衡工作負載，優化成本並維持網絡性能。

• AI 節能解決方案
AI 在基站部署的解決方案通過分析使用模式來提升網絡性能。這些解決方案在低流量時段切換

during low-traffic periods, these solutions contribute to cost savings and environmental sustainability.

• Cost Saving
AI facilitates cost savings through observability and cost analysis. By understanding signaling and compliance standards, AI can optimize resource allocation and reduce unnecessary expenditures.

• Anomaly Detection
Pattern recognition in AI enables effective anomaly detection. Network engineers can detect, diagnose, and address issues more rapidly, gaining deeper insights into network performance.

• Empowering Autonomous Communication Networks
AI-native architectures are becoming central to network design. With control and knowledge loops based on digital twins, communication networks are moving towards full autonomy, achieving self-configuration, self-healing, and self-optimization.

• Navigating Evolution
The evolution of network architecture involves both disruptive innovation and iterative pathways. Disruptive innovation focuses on self-development with the operations support system (OSS) at the core, while iteration involves collaboration with network applications and infrastructure. This evolution necessitates a transformation in operations and maintenance (O&M) modes, requiring organizational adaptation and the establishment of intelligent domain O&M systems.

Customer Experience
• Intelligent Customer Service Systems
AI personal assistants enhance customer service by answering calls, filtering fraudulent ones, acting as secretaries, and providing voicemail services. This automation improves efficiency and customer satisfaction.

• AI in Rescue
The HKSOS app of Police providing real-time insights and assistance to users in emergencies. Another App aimed at assisting the public with inquiries and streamlining operations.

• AI Intelligent Text Customer Service
AI-powered text services quickly identify customer intentions and provide rapid responses in multiple languages, ensuring effective communication across diverse linguistic groups.

• Video Customer Service
AI systems in video customer service identify customer needs and respond promptly, enhancing the overall customer interaction experience.

• Sentiment Analysis and Predictive Analytics
AI leverages sentiment analysis and predictive analytics to enhance customer engagement. By understanding consumer preferences, businesses can tailor their services to meet specific needs and improve satisfaction.

至節能模式，有助於節省成本並促進環境可持續性。

• 成本節約
AI 通過可觀察性和成本分析促進成本節約。通過了解信號和合規標準，AI 能夠優化資源分配並減少不必要的支出。

• 異常檢測
AI 的模式識別能力使得異常檢測更加有效。網絡工程師可以更快地檢測、診斷和處理問題，並深入了解網絡性能。

• 賦能自主通訊網絡
AI 原生架構正成為網絡設計的核心。基於數字雙胞胎的控制和知識循環，通訊網絡正向完全自主化邁進，實現自我配置、自我修復和自我優化。

• 演進中的網絡架構
網絡架構的演進既涉及顛覆性創新，也涉及迭代路徑。顛覆性創新以運營支持系統 (OSS) 為核心進行自我發展，而迭代則需要與網絡應用和基礎設施的協作。這一演進要求運營和維護(O&M) 模式的轉變，並需要組織適應和建立智能領域的 O&M 系統。

客戶體驗
• 智能客服系統
AI 個人助理增強了客服系統，能夠接聽電話、過濾騷擾電話、擔任秘書並提供語音信箱服務。這種自動化提高了效率和客戶滿意度。

•AI 在救援中的應用
香港警隊的 HKSOS 應用程式為用戶在緊急情況下提供實時洞察和幫助。另一款應用程式旨在幫助公眾進行查詢並簡化操作流程。

•AI 智能文本客服
AI 驅動的文本服務能快速識別客戶意圖，並以多種語言快速回應，確保跨語言群體之間的有效溝通。

• 視頻客服
AI 系統在視頻客服中能夠識別客戶需求並迅速回應，提升了整體客戶互動體驗。

• 情感分析與預測分析
AI 利用情感分析和預測分析來提升客戶參與度。通過理解消費者的偏好，企業可以量身定制其服務，以滿足具體需求並提高滿意度。

KPIs Alignment

AI helps align customer service with key performance indicators (KPIs) by understanding the context of customer inquiries. This alignment ensures that customers receive the best experience in real-time, addressing mismatches between customer needs and service delivery.

Increase Operating Efficiency

• Automate Repetitive Tasks

AI automates routine tasks such as data entry, scheduling, and email marketing. This automation frees employees to focus on strategic and creative tasks that add greater value to the organization.

• AI in Patrolling

Use of Wi-Fi checkpoints and NFC technology in iPatrol for data collection and analysis. Use of patrol robots for situational awareness and directing citizens to appropriate departments. The Electronic Visiting Book (EVB) Streamlines police operations and enhancing data collection efficiency.

• Call filtering for emergency number

Automating responses to manage high call volumes effectively.

• AI for Fraud Detection

AI enhances fraud detection by analyzing transaction records and behavioral patterns. This capability helps safeguard against identity theft and SIM card cloning, protecting both customers and the company.

• Hybrid Cloud for IT Operations

To streamline IT operations, AI employs predictive analysis for network failure prediction and enhances incident management. This leads to faster response times and improved service reliability.

• AI-Driven Efficiency and Integration

AI addresses complex network issues, enhancing productivity in operations and maintenance. By eliminating interruption points and simplifying processes, AI improves overall operational efficiency. Moving away from traditional API integration, AI enables automatic tool invocation, further reducing time-to-market (TTM) for business transactions.

Asset Management

• AI in Communications

AI's predictive capabilities help optimize resource use and manage assets within telecommunications. By forecasting demand, AI ensures efficient resource allocation and utilization.

• AI in Energy Consumption

AI regulates network power consumption by integrating efficient antenna components. This regulation reduces energy use while maintaining high-quality customer experiences.

• Construction Site Safety

AI contributes to safety on construction sites by accurately predicting risks and suggesting mitigation strategies. This proactive approach enhances worker safety and project compliance.

•KPI 對齊

AI 通過理解客戶查詢的背景來幫助客服系統對齊關鍵績效指標（KPI）。這種對齊確保了客戶能夠實時獲得最佳體驗，解決了客戶需求與服務交付之間的不匹配。

提升運營效率

• 自動化重複性任務

AI 自動化處理如數據輸入、排程和電子郵件營銷等日常任務。這種自動化使員工能夠專注於更具戰略性和創造性的工作，為組織帶來更大的價值。

•AI 在巡邏中的應用

通過 Wi-Fi 檢查點和 NFC 技術進行數據收集和分析。巡邏機械人用於形勢掌握及評估，並引導市民至適當部門。電子訪客簿（EVB）簡化警務運作並提高數據收集效率。

• 緊急號碼的呼叫篩選

自動化回應系統有效管理高呼叫量。

•AI 在欺詐檢測中的應用

AI 通過分析交易記錄和行為模式提升了欺詐檢測能力。這一能力有助於防範身份盜竊和 SIM 卡克隆，保護客戶和公司的安全。

• 混合雲在 IT 操作中的應用

為了簡化 IT 運作，AI 使用預測分析進行網絡故障預測並提升事件管理。這提升了回應速度並改善了服務可靠性。

• AI 驅動的效率與整合

AI 解決了複雜的網絡問題，提升了運營和維護的生產力。通過消除中斷點並簡化流程，AI 改善了整體運營效率。擺脫傳統的 API 集成，AI 能夠自動調用工具，進一步縮短業務交易的上市時間（TTM）。

資產管理

• AI 在通訊中的應用

AI 的預測能力有助於優化資源使用並管理電訊中的資產。通過預測需求，AI 確保了資源的高效分配和利用。

• AI 在能源消耗中的應用

AI 通過集成高效天線組件來調節網絡功耗。這種調節減少了能源使用，同時保持了高質量的客戶體驗。

• 施工安全

AI 有助於施工現場的安全，能準確預測風險並提出減輕策略。這種前瞻性的方法提升了工人安全和項目合規性。

• Credit Control
AI assists in managing complex systems for different customer types, preventing revenue loss from discounts, free credits, and unreturned hardware. By optimizing credit control, AI protects company revenue and customer satisfaction.

• Predictive Maintenance
AI predicts equipment failures and recommends timely maintenance, such as for cell towers or fiber optic cables. This predictive capability ensures network reliability and reduces unexpected outages.

Data Privacy and Protection
• Challenges and Countermeasures for AI
Emphasizing the importance of data security and authorization management, AI plays a vital role in safeguarding customer data privacy and ensuring compliance with regulations.

• Cybersecurity Risks
AI algorithms identify potential cybersecurity threats, preventing security incidents and data breaches. This protective measure is essential for maintaining customer trust and data integrity.

Future Prospects
• Deep Integration of AI and 6G
The future will see AI PCs and the enhancement of AI integration with networks through 6G technology, opening new possibilities for connectivity and innovation.

• AI in Policing
Ongoing development and testing of AI technologies in policing, including patrol robots and facial recognition systems.

• AI in the Future
As AI technology advances, debates over safety, security, and accessibility will intensify. There is concern that AI could exacerbate the digital divide if not managed inclusively.

• Opportunities in Hong Kong
Local telecom operators in Hong Kong can leverage a tech-savvy population to seamlessly integrate AI solutions into their operations, fostering growth and innovation.

• The "Operator Trap"
Caution is advised against the potential misuse of AI, which could diminish human cognitive abilities. Responsible AI usage is critical to avoid such pitfalls.

• Computing Power Focus
As devices transform, there will be a greater focus on computing power rather than hardware, driving advancements in digital technology.

• 信用控制
AI 幫助管理不同客戶類型的複雜系統,防止因折扣、免費信用和未歸還硬件造成的收入損失。通過優化信用控制,AI 保護了公司收入並提升了客戶滿意度。

• 預測性維護
AI 預測設備故障並推薦及時維護,例如對於基站或光纖電纜。這種預測能力確保了網絡的可靠性並減少了意外停機。

數據隱私與保護
• AI 的挑戰與對策
強調數據安全和授權管理的重要性,AI 在保護客戶數據隱私和確保合規性方面發揮了關鍵作用。

• 網絡安全風險
AI 演算法能夠識別潛在的網絡安全威脅,防止安全事件和數據洩露。這一保護措施對於維護客戶信任和數據完整性至關重要。

未來展望
• AI 與 6G 的深度整合
未來將看到 AI 電腦以及 AI 與網絡通過 6G 技術的深度整合,開啟連接和創新的新可能性。

• AI 在警務中的應用
AI 技術在警務中的開發和測試仍在進行中,包括巡邏機械人和面部識別系統。

•AI 的未來
隨著 AI 技術的進步,關於安全性、隱私性和可及性的辯論將愈加激烈。如果管理不善,AI 可能會加劇數字鴻溝。

• 香港的機遇
香港本地電訊運營商可以利用技術熟練的用戶群,將 AI 解決方案無縫集成到其運營中,促進增長與創新。

•「運營商陷阱」
應警惕 AI 的潛在誤用,這可能削弱人類的認知能力。負責任地使用 AI 對於避免這類問題至關重要。

• 計算能力的關注點
隨著設備的變革,將會有更多的關注點轉向計算能力而非硬件,推動數字技術的進步。

- **Employee Adaptation**

Training and workshops are crucial for equipping employees with AI-related skills. This preparation ensures that the workforce can adapt to AI-driven changes and leverage new technologies effectively.

- **Satellite Communications**

Satellite-based systems will expand rapidly, providing robust connectivity to remote areas and enhancing global communication capabilities.

- **Networks Fueling AI Development**

Networks will play a key role in AI development, laying a foundation for the mobile AI era. AI will empower networks, boosting productivity across various sectors and creating new opportunities for innovative applications and services.

- **Smart City Initiatives**

Collaborations and initiatives in smart city development will drive innovation and sustainable growth. AI's integration into urban planning will enhance connectivity, efficiency, and quality of life.

- **員工適應**

培訓和研討會對於讓員工掌握 AI 相關技能至關重要。這種準備確保了員工能夠適應 AI 驅動的變革並有效利用新技術。

- **衛星通訊**

基於衛星的系統將迅速擴展，為偏遠地區提供強大的連接，並提升全球通訊能力。

- **推動 AI 發展的網絡**

網絡將在 AI 發展中發揮關鍵作用，為移動 AI 時代奠定基礎。AI 將賦能網絡，提升各行業的生產力，創造創新應用和服務的新機會。

- **智慧城市倡議**

智慧城市發展中的合作與倡議將推動創新和可持續增長。AI 在城市規劃中的整合將提升連接性、效率和生活質量。

Business Strategy in AI Industry

人工智能產業中的商業策略

Let's delve into AI business strategies in general before going into the Communication Industry. The Economist construct an AI millefeuille as shown in Chart 1 (https://www.economist.com/business/2024/03/17/just-how-rich-are-businesses-getting-in-the-ai-gold-rush). With that, I tried to formulate a business strategy in this tech stack:

在深入探討通訊產業的 AI 商業策略之前，我們先來了解 AI 產業中的一般商業策略。《經濟學人》構建了一個 AI 技術堆疊，如圖 1 所示 (https://www.economist.com/business/2024/03/17/just-how-rich-are-businesses-getting-in-the-ai-gold-rush)。基 於 此，我 嘗 試 在 這 個技術堆疊中制定一個商業策略：
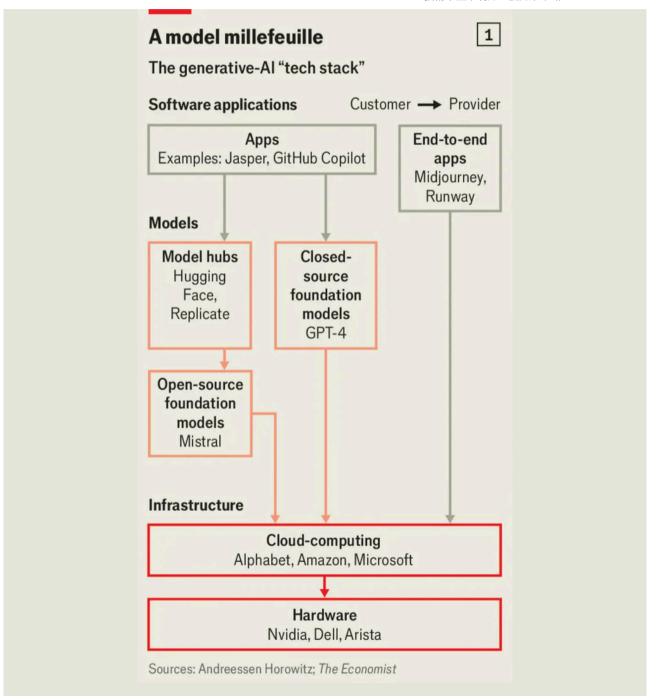

Chart 1
圖 1

COVER STORY
封面故事

1. Capitalizing on Market Trends

The AI sector is characterized by rapid developments and high volatility. Companies must stay ahead of these trends to capitalize on growth opportunities. For instance, Dell's recent surge in share price was driven by market optimism around AI's potential to boost sales. Businesses should invest in market research and predictive analytics to identify and act on these trends promptly.

2. Strategic Partnerships and Investments

Forming strategic partnerships and making targeted investments can significantly enhance a company's position in the AI landscape. Together AI, a cloud-computing startup, raised its valuation from $500 million to $1.3 billion in just a few months, partly due to backing from Nvidia. Collaborating with established AI players or investing in promising startups can provide access to cutting-edge technologies and new markets.

3. Innovation and Product Development

Continuous innovation is crucial for staying competitive in the fast-evolving AI market. Nvidia's rise from a market value of $300 billion to $2.3 trillion was fueled by its development of AI chips that are integral to numerous AI applications. Companies should prioritize R&D to develop unique products that address emerging needs in the AI sector.

4. Scalability and Flexibility

The ability to scale operations quickly and adapt to changing market conditions is vital. AI technologies can provide businesses with the tools to enhance their scalability and flexibility. For example, the use of AI in cloud computing allows for efficient resource management and scalability, ensuring that businesses can meet increasing demand without compromising performance.

5. Ethical Considerations and Sustainability

As AI becomes more pervasive, ethical considerations and sustainability will play a pivotal role in shaping public perception and regulatory frameworks. Companies should adopt ethical AI practices, ensuring transparency, fairness, and accountability in their AI deployments. This not only fosters trust but also mitigates the risk of regulatory backlash.

1. 利用市場趨勢

AI 產業的特點是快速發展和高度波動。公司必須跟上這些趨勢才能抓住增長機會。例如，戴爾的股價最近因市場對 AI 提振銷售的樂觀預期而飆升超過 30%。企業應投資於市場研究和預測分析，以便及時識別並採取行動。

2. 戰略夥伴關係與投資

建立戰略夥伴關係並進行有針對性的投資可以顯著提升公司在 AI 領域的地位。Together AI，一家雲計算創業公司，幾個月內將估值從 5 億美元提升至 13 億美元，部分原因是得到了 Nvidia 的支持。與知名 AI 企業合作或投資有前景的初創企業，能夠讓公司接觸到尖端技術和新市場。

3. 創新與產品開發

持續創新對於在快速變化的 AI 市場中保持競爭力至關重要。Nvidia 的市值從 3000 億美元增至 2.3 兆美元，這是得益於其開發的 AI 晶片，這些晶片對許多 AI 應用至關重要。企業應優先考慮研發，開發能夠滿足 AI 行業新需求的獨特產品。

4. 可擴展性與靈活性

快速擴展業務和適應市場變化的能力至關重要。AI 技術可以為企業提供增強可擴展性和靈活性的工具。例如，AI 在雲計算中的應用能夠實現高效的資源管理和可擴展性，確保企業在面對需求增加時不會影響性能。

5. 道德考量與可持續性

隨著 AI 的普及，道德考量和可持續性將在塑造公眾認知和監管框架中發揮關鍵作用。企業應採用道德的 AI 實踐，確保 AI 部署中的透明度、公平性和責任感。這不僅能夠建立信任，還能降低監管反彈的風險。

Strategic Contributions of AI in Communication Companies

人工智能對通訊公司的戰略貢獻

COVER STORY
封面故事

AI significantly influences how communication companies formulate and execute their business strategies. By leveraging AI technologies, these companies can gain valuable insights and enhance decision-making processes across various strategic dimensions. Here are some of the key strategies being adopted in the communication industry as depicted in the Interviews with the Industry Leaders:

1.Market Trend Analysis:
• Data-Driven Insights
AI-powered analytics tools can sift through extensive datasets from diverse sources, including industry reports, customer feedback, and competitor activities. By processing this information, AI identifies emerging trends, shifts in consumer preferences, and untapped market opportunities.

• Strategic Decision-Making
These insights empower communication companies to make well-informed decisions regarding market expansion, product development, and strategic positioning. By understanding where the market is headed, companies can adapt their offerings and approach to stay competitive.

2. Customer Segmentation and Targeting:
• Detailed Segmentation
AI algorithms excel at segmenting customers based on complex datasets that include behavioral, demographic, and psychographic information. This segmentation allows companies to tailor strategies and personalize offerings for distinct customer groups.

• Enhanced Customer Engagement
By targeting specific segments with personalized marketing and service strategies, communication companies can improve customer acquisition, retention, and loyalty—critical components of sustained business growth.

3.Competitive Analysis and Benchmarking:
• Comprehensive Intelligence Gathering
AI facilitates the analysis of competitive intelligence, encompassing aspects like pricing strategies, marketing campaigns, and service offerings. This analysis helps companies benchmark their performance against industry peers.

• Strategic Positioning
With these insights, communication companies can make informed strategic decisions about pricing, product differentiation, and market positioning to gain a competitive advantage.

4. Scenario Planning and Risk Assessment:
• Predictive Modeling
AI-based predictive models simulate various business scenarios, assessing impacts from changes in market conditions, regulatory environments, or technological advancements. This foresight helps companies anticipate and mitigate potential risks.

AI 對通訊公司制定和執行商業策略的影響顯著。通過運用 AI 技術，這些公司可以獲得寶貴的洞察力，並提升在各種策略層面的決策能力。以下是通訊產業領導者訪談中所描繪的一些關鍵策略：

1. 市場趨勢分析：
• 數據驅動的洞察
AI 驅動的分析工具能夠從包括行業報告、客戶反饋和競爭對手活動在內的多樣化數據集中篩選出有用信息。通過處理這些信息，AI 能夠識別新的市場趨勢、消費者偏好轉變以及未開發的市場機會。

• 戰略決策
這些洞察使通訊公司能夠在市場擴展、產品開發和戰略定位方面做出明智的決策。通過了解市場的發展方向，公司可以調整產品和策略以保持競爭力。

2. 客戶細分與定位：
• 詳細的細分
AI 演算法擅長根據行為、人口統計和心理特徵等信息進行客戶細分。這種細分使公司能夠為不同的客戶群體量身定制策略和提供個性化的產品。

• 增強客戶參與度
通過針對特定細分客群實施個性化的營銷和服務策略，通訊公司可以提升客戶獲取、保留和忠誠度，這是持續業務增長的關鍵組成部分。

3. 競爭分析與基準測試：
• 全面的情報收集
AI 幫助分析競爭情報，包括定價策略、營銷活動和服務產品。這些分析幫助公司將自身表現與行業同儕進行基準比較。

• 戰略定位
通訊公司可以利用這些洞察，在定價、產品差異化和市場定位方面做出明智的戰略決策，從而獲得競爭優勢。

4. 情景規劃與風險評估：
• 預測模型
基於 AI 的預測模型能夠模擬各種業務情景，評估市場條件變化、監管環境或技術進步的影響。這種前瞻性有助於公司預測並減輕潛在風險。

• Resilient Strategies

By understanding possible future challenges, communication companies can develop robust and adaptable business strategies that are better equipped to withstand unexpected disruptions.

5. Resource Optimization and Investment Prioritization:
• Operational Efficiency

AI analyzes data on operational efficiency, cost structures, and resource utilization, enabling companies to optimize resource allocation, including capital, personnel, and infrastructure.

• Investment Decisions

These insights inform strategic decisions regarding investment priorities, cost-saving initiatives, and resource deployment, ultimately enhancing profitability and competitiveness.

6. Innovation and Product Development:
• Identifying Opportunities

AI assists in uncovering new product and service opportunities by examining consumer trends, emerging technologies, and unmet market needs.

• Driving Innovation

With these insights, communication companies can spearhead innovation, developing novel offerings that keep them ahead of the competition.

7. Strategic Partnerships and Acquisitions:
• Evaluating Partnerships

AI-powered analytics provide critical evaluations of potential strategic partners, acquisition targets, or joint venture opportunities by assessing financial, operational, and cultural compatibility. Collaborate with universities, research institutions, and cybersecurity firms specializing in quantum technologies.

• Successful Alliances

These evaluations lead to more informed and successful strategic alliances, mergers, and acquisitions that align with overall business objectives. Join industry groups to share knowledge and best practices regarding quantum cybersecurity.

By integrating AI-driven insights into their strategic planning processes, communication and telecommunications companies can make more data-driven, forward-looking decisions. This integration enables firms to adapt swiftly to changing market conditions, ultimately strengthening their competitive position within the industry.

• 韌性策略

通過了解未來可能的挑戰，通訊公司可以制定更具韌性和適應性的商業策略，從而更好地應對意外的中斷。

5. 資源優化與投資優先級：
• 運營效率

AI 分析運營效率、成本結構和資源利用情況，使公司能夠優化資源分配，包括資本、人員和基礎設施。

• 投資決策

這些洞察為戰略決策提供了依據，幫助公司確定投資優先級、節約成本的舉措和資源部署，最終提升盈利能力和競爭力。

6. 創新與產品開發：
• 識別機會

AI 通過分析消費者趨勢、新興技術和未滿足的市場需求，幫助公司發現新的產品和服務機會。

• 推動創新

憑藉這些洞察，通訊公司可以引領創新，開發出能夠讓它們在競爭中保持領先的新產品。

7. 戰略夥伴關係與收購：
• 評估合作夥伴

AI 驅動的分析為潛在戰略夥伴、收購目標或合資機會提供了關鍵評估，通過評估財務、運營和文化的兼容性來支持決策。與專注於量子技術的網絡安全公司、大學和研究機構合作也至關重要。

• 成功的聯盟

這些評估促使公司做出更明智的戰略聯盟、合併和收購決策，並且這些決策與整體商業目標一致。加入行業組織以分享量子網絡安全的知識和最佳實踐。

通過將 AI 驅動的洞察整合到其戰略規劃過程中，通訊和電訊公司能夠做出更多數據驅動且具有前瞻性的決策。這種整合使企業能夠迅速適應變化的市場條件，最終增強其在行業中的競爭地位。

AI and Robotics
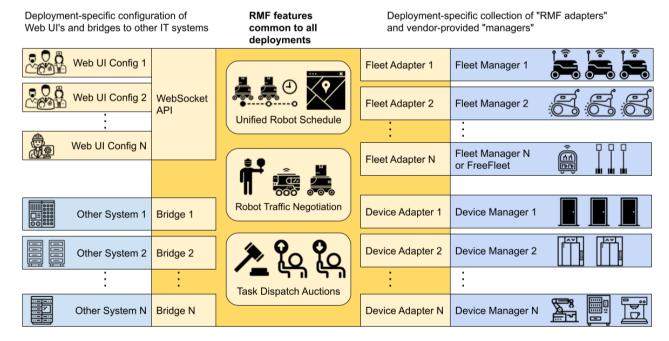
人工智能與機械人技術

COVER STORY
封面故事

The integration of AI and robotics is poised to revolutionize various industries. There is a need to facilitate a communication platform amongst Robots. In today's marketplace, robots from different manufacturers often cannot communicate with each other, leading to conflicts. To address this, an open Robotic Middleware Framework (RMF) can provide a set of conventions, tools, and software implementations that enable multiple fleets of robots to interoperate with each other and with shared building infrastructure, such as lifts, doors, corridors, and other natural "bottlenecks" to traffic flows and tasks. As the scope and scale of robotic deployments increase, this framework is essential for allowing customers to choose different vendors for different tasks in an interoperable manner.

RMF is a collection of reusable, scalable libraries and tools built on top of the Robot Operating System 2 (ROS 2) that enable the interoperability of heterogeneous fleets of any type of robotic systems. RMF utilizes standardized communication protocols to optimize the use of critical resources (e.g., robots, lifts, doors, passageways) in the environments where robots are deployed. It is flexible and robust enough to operate over virtually any communications layer and integrate with any number of Internet of Things (IoT) devices. A Lightweight Messaging Protocol, Message Queuing Telemetry Transport (MQTT) is often used in IoT applications, making it a good fit for robotic systems needing to connect with cloud services.

人工智能（AI）與機械人技術的整合，正準備徹底改變各行各業。目前，需要促進機械人之間的通訊平台。在現今的市場中，不同製造商的機械人往往無法相互溝通，導致衝突。為了解決這個問題，一個開放的機械人中間件框架（Robotic Middleware Framework, RMF）可以提供一套規範、工具和軟體實現，讓多個機械人隊列能互相協作，並且能與共享的建築基礎設施（如電梯、門、走廊及其他交通流動和任務流程中的自然"瓶頸"）進行互操作。隨著機械人部署的範圍和規模擴大，這個框架對於讓客戶能夠選擇不同廠商並在互操作的環境中執行不同任務至關重要。

RMF 是一組可重複使用、可擴展的庫和工具，基於機械人作業系統 2（ROS 2）之上，旨在實現各類異質機械人隊列的互操作性。RMF 利用標準化的通訊協議來優化關鍵資源（如機械人、電梯、門、通道）在機械人部署環境中的使用效率。它既靈活又強大，幾乎可以在任何通訊層上運行，並能與任何數量的物聯網（IoT）設備集成。輕量級消息傳遞協議——消息佇列遙測傳輸協議（MQTT）常用於物聯網應用，因此它非常適合需要連接雲端服務的機械人系統。

Reference: Introduction – Programming Multiple Robots with ROS 2 (osrf.github.io)

引自:《使用 ROS 2 編程多機械人系統》(osrf.github.io）

Potential Threats

Some of our interviewees mentioned about the potential threats we must address. As AI technologies continue to advance and integrate into various facets of society, they rely on extensive data and significant computational resources. This reliance necessitates the use of heavy-duty data centers that power AI applications, predominantly hosted in the cloud. These cloud services are maintained in expansive data centers composed of thousands of processors. While local power supplies are generally reliable, the necessity of accessing overseas cloud services may become constrained if the growth of undersea cable capacities does not keep pace with demand. This limitation could create bottlenecks, affecting the seamless operation and scalability of AI-driven solutions. Here are some additional concerns, although this list is not exhaustive:

Exacerbation of the Digital Divide

1. Algorithmic Bias

AI systems, by nature, mirror the data they are trained on. If these datasets contain biases present in society, AI can inadvertently perpetuate and amplify these biases. This can lead to discriminatory practices in critical areas such as hiring, lending, and content curation, where decisions may unfairly disadvantage underrepresented groups. The entrenchment of such biases in AI systems risks deepening existing inequalities in access and opportunity, further marginalizing vulnerable populations.

2. Automation of Jobs

The progression of AI and automation threatens to displace many routine and low-skilled jobs, which are often held by individuals from lower-income brackets. Without mechanisms to equitably distribute the productivity gains that AI introduces, economic disparities may widen. This displacement poses a challenge to workforce stability and underscores the need for reskilling and upskilling programs to prepare affected workers for emerging roles.

3. Barriers to Accessing AI

Advanced AI systems and applications are often costly, posing significant barriers for low-income individuals and communities. This economic hurdle can lead to an "AI divide," compounding the existing digital divide. As a result, those who cannot afford these technologies may miss out on the benefits of AI, exacerbating social and economic inequalities.

4. Data Scarcity

The efficacy of AI systems heavily depends on access to large and high-quality datasets. Underrepresented groups might not have sufficient data reflecting their unique experiences and needs, leading to AI applications that underperform or fail to serve these communities adequately. This data gap can perpetuate a cycle of neglect and exclusion, reinforcing systemic disparities.

5. Quantum AI

Quantum AI poses certain threats to cybersecurity; it also opens the door for innovative security solutions. Preparing for these changes is crucial for organizations to safeguard their data and systems in the evolving technological landscape.

潛在威脅

一些受訪者提到了一些我們必須應對的潛在威脅。隨著 AI 技術的持續進步並融入社會的各個層面,它們依賴於大量數據和強大的計算資源。這種依賴促使 AI 應用需要使用雲端支援的大型數據中心,這些雲端服務主要託管於由數千個處理器組成的龐大數據中心中。儘管本地電力供應通常是可靠的,但如果海底電纜容量的增長無法跟上需求,訪問海外雲端服務的能力可能會受到限制。這種限制可能會產生瓶頸,影響 AI 驅動解決方案的無縫運行和擴展性。以下是一些其他的問題,儘管這個列表並不詳盡:

加劇數位鴻溝

1. 演算法偏見

AI 系統本質上反映了其所訓練的數據。如果這些數據集中包含了社會中的偏見,AI 可能會無意中延續並放大這些偏見。這可能導致在招聘、貸款和內容推薦等關鍵領域出現歧視性行為,這些決策可能會不公平地損害弱勢群體。這些偏見若在 AI 系統中根深蒂固,會加劇機會和權益的既有不平等,進一步邊緣化脆弱的群體。

2. 工作自動化

AI 和自動化技術的進步威脅著許多例行和低技能工作的消失,而這些工作通常由低收入人群從事。如果不採取機制公平分配 AI 帶來的生產力收益,經濟不平等可能會進一步擴大。這種工作流失對勞動力穩定性構成挑戰,並強調了為受影響的工人進行再培訓和技能提升計劃的必要性。

3. 獲取 AI 的障礙

先進的 AI 系統和應用往往成本高昂,對低收入個人和社區構成了重大障礙。這種經濟壁壘可能導致 "AI 鴻溝",加劇現有的數位鴻溝。因此,無法負擔這些技術的人可能會無法享受 AI 帶來的好處,進一步加劇社會和經濟的不平等。

4. 數據稀缺

AI 系統的效力很大程度上取決於獲取大量且高質量的數據。弱勢群體可能沒有足夠的數據來反映他們的獨特經歷和需求,導致 AI 應用在服務這些社區時表現不佳或失敗。這種數據差距可能會延續忽視和排斥的惡性循環,強化系統性的不平等。

5. 量子 AI

量子 AI 對網絡安全構成了某些威脅,但也為創新的安全解決方案提供了機會。為這些變革做好準備,對於組織保護其數據和系統至關重要。

Mitigation Strategies

To address these threats, experts advocate for a range of proactive measures:

• Inclusive AI Development

Ensuring that AI systems are designed with inclusivity in mind is crucial. This involves diversifying the teams that develop AI technologies and consciously addressing biases in training data.

• Investing in Digital Infrastructure and Skills Training

Targeted investments in digital infrastructure can help bridge the gap in connectivity and access. Additionally, programs aimed at developing digital literacy and technical skills are essential to prepare the workforce for a future increasingly dominated by AI.

• Equitable Distribution of AI Benefits

Policies must be crafted to ensure that the benefits of AI are shared equitably. This includes considering the redistribution of wealth generated by AI advancements and implementing safety nets for those displaced by automation.

• Ongoing Vigilance and Intervention

Continuous monitoring and responsive interventions are necessary to prevent AI from exacerbating societal disparities. By staying vigilant, stakeholders can promptly address emerging issues and adapt to new challenges.

As we contemplate the future of AI, it is imperative to recognize the uncertainty inherent in predicting technological impacts. The futurist Roy Amara aptly noted that we often overestimate the short-term effects of new technologies while underestimating their long-term implications. This perspective urges humility and openness to the unforeseen developments that AI might bring. While we cannot pinpoint the most transformative applications of AI, preparing for a range of possibilities will be crucial in navigating its evolving landscape. ▼

緩解策略

為應對這些威脅，專家們提倡採取一系列積極措施：

• 包容性 AI 開發

確保 AI 系統在設計時考慮到包容性至關重要。這包括多樣化 AI 技術開發團隊，並有意識地解決訓練數據中的偏見問題。

• 投資於數位基礎設施和技能培訓

針對性的數位基礎設施投資可以幫助縮小連接性和可訪問性的差距。此外，旨在提升數位素養和技術技能的計劃對於培養適應 AI 主導未來的勞動力至關重要。

• 公平分配 AI 的利益

必須制定政策，確保 AI 產生的利益能夠公平分配。這包括考慮將 AI 創造的財富重新分配，並為因自動化而失業的人提供安全網。

• 持續的警覺與干預

持續的監測和應對措施對於防止 AI 加劇社會差距至關重要。通過保持警覺，利益相關者可以及時應對新出現的問題，並適應新的挑戰。

當我們思考 AI 的未來時，必須認識到預測技術影響的不確定性。未來學家羅伊·阿馬拉（Roy Amara）曾恰當地指出，我們往往高估新技術的短期影響，而低估其長期影響。這一觀點提醒我們要對 AI 可能帶來的不可預見的發展保持謙虛和開放態度。儘管我們無法準確預測 AI 最具變革性的應用，但為各種可能性做好準備，對於應對其不斷變化的格局至關重要。▼

As the saying goes, "A picture is worth a thousand words, but a video is worth a million." With that in mind, I've created a concise video summarizing the key findings from our study with the help of AI. Feel free to explore it!

正如俗話所說，"一張圖片勝過千言萬語，但一段影片勝過百萬字。"基於此，我創建了一個簡短的影片，總結了我們研究的關鍵發現，並借助 AI 完成。隨時歡迎查看！