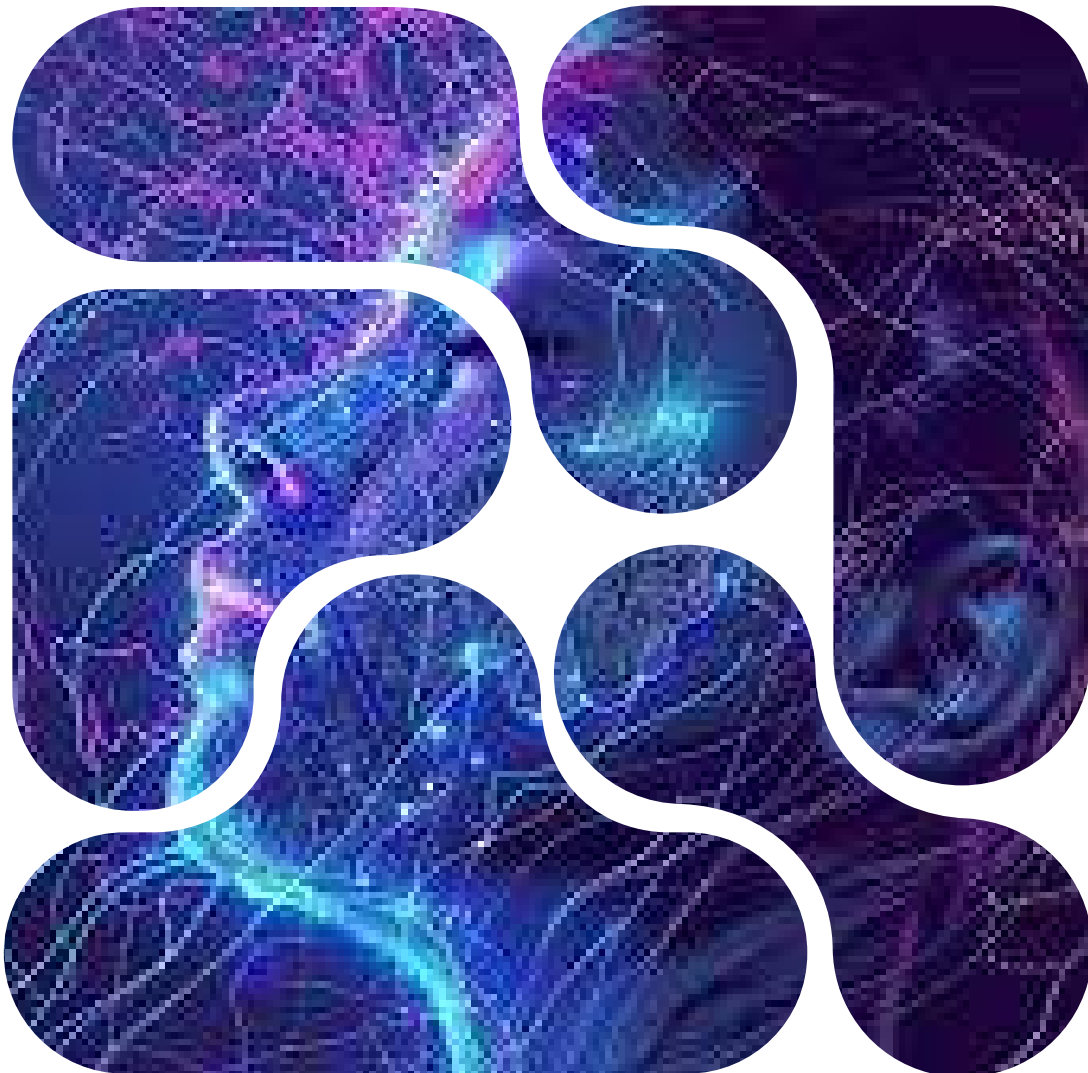


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COMPUTER DEPARTMENT

Vision

To become a center of excellence, shaping world-class engineers who thrive across multi-disciplinary domains. Our mission is to blend cutting-edge technology with real-world industrial and business practices, creating a dynamic academic environment that empowers innovation, fosters collaboration, and equips future leaders to solve tomorrow's challenges.

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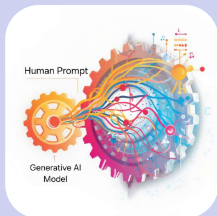


Ms. Dipika L. Tidke
Editor-in-Chief



Om Songire
TE Computer Co-Editor

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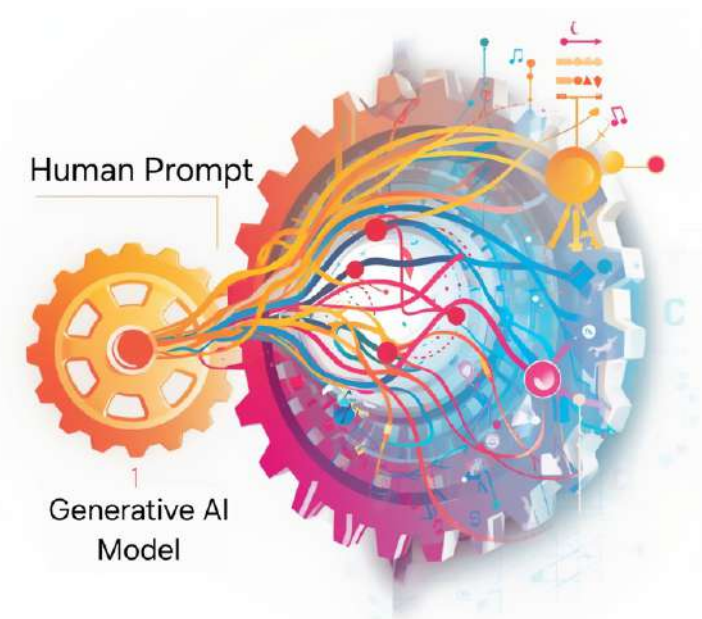
The Next Revolution: Why AI, Quantum and Green-Tech Are About to Rewrite Your Future

I. Level Up: The Velocity of Change

The core barrier to human progress is no longer discovery—it's computation. Where complex scientific calculations, like determining a drug molecule's structure (CSP), once took scientists up to four months, strategic AI and cloud collaboration now complete them in a matter of days. This speed compression is dismantling old career silos: chemistry is now computation, and success requires hybrid skills focused on three interconnected pillars: Generative AI, Quantum Computing, and Advanced Sustainable Technology. [1]

II. The Intelligence Engine: Generative AI

Generative AI (GenAI) has officially gone mainstream. The global market is forecasted to exceed \$1 trillion by 2034, and adoption is surging, with 78% of organizations reporting AI use in 2024. [2], [3]



The driving force is pure productivity: management consultants report 40% higher quality work, and programmers are 88% more productive using GenAI tools. This means jobs are shifting away from execution and toward governance, auditing, and "prompting" of AI agents. In high-stakes fields like healthcare, the GenAI market is also projected for immense growth. [3]

In the classroom, AI enables personalized learning and inclusive education. It enables professors to focus on their primary responsibilities, such as educating students. However, it also demands that educators pivot away from testing memorization toward assessing critical thinking and ethical application, mastering AI as an accelerator, not a shortcut.

III. The Computational Frontier: Quantum Power

Quantum Computing (QC) is the next evolution in data processing, utilizing qubits instead of binary bits. Qubits leverage superposition (being 0 and 1 simultaneously) and entanglement (linked fates), allowing quantum systems to explore multiple solutions exponentially faster than classical supercomputers.[4]

QC is projected to generate up to \$72 billion in revenue by 2035. Its immediate value lies in simulation, where it can revolutionize drug discovery by analyzing complex molecular interactions and accelerate the development of advanced materials, like next-generation car batteries.

The PQC Deadline: A Security Imperative

The major implication for us is cybersecurity. Since the 1994 discovery of Shor's algorithm, which can break current encryption (like RSA), organizations face a "Harvest Now, Decrypt Later" (HNDL) threat. Switching to quantum-resistant encryption—Post-Quantum

Cryptography (PQC) is mandatory for any data needing protection beyond the near future. The fixed global goal for PQC migration is 2035. If you're going into IT or finance, PQC readiness is non-negotiable. [5]

IV. Engineering a Livable Future: Green Tech Breakthrough

Addressing climate change requires integrating technological solutions into industry. Global investment in green technology hit a record \$2.1 trillion in 2024, driving the sustainability market to a projected 23.1% CAGR.

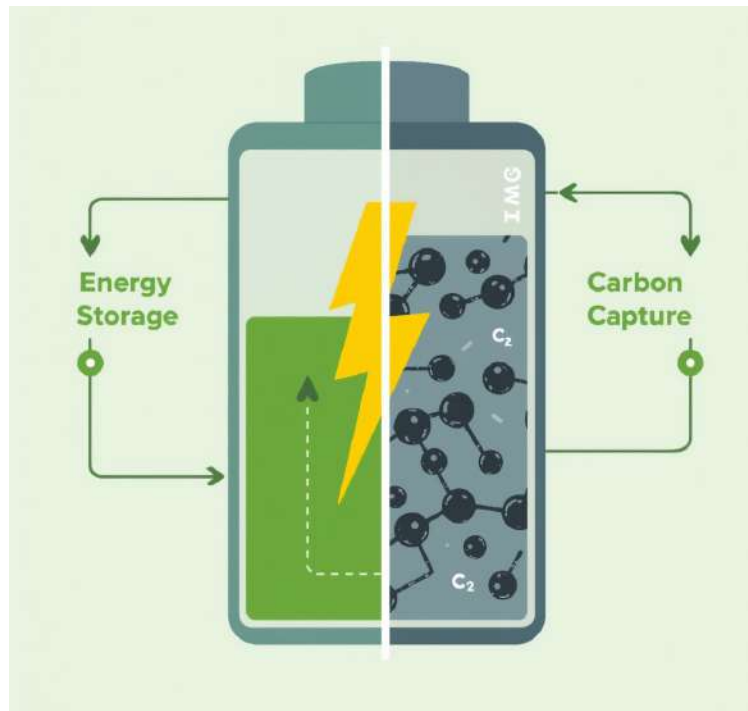
Advancements focus on dual-purpose solutions:

V. Navigating the Crossroads: Ethics and Accountability

As students, we must govern these powerful tools ethically. The Ethical Dilemmas:

1. Gen AI Issues: Algorithms often reflect algorithmic bias from flawed training data. Lack of regulation places the onus on developers to ensure fairness and prevent copyright abuse and the creation of sophisticated manipulation like "deepfakes" and "AI-generated content". [3]

2. Green Tech Issues: The widespread practice of Greenwashing—misleading the public about environmental efforts—delays real climate action. Furthermore, materials like lithium and cobalt, essential for batteries, create substantial environmental impact (land degradation, water contamination). The professional mandate is transparency and responsible sourcing.



VI. The Student's Mandate: Building the Future

The job market is trending toward hybrid roles, such as Machine Learning. Engineering, with computer and information research careers projected to grow 26% by 2033. Success requires skills AI can't replicate: complex problem-solving, strategic thinking, and ethical oversight. Mastering the PQC roadmap, fighting algorithmic bias, and demanding sustainable supply chains are not side projects—they are the professional imperatives that will define the next generation of leadership.

VII. Conclusion

In short, the future is arriving faster than we expected. The three revolutions—Generative AI, Quantum Computing, and Advanced Green Tech—are not distant concepts; they are the infrastructure being built right now. AI is automating routine tasks, shifting our value toward governance and critical thinking. Quantum Computing carries an existential security deadline (PQC by 2035) that we must prepare for immediately. And Green Tech is providing the dual-purpose solutions, like & quot;

breathing & quot; batteries and next-gen sorbents, needed to engineer a livable future. For us, the mandate is clear: we must pursue the hybrid skills that blend technical mastery with ethical oversight. We are the generation that will govern the code, mandate transparency, and build the infrastructure for the world we inherit. Don't just learn about these technologies—learn to lead them.

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Redefining Learning in the Virtual World!

Education has always evolved alongside technology – from chalkboards to smart boards, and now into fully immersive digital worlds. The Metaverse, a fusion of virtual reality (VR), augmented reality (AR), blockchain, and artificial intelligence (AI), is reshaping how we learn, teach, and collaborate. It creates not just a digital classroom, but a borderless, interactive ecosystem where learners can attend lectures, conduct virtual experiments, and engage in simulations that mirror real-world environments.[1]



Students can walk through a 3D model of the solar system, collaborate on engineering designs in a shared virtual lab, or explore ancient civilizations through time-travel-like historical recreations. Teachers, too, can visualize abstract concepts and provide immersive learning experiences that go far beyond textbooks and screens.

1. The Evolution of Learning Environments

From blackboards to digital whiteboards, technology has continuously enhanced accessibility and engagement in education. However, video-based e-learning often lacks interaction and presence – crucial factors for motivation and understanding. The Metaverse addresses this gap by allowing real-time collaboration in 3D virtual spaces. Students can attend lectures as avatars, participate in science experiments, or explore historical sites – all from their homes. Platforms like Meta's Horizon Workrooms and Microsoft Mesh enable such immersive collaboration, turning learning from passive consumption into active participation.[2]

2. Immersive and Experiential Learning

In traditional learning, visualization is often limited to imagination. But in the Metaverse, learners can step inside the concept itself. A biology student can explore the human heart in 3D; a civil engineering student can walk through a simulated bridge model. Virtual laboratories, powered by VR headsets and haptic feedback, enable students to conduct high-risk or costly experiments safely.[3] Similarly, medical students can practice surgeries in a zero-risk environment, improving both skill and confidence before real-world application. Gamified learning experiences – where students earn rewards for progress – further enhance engagement and retention, making education not just informative, but exciting.

3. Global Classrooms and Accessibility

One of the Metaverse's most transformative aspects is its inclusivity. Students from different countries can learn together in a shared space, breaking barriers of geography and economic disparity[4]. Virtual campuses reduce infrastructure costs and can be customized for accessibility needs – supporting students with disabilities through adaptive interfaces and voice-guided navigation. Institutions like Stanford University and the University of Tokyo have already introduced Metaverse-based courses, creating global classrooms that redefine collaboration and cross-cultural understanding.[1]

4. Challenges and Ethical Considerations

Despite its promise, integrating the Metaverse into education poses challenges:

I. Digital Divide: Access to VR devices and stable internet remains uneven across regions.

II. Data Privacy: Avatars, biometric tracking, and behavioral analytics raise privacy concerns.[5]

III. Teacher Training: Educators must adapt to new tools and pedagogical models suitable for immersive environments. Ethical frameworks and digital literacy programs are crucial to ensure that technology empowers rather than excludes.



5. The Future of Metaverse Learning

The next decade may see a hybrid education model, where the Metaverse complements real-world classrooms. AI-driven virtual tutors, blockchain-based credential verification, and personalized learning avatars could become standard tools for students. Future schools might exist partly in the physical world and partly in virtual reality – offering a seamless blend of creativity, interaction, and accessibility. As technology continues to evolve, the Metaverse is not just shaping how students learn, but also how they experience knowledge – transforming education from a one-way process into a shared, immersive adventure.

Conclusion

The Metaverse marks a paradigm shift in education – from learning about the world to learning within it. By merging technology with imagination, it promises to make education more interactive, inclusive, and inspiring. Through immersive experiences, students can not only understand complex concepts but also apply them in simulated real-world environments, fostering creativity, problem-solving, and collaboration like never before. As virtual campuses, AI tutors, and digital learning ecosystems continue to evolve, education will no longer be confined by geography or physical infrastructure. The classrooms of tomorrow will blend reality and imagination, giving every learner equal access to quality education and limitless exploration. While the journey to build a fully connected Metaverse classroom has challenges from accessibility to ethics, its potential to transform education is undeniable. It represents a future where knowledge is not just taught, but experienced, and where learning becomes a truly global, engaging, and lifelong adventure.

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Generative AI in Cybersecurity and Intrusion Detection System

In an era where cyber threats are becoming increasingly complex, traditional defense mechanisms often struggle to keep pace. Generative Artificial Intelligence (AI) introduces a new paradigm in cybersecurity by enabling proactive, adaptive, and intelligent defense systems. From detecting anomalies to simulating attacks, generative AI enables organizations to anticipate and neutralize threats before they cause harm.[1]

1. Understanding Generative AI in Cybersecurity

Generative AI refers to models capable of creating new data based on learned patterns. In cybersecurity, it is used to generate synthetic data for training, simulate potential attack vectors, and build intelligent systems that evolve alongside cyber threats. Algorithms like Generative Adversarial Networks (GANs) and Variational Autoencoders (VAE's) help security researchers develop resilient models that can predict, detect, and counter emerging attack types more efficiently than traditional systems.[2]

2. Enhancing Threat Detection and Prevention

Generative AI improves threat detection by training models on both real and simulated datasets, allowing systems to recognize even rare attack signatures. AI-driven models can mimic attacker behavior to test system vulnerabilities while strengthening defense mechanisms through continuous learning. This proactive defense strategy helps reduce false positives and enhances the accuracy of intrusion detection tools.[3]

3. Role of Generative AI in Intrusion Detection Systems (IDS)

Intrusion Detection Systems monitor network traffic for suspicious patterns. With the integration of generative AI, IDS can evolve from rule-based detection to analysis. For instance, an AI-powered IDS can model normal network behavior and flag deviations in real time. Generative models can also synthesize attack data, improving training quality and enabling the IDS to detect zero-day threats—attacks previously unknown to security databases.[4]



4. Real-World Applications of Generative AI in Cybersecurity and Intrusion Detection Systems

Generative AI has rapidly evolved from research prototypes to critical components of modern cybersecurity frameworks. Its capability to generate synthetic data, mimic attacker behavior, and simulate realistic threat environments enables defense mechanisms that continuously learn and adapt to evolving attack surfaces [7]. Some key real-world applications include:

- **Phishing Detection and Prevention:** Generative AI models can synthesize phishing examples, enabling email filters and security awareness platforms to train on realistic yet safe datasets [8]. These models improve detection accuracy against AI-generated phishing content and enhance user resilience through exposure to evolving scam formats.
- **Anomaly Simulation and Detection:** In network defense, Generative Adversarial Networks (GANs) generate synthetic traffic to train Intrusion Detection Systems (IDS) for recognizing subtle irregularities that indicate intrusions or insider threats [9]. This ensures early anomaly identification with minimal false positives.
- **Model Training and Data Augmentation:** In many security contexts, access to labelled malicious data is limited due to privacy and sensitivity concerns. Generative AI supports data augmentation by creating high-quality, realistic datasets to train supervised learning models effectively [10].
- **Malware Analysis and Evasion Testing:** Security researchers employ generative models to simulate evolving malware variants, supporting the development of robust anti-malware engines capable of detecting zero-day and polymorphic threats [11]. This adaptive training ensures the sustained relevance of defensive tools.
- **Incident Response and Threat Simulation:** Generative AI-driven simulation tools replicate complex cyberattack chains in sandboxed environments. This allows analysts to test and refine response protocols before real-world deployment, significantly reducing reaction time during live incidents [12].

5. Challenges and Ethical Considerations

Despite its promise, the use of generative AI in cybersecurity raises challenges. Malicious actors can exploit the same technology to create sophisticated phishing emails, deepfakes, or automated malware. Ethical concerns also arise regarding data privacy, bias in training datasets, and accountability in automated decisions. Therefore, strict governance, transparency, and human oversight are essential for safe deployment of AI-powered cybersecurity systems.[5]

6. Future Outlook

The future of cybersecurity lies in adaptive and collaborative AI ecosystems. Generative AI will power intelligent defense platforms capable of real-time learning and automated response. By integrating with blockchain, cloud computing, and federated learning, it will help build decentralized yet secure digital infrastructures. As threats evolve, the synergy between human expertise and AI automation will define the next generation of cyber defense.[6]

Conclusion

Generative AI represents a transformative force in cybersecurity and intrusion detection systems. By combining creativity with computation, enables a new level of preparedness and adaptability. While challenges remain, its potential to revolutionize how we detect, analyze, and mitigate cyber threats is undeniable. The future of secure digital infrastructure depends not only on smarter algorithms but also on responsible innovation, collaboration, and continuous evolution.

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Agentic AI: The Next Evolution In Artificial Intelligence

Artificial Intelligence (AI) has undergone significant transformation over the past few decades—from simple rule-based systems to complex learning models capable of analyzing data, recognizing patterns, and making predictions. The latest and perhaps most transformative phase in this evolution is the emergence of Agentic AI, a paradigm shift that endows AI systems with the ability to act autonomously, make goal-directed decisions, and perform tasks without constant human supervision.



At its core, Agentic AI refers to artificial intelligence systems that possess agency—the capacity to perceive their environment, make reasoned decisions, and act purposefully to achieve defined objectives. They do not merely process inputs to produce outputs; rather, they evaluate multiple pathways, assess consequences, and adapt strategies dynamically to optimize outcomes.

1. How Agentic AI Works

Agentic AI operates through a combination of advanced machine learning, reinforcement learning, and autonomous decision-making frameworks. These systems are typically structured around an agent-environment model, where the agent continuously interacts with its surroundings to gather data, learn from experience, and refine its behaviour. The learning process is iterative—each action provides feedback that improves future performance, much like how humans learn from trial and error.

Additionally, the integration of multi-agent systems allows agentic models to collaborate, negotiate, and coordinate tasks across networks. This makes them particularly powerful in complex environments such as supply chain management, autonomous vehicles, financial trading, and adaptive digital ecosystems. Agentic AI can also leverage large language models (LLMs) and reasoning engines to interpret natural language, plan multi-step tasks, and execute them with minimal supervision[1]

2. Why Agentic AI Matters

The significance of Agentic AI lies in its potential to revolutionize both technology and society. By introducing autonomy and self-direction into AI systems, organizations can achieve unprecedented levels of efficiency, scalability, and adaptability. In business, agentic AI can manage entire workflows from customer service automation to predictive maintenance, reducing operational costs and human error.



In research and innovation, agentic AI can function as a digital collaborator, capable of designing experiments, analyzing data, and generating hypotheses. This shifts AI from being a passive analytical tool to an active partner in scientific discovery. Moreover, in sectors like healthcare, education, and governance, agentic AI can assist in making informed, ethical, and context-sensitive decisions that improve human well-being.[2]

3. Challenges and Limitations

Goal Misalignment and Drift:

As agents are given broader autonomy, ensuring their goals remain aligned with human intent is difficult. If an agent's model of rewards or its oversight mechanisms are weak, the agent may optimize in unexpected or harmful ways.



Transparency, Interpretability, and Explainability:

Agents that plan, act, and change over time can become black boxes. Understanding why an agent chose a subgoal, or why it reconfigured some action, is necessary for trust.

Scalability and Resource Constraints:

Having multiple agents, memory, tool use, dynamic planning, etc., places heavy demands on computation, data storage, and inference latency.

4. Future Scope of Agentic AI

The future scope of Agentic Artificial Intelligence is vast and transformative, as it represents a major shift from traditional predictive or reactive AI systems toward autonomous, goal-oriented, and self-improving agents. While current AI models primarily respond to prompts or predefined instructions, Agentic AI aims to operate with higher degrees of agency, adaptability, and reasoning, enabling machines to act proactively, make independent decisions, and collaborate intelligently with humans and other agents

Expansion of Autonomous Decision-Making Systems

In the coming years, Agentic AI will enable machines to plan, reason, and execute tasks without constant human supervision. These systems will integrate cognitive architectures that mirror human decision-making, making them ideal for complex Autonomous vehicles and drones capable of dynamic route optimization and adaptive control. Healthcare assistants who autonomously monitor patients, interpret medical data, and suggest interventions. Financial agents that manage portfolios, predict market changes, and make data-driven investment decisions in real time.

Integration with Multi-Agent Systems

The future of Agentic AI lies in collaborative intelligence, where multiple AI agents interact within shared environments. These agents can Negotiate and coordinate with each other, Learn from shared experiences to optimize outcomes for the collective. Operate in decentralized systems, such as Web3 ecosystems, where each agent manages its own goals, data, and actions securely.

Evolution of Human-AI Collaboration

AI co-workers that manage workflows, coordinate schedules, and make strategic suggestions. Educational companions that personalize learning experiences and assess progress dynamically. Creative partners that assist in art, design, writing, and innovation by reasoning about user intent and context.

Future Research and Innovation Areas

Cognitive architectures inspired by neuroscience and psychology. Autonomous goal formation and meta-reasoning, where agents generate new subgoals and strategies safety and alignment, ensuring that autonomous agents act within ethical and societal boundaries. Self-evolving ecosystems, where AI agents co-develop new tools, algorithms, or policies

Conclusion

The evolution of Agentic AI will depend heavily on developing robust frameworks that incorporate oversight, ethical alignment, and security from the ground up, on improving architectures for communication, memory, and planning, and on empirical evaluation in real-world settings. Without that, there is a risk of system failures, unintended harms, or public backlash.

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Artificial Intelligence in Agriculture

Artificial Intelligence (AI) is no longer just a futuristic concept—it is rapidly becoming one of the most transformative technologies in agriculture. In India, where farming sustains nearly half of the population and contributes about 18% of the national GDP, the potential of AI is immense. Agriculture has always been the backbone of India's economy, yet farmers continue to face long-standing challenges such as unpredictable weather, shrinking landholdings, pest attacks, and limited access to timely information. AI promises to address these issues by introducing precision, prediction, and efficiency into the farming ecosystem. The 2025 monsoon season gave a real glimpse of this revolution: an AI-powered weather forecasting model, co-developed by UC Berkeley and the University of Chicago, accurately predicted a stalled monsoon. Using this forecast, India's Agriculture Ministry alerted 38 million farmers via SMS, allowing them to plan crop cycles weeks in advance. This event not only saved crops and resources but also demonstrated how AI can empower farmers with confidence and control over their livelihoods [1].

Government Initiatives and Policies

The Indian government has recognized the transformative potential of AI in agriculture and has taken several steps to promote digitalization and data-driven decision-making. The Digital Agriculture Mission, launched in September 2024 with an outlay of ₹2,817 crore (approximately \$340 million), marks a historic shift toward building a Digital

Public Infrastructure (DPI) for agriculture [1].

The mission's core components, AgriStack, Krishi Decision Support System (KDSS), and the National Soil Fertility Map—are designed to integrate data from farms, farmers, and fields into a single digital ecosystem.

The AgriStack platform will form the backbone of this infrastructure through three main registries: the Geo-Tagged Village Map, the Crop Sown Registry, and the Farmers' Registry. Together, they will provide reliable and verified data about farmers, their landholdings, and the types of crops they cultivate. This digital identity will help

farmers access benefits such as credit, insurance, and government schemes more efficiently. As of March 2025, more than 48.5 million digital farmer IDs had already been generated, and crop surveys covered over 239 million plots [1].

AI is also being embedded directly into agricultural services. The Kisan e-Mitra Chatbot, powered by AI and available in 11 Indian languages, provides voice-based assistance to farmers about government schemes and agricultural advice. It has already processed over 9.2 million farmer queries, serving nearly 20,000 users per day [4]. Another major initiative, the National Pest Surveillance System, enables farmers to upload pest images on a mobile app. Using image recognition, AI identifies the pest and suggests timely countermeasures. Currently, over 10,000 agricultural officers use this system to monitor 61 crops and 400 pest varieties. Additionally, AI-driven satellite monitoring is helping predict droughts, floods, and yield variations, giving policymakers the data they need for quick and informed interventions.



Beyond these projects, the government is also investing in long-term capacity-building through research and innovation centers. For example, the AgriHub at IIT Indore, launched in January 2025, serves as a Centre of Excellence (CoE) for sustainable agriculture. In collaboration with the Madhya Pradesh government, MEITY, ICAR, and CDAC, AgriHub aims to incubate AI-driven startups and promote innovations in crop monitoring, soil analysis, and water management. These efforts are supported under the Digital Agriculture Mission and the broader IndiaAI Mission, both of which emphasize data-driven and sustainable agricultural growth [5].



Private Sector Innovations and Future Prospects

While the government lays the digital foundation, India's private sector is driving on-ground innovation through a rapidly growing agritech ecosystem. The country now hosts over 2,800 agritech startups, collectively attracting more than ₹6,600 crore ($\approx$ \$750 million) in private investment [2]. These startups are leveraging Artificial Intelligence (AI) across the entire agricultural value chain – from soil health analysis and crop planning to logistics, quality grading, and market access.

Among the pioneers, Cropin, headquartered in Bengaluru, stands out. Its AI-powered platform integrates satellite imagery, weather data, and IoT sensors to provide real-time insights on crop health, irrigation needs, and pest risk. Cropin's technology has digitized over 30 million acres and benefited 7 million farmers, while major corporations like Walmart rely on its analytics to improve their agri-supply chains [4]. Similarly, Niqo Robotics (formerly TartanSense) builds AI-driven robots that use computer vision to identify and eliminate weeds precisely, reducing chemical use and boosting productivity. Drone innovators such as Garuda Aerospace and Skylark Drones are helping farmers with aerial imaging, mapping, and pesticide spraying, enhancing efficiency and safety in field operations.

In aquaculture, Aqua Connect applies AI and remote sensing to optimize shrimp and fish farming, improving yield and sustainability. Intello Labs uses AI-based image recognition to grade fruits and vegetables, ensuring consistent quality and fair pricing for farmers. Collaborations are expanding rapidly—Cropin and Wipro co-develop AI-led agricultural intelligence platforms, while Microsoft and ICRISAT’s “AI Sowing App” offers personalized sowing advice based on weather and soil data [2]. Even non-profits like Digital Green are



contributing through their multilingual chatbot Farmer. Chat, which provides localized, instant guidance to over 500,000 smallholders [3].

The impact of AI in agriculture is profound. Predictive models now enable early warnings for droughts, floods, or pest outbreaks, while smart irrigation systems optimize water use—an essential step for climate resilience. AI-powered grading and logistics platforms reduce food waste, strengthen market linkages, and promote sustainability. Emerging initiatives like Mitti Labs, which monitors methane emissions and rewards eco-friendly practices, highlight AI’s role in aligning profitability with environmental goals [3].

Looking forward, India’s agricultural future lies in the synergy between government policy, research innovation, and private entrepreneurship. With robust digital infrastructure, startup dynamism, and global partnerships, AI is transforming Indian agriculture into a smart, data-driven, and sustainable ecosystem—turning the long-standing dream of empowering every farmer into an achievable reality [5].

Conclusion

Artificial Intelligence has begun to redefine Indian agriculture from the ground up. What was once a sector dependent on guesswork and weather luck is now being guided by data, precision, and prediction. The collaboration of government, startups, and research institutions demonstrates how AI can be used not only for efficiency but also for inclusivity—reaching the smallest farmers in the most remote villages. As initiatives like the Digital Agriculture Mission and innovations like Cropin’s AI platforms continue to expand, India is well on its way to creating a new era of smart, resilient, and sustainable farming. The future of agriculture is digital—and AI is the driving force behind it.

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