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EDITORIAL

The month of May marks a period of new learning experiences and opportunities for our students as many of them actively engage in summer internships and training programmes during the vacation. Such experiences provide valuable exposure to practical applications of technology, industry practices, and emerging innovations beyond the classroom environment.

In today's rapidly evolving digital world, continuous learning and skill development are essential. Summer internships not only help students strengthen their technical knowledge but also improve creativity, problem-solving abilities, teamwork, and professional confidence.

As we present this issue of Vita Digital Journal, we appreciate the enthusiasm and dedication shown by our students in utilizing their vacation productively for academic and professional growth. We hope these experiences inspire them to explore new ideas, embrace innovation, and prepare themselves for future opportunities.

- Chief Editor

Mr. Livin M Miranda

Head, Department of Computer Science

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AI and the Future of Work : Changes, New Careers, and the Human-Machine Collaboration Approach

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ABSTRACT

The swift spread of Artificial Intelligence (AI) technology is revolutionizing the labor market landscape, transforming the very nature of skill sets required of professionals, and spawning entirely new career options. This article investigates the complex changes that are taking place in terms of AI-induced automation and its impact on jobs in such major industries as healthcare, finance, manufacturing, transport, and education. Based on the theoretical concepts related to human-computer interactions and sociotechnical system thinking, the paper elaborates on the ways in which current AI advances—such as machine learning, natural language processing, robotics, and computer vision—are eliminating low-skill professions, and at the same time opening the doors to highly-valued professions of AI engineer, data scientist, and algorithmic governor. In addition, the paper provides a set of competencies required of future employees and the need to balance technical, cognitive, and soft skills.

INTRODUCTION

The advent of AI as a general purpose technology marks one of the most significant shifts in the landscape of technological change for the 21st century. While previous generations of automation technology were confined to replacing physical effort through specialized tasks within industries, modern AI systems show evidence of being able to enhance or displace human cognitive processes in an n this paper, we explore the technologies enabling such trends,

the effects seen in empirical research, the dangers inherent to AI-based code generation, and the implications for the lives of professional software developers.

As stated by both ILO and WEF, it is true that the disruption by AI technology does not lead to job elimination, but rather leads to restructuring of the occupational profile by moving away from routine-based tasks and towards analysis and creativity . This calls for an in-depth analysis of the jobs that might become redundant, the types of jobs that would be created, and the skills required by the workforce of tomorrow.

ARTIFICIAL INTELLIGENCE TECHNOLOGY AND WORKPLACE IMPLEMENTATION

Core Artificial Intelligence Technologies

Artificial Intelligence is made up of a range of computational technologies through which computers can achieve things normally reserved for human beings. These include Machine Learning (ML), a field concerned with creating algorithms that can learn from experience to recognize patterns and predict outcomes; Natural Language Processing (NLP), which involves training models to understand and produce human language; Computer Vision, a technology concerned with deriving actionable knowledge from visual inputs; and Robotics, the study of sensing, actuating, and computing to execute physical actions.

Advancements in Deep Learning architecture have revolutionized the scope of operation of AI systems to an extent that recent Large Language Models (LLMs) have shown the ability to carry out tasks like summary generation, code writing, and multiple steps reasoning .

Transformation of the Workplace Through AI

There are three key ways by which AI transformation takes place in workplaces. The first one is called task automation. This entails replacing human beings with AI systems in performing clearly defined tasks during their work. Examples include the automated handling of customer requests, accounting tasks like invoicing, and other routine activities such as inventory control. The second mechanism is known as process augmentation. Here, AI is used as an assistive technology

aimed at enhancing human abilities, seen in areas such as radiology, where imaging can be aided by AI technology, and law firms, where legal research can be performed using AI systems.

SECTOR-WISE IMPACT ANALYSIS

Healthcare

The healthcare industry has seen many implementations of AI technology in the areas of medical imagery, genetic analysis, decision support tools, and patient surveillance. The AI algorithm's accuracy in diagnosing diabetic retinopathy, skin cancers, and lung nodules is comparable to that of specialists . Surgical robots like the Da Vinci system make minimal incisions with superior accuracy. However, AI applications in the healthcare sector act as a supplementary resource since human factors like decision-making, interpersonal communications, and ethics still play vital roles.

Banking and Financial Services

AI systems are widely used by banks in detecting fraudulent activities, risk management models, algorithmic trading, RegTech, and customer service automation. The natural language interface (chatbots and virtual assistants) performs repetitive customer queries on a massive scale, and machine learning systems keep optimizing the credit scores using untraditional data sources. According to reports, more than 88% of leading banks globally have implemented AI technology as of 2024.

Manufacturing

The manufacturing industry is the oldest field in terms of automation. Modern AI technology complements robotics by introducing adaptability; computerized vision systems can inspect products at the microscopic level, predictive maintenance systems help prevent machine breakdowns by predicting failures, and collaborative robots (cobots) cooperate with humans in their workplaces. From rigid to flexible manufacturing systems that employ AI technology, productivity and safety have increased.

Transportation and Logistics

The transportation industry is witnessing an unprecedented change due to the research conducted on autonomous vehicles, intelligent

traffic management systems, and logistics optimizations based on AI. Even though complete automation for vehicles is still a topic for research and not yet operational, AI has significantly improved freight logistics by introducing optimization in routing and warehousing.

Education

Adaptive learning techniques are used in educational AI applications to customize teaching materials to the unique needs of each student. AI technology is commonly used in intelligent tutoring systems, automated essay grading software, and student performance analysis. The use of AI in education is primarily geared towards enhancing teacher capabilities without displacing them.

VULNERABILITY OF OCCUPATIONS AND AUTOMATION RISK CONTINUUM

The widely accepted theory that explains automation risk is the task-oriented approach developed by Autor, Levy, and Murnane . Work tasks can be analyzed on two axes, the degree of routineness and cognitive complexity. Jobs that are highly routine and cognitive (data entry, basic accounting tasks) or routine and physical (assembly line operations) are the most vulnerable to automation.

Occupations that have a high potential for replacement are: data entry clerks and administrative support personnel, whose responsibilities are performed by robotic process automation (RPA) applications; cashiers and retail employees, whose duties are gradually automated through self-service and online shopping portals; telemarketing representatives and customer service agents, who perform their roles using conversational AI technology; and factory workers on assembly lines when robotics are feasible.

However, it is important to mention that a job-level perspective may lead to biased conclusions. Even among occupations that pose a risk of being displaced by automation, human supervision, exception handling, social interaction, and decision-making on moral grounds cannot be replaced by machines. The existing body of research proves that AI alters the nature of employment but does not completely eliminate certain job categories .

THE FUTURE OF CAREERS AS A RESULT OF THE RISE OF AI

The emergence of artificial intelligence technologies creates steady employment opportunities in the sphere of technical and cross-functional professions. Below are presented several occupations which are expected to develop at the highest rates:

- ·AI Engineer: This role involves designing, implementing and deploying AI-based solutions into production software.
- ·Data Scientist: A professional engaged in using statistical models and machine learning algorithms as well as visualizing big data.
- ·Machine Learning Specialist: This occupation is centered on building and optimizing machine learning algorithms for different purposes.
- ·Robotics Engineer: The development of intelligent robotic systems for various fields including production, medicine, logistics and space exploration.
- ·Cybersecurity Analyst: Applying advanced tools for protecting the company's cyberinfrastructure with the help of AI-based solutions.
- ·AI Ethics Consultant: Evaluation of different aspects such as bias, unfairness and compliance of AI-based solutions with existing legislation.
- Cloud Computing Specialist: Designing scalable cloud architecture for implementing AI solutions.

According to the World Economic Forum Future of Jobs Report (2023), artificial intelligence and its implementations can provide the world economy with 69 million new jobs during 2023-2027. At the same time, 83 million other jobs are expected to transform due to new technological changes.

THE AI ERA SKILLS FRAMEWORK

To navigate the labor force in the AI era, a skills set combining technical skills with advanced thinking abilities and socioemotional competencies will be needed. Here is a proposed skills framework based on insights drawn from several workforce preparedness analyses:

Technical Skills

Programming competency, especially in languages such as Python and R, alongside the capability to work

within ML software frameworks (TensorFlow, PyTorch), forms the basis for technical skills development. Data literacy, which involves understanding the results generated by statistics and comprehending biases embedded within algorithms, is another critical skill. The basics of cloud computing and cybersecurity must also be mastered.

Competences in Cognitive Skills and Creativity

Reasoning and problem solving have proven to be some of the most resilient competencies in humans because of their complexity. The ability to draw meaning from ambiguous information, combine knowledge from various fields, and create new solutions is what gives humans a cognitive edge that artificial intelligence is yet to match despite its remarkable proficiency in other clearly defined areas. Creativity, including idea generation and imagination, also holds great economic value.

Interpersonal and Adaptability Competences

Emotional intelligence involves self-awareness, empathy, and regulation in interpersonal relations. With the increasing role played by artificial intelligence in handling analytical and administrative functions, the uniquely human competencies of building trust, conflict resolution, and motivation become critical professional attributes. Continual learning and adaptability are some of the essential meta-competences for the current technology-driven environment.

THE COLLABORATION BETWEEN HUMANS AND AI PARADIGM

One of the key learnings derived from the scientific literature is that the most efficient ways of working combine AI and human workers. Rather than using machines as substitutes for people, the most successful designs involve creating a collaborative relationship between people and artificial intelligence where each party takes responsibility for activities where it can excel the most.

Task decomposition involves defining tasks that should be assigned to machines thanks to their superior ability to process lots of data fast and consistently and

execute predetermined tasks, as well as tasks requiring people's intervention in case of judgment required or ethical considerations. In addition, a good human-AI system requires designing an interface that allows people to effectively evaluate, modify, and enhance the results provided by artificial intelligence.

Organizations with the right culture will be more efficient in terms of deploying AI. According to studies conducted on the topic, a collaborative approach to AI deployment involving employee participation in designing algorithms and communication about how they will influence employees' jobs helps increase AI acceptability among people.

ETHICAL AND SOCIETAL CONSIDERATIONS

The integration of AI in the labor market has presented a wide array of ethical dilemmas, which necessitates appropriate forms of regulation. For instance, algorithmic bias is an ethical issue arising from AI's ability to perpetuate past discrimination through its algorithms.

Therefore, AI's application in the labor market could affect hiring and promotional processes and even the ability of employees to access health insurance or credit facilities. Thus, transparency and explainability of decisions made through AI are key.

Data privacy is another ethical consideration in the employment setting since AI requires a lot of data to be collected and analyzed. The need to ensure data privacy is critical considering that individuals whose data will be utilized in AI should be assured of their rights when doing so. This calls for frameworks such as GDPR and AI regulation to establish legal limits on using AI in decision making.

Another ethical issue that arises from the adoption of AI in the employment sector relates to structural unemployment and labor market polarization, where gains from increased productivity through AI flow only to capital owners and highly skilled laborers.

CONCLUSION

Artificial Intelligence is a disruptive force that will radically transform the way work is organized, shape the demands for skills and capabilities, and fundamentally change the way humans engage in their professional activities. From the analysis presented above, it is evident that AI will eliminate some routine jobs from the labor markets, but at the same time, it will create entirely new employment opportunities in technologically complex and ethical positions.

Three key actions are necessary for individuals, organizations, and policymakers in dealing with this disruption. Individuals need to proactively invest in gaining technical skills and critical thinking capabilities to remain relevant in the job markets. Organizations should adopt deployment strategies for AI that will leverage human capabilities and preserve human agency. Policymakers, on the other hand, must ensure that the gains in productivity from AI are equitably distributed through education, labor regulations, and AI governance.

In essence, Artificial Intelligence is neither the enemy of human labor nor a threat to our capabilities. Instead, AI is an empowering technology that, when properly managed, can unleash our creativity, minimize the drudgery of repetitive tasks, and extend the reach of our intelligence.

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Agentic AI : The Future of Autonomous Intelligent Systems

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INTRODUCTION

Since its inception, artificial intelligence has developed from being mere rules-based programs to sophisticated applications capable of comprehension of language, creation of content, and solution of complicated problems. One such development in this regard is that of agentic artificial intelligence. While classical forms of AI respond only to human commands, an agentic form has the capability of making independent decisions, planning actions, adapting to situations, and accomplishing goals without any human input. Reasoning, memory, learning, and agency have all been integrated into one system by an agentic approach to AI. These systems act like intelligent agents, which are capable of observing, thinking, deciding, and completing various tasks.

WHAT IS AGENTIC AI?

The agentic AI denotes AI systems which have been engineered to operate on their own in pursuit of particular goals. Unlike the conventional type of AIs that require constant human directions, these systems are able to analyze, devise plans, and undertake tasks without necessarily relying on any further direction from people. The term 'agentic' stems from 'agency', which is basically the capability to act and decide.

KEY CHARACTERISTICS OF AGENTIC AI

- Autonomy - Autonomous AI is capable of performing tasks independently.

- Purposeful Actions - Such systems have specific goals to achieve.
- Reasoning and Planning - They are capable of problem-solving and making rational plans.
- Learning and Memory - More advanced systems learn from their experiences.
- Adaptability - They alter their behavior according to situations.

HOW AGENTIC AI WORKS

The operations for an agentic AI system usually involve the following process:

- Perception - Gathering data from the surroundings.
- Reasoning - Evaluating the collected data.
- Planning - Developing plans for completing assigned tasks.
- Action - Carrying out the plans.

APPLICATIONS OF AGENTIC AI

- ·Healthcare: Helping physicians, monitoring patients, and streamlining processes.
- ·Education: Serving as private tutors to students.
- ·Finance: Helping detect fraud and analyze investments.
- ·Robotics and Automation: Working with autonomous robots and automation systems.
- ·Software Engineering: Helping with programming, debugging, and testing.
- ·Customer Support: Offering customer assistance and suggestions.

ADVANTAGES OF AGENTIC AI

- More efficient and faster processes.
- Operation around the clock.
- Better decision-making using data analysis.
- Less work for humans.
- Ability to scale up for many tasks. Problems and Threats

CHALLENGES AND RISKS

- Ethical issues about self-reliance.
- Security problems and abuse possibilities.
- Job loss because of automation.
- No human intervention in high-tech machines.
- Prejudice in artificial intelligence results.

THE FUTURE OF AGENTIC AI

Agentic AI in the future will bring about radical changes in industries and people's lives. Autonomous vehicles, smart cities, robotics, and digital assistants will heavily rely on Agentic AI in the years to come. Efforts by scientists to make these systems safer, more trustworthy, and secure will never cease.

CONCLUSION

Agentic AI is considered to be a significant step forward in the domain of artificial intelligence. The integration of autonomy, reasoning, learning, and action enables agentic AI to conduct operations efficiently and intelligently. Despite the advantages provided by such technology, there must be careful consideration taken during development for responsible usage within society.

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AI Hardware and Foundation Models

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INTRODUCTION

The rise of Artificial Intelligence (AI) represents one of the most revolutionary changes in the world of technology. It encompasses everything from virtual assistants and recommendation engines to autonomous driving and sophisticated scientific research. AI hardware and foundation models represent two crucial aspects that propel contemporary AI advancement. While AI hardware offers the processing power necessary for handling vast amounts of information, foundation models represent intelligent systems that understand languages, visuals, codes, and human communication. The expansion of AI applications led to the emergence of greater needs for more efficient processing units, more sophisticated memory, and specialized chips used in machine learning operations. On the other hand, foundation models initiated an era of versatile AI tools that can be easily adapted for several purposes. The current article offers insights into the notion of AI hardware and foundation models, their relevance, types, uses, benefits, difficulties, and perspectives on future advancements.

UNDERSTANDING AI HARDWARE

"AI hardware" is the name used to refer to hardware or computing machines that are specifically tailored for use in artificial intelligence and machine learning processes. In the case of conventional computer machines,

the former was meant for general computing purposes, but not AI computations which involve massive and extremely fast computations. The reason why companies invested in such hardware machines is that of improving processing efficiency. AI hardware can be in the form of a processor, memory system, storage, networking systems, and accelerators. This hardware helps in carrying out AI computations in terms of training and deployment of machine learning models.

TYPES OF AI HARDWARE

Central Processing Unit (CPU):
A CPU is a processor with general processing capabilities that can perform many functions. However, CPUs are not always effective at training AI algorithms. CPUs are used for pre-processing data and controlling computer operations.

Graphics Processing Unit (GPU):
A GPU is a highly parallel processor that was originally created to render images. Currently, GPUs are extensively used in AI applications since they can handle thousands of computations simultaneously. Companies like NVIDIA have emerged as pioneers in developing AI-compatible GPUs.

Tensor Processing Unit (TPU):
TPUs are specialized hardware that have been created for accelerating machine learning tasks. They are designed to perform neural network operations and are mainly used in cloud AI applications.

Field-Programmable Gate Array (FPGA):
FPGAs are integrated circuits that have been made to be flexible enough to fit certain AI applications. They are efficient and save energy.

Neural Processing Unit (NPU):
NPUs are processors that accelerate neural network operations on mobile phones and other embedded devices.

AI Supercomputers:
Many large AI research companies utilize supercomputers, which integrate thousands of GPUs and CPUs to train huge AI algorithms with trillions of parameters.

IMPORTANCE OF AI HARDWARE

AI hardware plays an essential role due to the fact that contemporary AI technologies need to have powerful processing capabilities. For example, teaching a sophisticated model can consume weeks or months with the help of a regular computer. AI hardware allows one to decrease the training period and implement AI solutions in real-time. Another benefit of efficient AI hardware is its scalability. Huge companies utilize AI technologies for analyzing tremendous amounts of information collected from social media platforms, the healthcare industry, financial services, and science research. It is worth noting that the development of AI hardware is crucial for handling these challenges.

WHAT ARE FOUNDATION MODELS?

Foundation models refer to massive artificial intelligence models that have been trained on huge data sets and can execute a broad range of operations. In contrast to classical AI algorithms created for a particular application, foundation models can be employed for many functions, including translating languages, generating texts, recognizing pictures, helping with programming, and analyzing information. The name 'foundation' model is used because they form the basis of many different AI software. After being trained on big data sets, they can be fine-tuned for specific uses utilizing small datasets. Large language models, picture generation models, and multimodal AI models are some examples of foundation models.

WORKING OF FOUNDATION MODELS

Foundation models employ self-supervised learning techniques during their training. Self-supervised learning involves training models by making them learn from predicting missing data in big data sets. For instance, a language model will learn by predicting the next word in a sentence. The training process comprises five main steps, which include:

Step 1: Data Gathering – Big data sets are gathered from various sources like books, websites, research journals, images, and multimedia.

Step 2: Preprocessing – Data preparation involves cleaning and organizing data and converting it into digital form.

Step 3: Training the Model – High performance artificial intelligence hardware like graphic processing units (GPUs) and tensor processing units (TPUs) analyze data via neural networks.

APPLICATIONS OF FOUNDATION MODELS

Foundation models have a wide range of applications across several domains, which include:

- Natural Language Processing: Chatbots, virtual assistants, generation of content, language translation, and summary of text.
- Computer Vision: Object recognition, medical image processing, autonomous vehicles, and identification of objects.
- Software Engineering: Programming assistants for developers to create code.
- Medicine: Predicting diseases, medical image analysis, discovering new drugs, and personalized treatments.
- Education: Personalized educational systems for students, automatic grading, and intelligent tutors.

SOFTWARE ENGINEERING: PROGRAMMING ASSISTANTS FOR DEVELOPERS TO CREATE CODE

Hardware and foundation models are very much intertwined. The training and operation of foundation models are resource-intensive activities. Without high-performance hardware, training and deploying contemporary AI models would take an unreasonably long time and cost a lot of money. Training a massive language model, for instance, could take many thousands of GPUs and weeks to complete. Specialized AI hardware is available on cloud platforms, making it possible to develop and

implement foundation models. As foundation models become increasingly intricate and larger in size, the need for AI hardware will only continue to increase.

ADVANTAGES OF FOUNDATION MODELS AND AI HARDWARE

- Enhanced Efficiency: AI systems can analyze huge amounts of data very quickly.
- Automation: Many mundane jobs can be automated to increase efficiency.
- Scalability: AI technologies can accommodate millions of users and massive data sets.
- Innovation: Highly advanced AI facilitates innovative achievements in scientific research, healthcare, and engineering.
- Adaptability: AI foundation models can be customized for various industries and functions.
- Instantaneous Computing: Dedicated hardware allows faster AI operations in robotics and self-driving cars.

CHALLENGES AND ETHICAL CONCERNS

However, despite the advantages mentioned above, AI hardware and foundation models have also encountered multiple obstacles on the way to improvement. One of them is the high cost of AI. Large AI models require advanced and costly hardware and consume a tremendous amount of electricity. Small companies might lack the necessary resources for training AI. Also, bias and fairness are one of the issues associated with foundation models since their learning is based on large amounts of data, which may include some inaccuracies or biases that result in biased outputs. The question of privacy and safety should also be considered as AI is able to handle personal data. Environmental problems are also worth mentioning due to the high energy consumption of AI.

FUTURE OF AI HARDWARE AND FOUNDATION MODELS

AI hardware and foundation models will undoubtedly have a bright future in the coming years.

Research is being conducted in creating AI chips that are smaller, faster, and more efficient. There could also be significant developments in quantum computing and neuromorphic computing that would contribute even more to revolutionizing AI technology. In addition, foundation models are getting smarter by virtue of multimodal learning, whereby one AI system processes several kinds of data, including texts, images, sounds, and videos. Future AI technologies will likely be more personalized, robust, and available to people all around the world.

CONCLUSION

AI hardware and foundation models are two of the critical elements that fuel the progress of artificial intelligence. AI hardware delivers the necessary computing performance and efficiency for training and running sophisticated machine learning algorithms, whereas foundation models allow the development of intelligent software solutions able to perform various tasks in different industries. The unprecedented growth of artificial intelligence has changed the way we communicate, seek medical care, educate ourselves, conduct business, and conduct scientific investigations.

While there are still problems related to affordability, ethics, security, and energy usage, ongoing innovations make it possible to overcome these obstacles. In the coming years, further advancements in AI hardware and increasingly sophisticated foundation models will lead to new generations of superintelligent machines.

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AI in Business and Productivity

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INTRODUCTION

AI is one of the most influential phenomena in contemporary businesses. In addition to automation of mundane tasks, the technology allows for more informed decision-making. These are just two aspects of the use of AI in business that makes it an indispensable element of almost any company. There are multiple reasons why this trend has emerged, including advanced AI technologies and their immediate effect on workplace efficiency. The technology enables companies to work faster, save money, and open up new possibilities for growth. It also influences collaboration among employees, leadership decision-making processes, and competition in the market

UNDERSTANDING AI IN BUSINESS

Introduction to AI in business involves the implementation of artificial intelligence techniques in automating processes, analyzing information, and making decisions. In traditional businesses, there was minimal automation and reliance on humans in decision-making. Today's AI workloads need systems that can adapt and think based on collected data. Consequently, organizations have embraced AI technologies that can do all the jobs in a business, including dealing with customers, predicting finances, and many more. The AI technologies consist of software applications, machine learning algorithms, natural language processors, and automation technologies.

TYPES OF AI APPLICATIONS IN BUSINESS

- **Generative AI:** Large Language Models and Diffusion Models used for generating content, creating marketing copies, writing code, and creating design prototypes. ChatGPT, Claude, and Midjourney are examples of such Generative AI.
- **Predictive AI:** Forecasting future events based on historical events and trends. Sales predictions, demand predictions, customer churning, and market trend prediction are done via Predictive AI.
- **Automation AI:** RPA integrated with AI to automate processes related to invoicing, data entry, e-mail filtering, and HR onboarding without human involvement.
- **Conversational AI:** AI-powered chatbots and voice-based bots for resolving customers' queries 24/7 and providing consistent results.
- **Decision Intelligence:** AI that makes decisions based on the analysis of thousands of variables. Used for Pricing, Logistics, and Resource Allocation among others.
- **Agentic AI:** Agents with autonomy who can plan and execute a series of actions in a number of different applications. E.g., An Agent could do competitor analysis, prepare a report, and book meetings accordingly.

IMPORTANCE OF AI FOR PRODUCTIVITY

The significance of AI can be justified by the fact that modern enterprises require speed and scalability that cannot be achieved without automation. Traditional methods will take weeks to complete the tasks of market analysis or customer service on a large scale. The use of AI decreases turnaround time and allows businesses to respond immediately to changing circumstances. Furthermore, efficient AI increases scalability. Large enterprises employ AI to analyze a huge volume of data generated through various departments such as marketing and customer services. This would be impossible without advanced technologies. Cost-effectiveness is another significant benefit of AI.

APPLICATIONS OF AI IN BUSINESS AND PRODUCTIVITY

Foundation Models and AI are employed in several sectors:

- **Customer Service:** AI chatbots can automatically answer 40 to 70 percent of questions, prioritize cases, and summarize calls.
- **Marketing:** Writing ad copies, segmenting audiences, large-scale A/B tests, and SEO for AI-era searches.
- **Sales:** Scoring leads, writing emails, CRM integration, and scheduling meetings via AI bots.
- **Software Development:** AI-assisted software development is enabled by AI programming helpers like Cursor, which increase productivity 2x-5x.
- **HR:** Screening resumes, scheduling interviews, analyzing employee sentiment, and personalized training programs.
- **Finance:** Detecting fraud, financial forecasts, expense audits, and reports.
- **Operations:** Predictive maintenance, optimizing inventories, and supply chain risk assessments.
- **Education & Training:** Personalized learning systems for employee skills improvement and compliance training.

RELATIONSHIP BETWEEN AI AND PRODUCTIVITY GROWTH

Productivity is highly associated with AI. The achievement of productivity depends on having a system that can perform both cognitive and repetitive work. In the absence of AI, businesses will have bottlenecks in their data analysis processes and slow decision-making speeds. For instance, analyzing the sentiments of customers based on 100,000 reviews could consume a lot of time for a business. However, with AI, this could be achieved within minutes. Clouds are an avenue through which businesses can access AI for productivity improvements without developing AI models themselves. With advanced capabilities of AI, there is still increasing need for workflow management and governance.

ADVANTAGES OF AI IN BUSINESS AND PRODUCTIVITY

- **Improved efficiency:** AI performs the same functions at a much faster pace than humans can.
- **Automation:** Several repetitive functions are automated, giving people time to think about strategic functions.
- **Scalability:** AI technology deals with millions of customers and data without employing additional personnel.
- I**nnovation:** AI is an innovation that facilitates new products and business models.
- **Versatility:** The same AI technology can be applied to multiple functions, including marketing, accounting, and sales.
- **Real-time processing:** AI technology provides real-time results in applications such as fraud detection and customer service.

CHALLENGES AND ETHICAL CONCERNS

Even with its advantages, there are various challenges facing the implementation of AI in business. The first is costs and ROI. The deployment of AI technology is costly and calls for proper investments.

2026 is the year when AI needs to prove its economic viability; otherwise, it will be terminated.

The other challenge is “Shadow AI.” Employees use unofficial AI tools more quickly than the IT department can control them, which poses a threat of data leakage.

It is vital to focus on bias and fairness since the models are based on historical information. It might contain certain biases, which could cause discrimination during recruitment and loan approvals.

Privacy and security are also crucial, as the use of AI entails processing private company and client data.

Lastly, the problem of job displacement and change management must be handled with care since AI technology not only leads to the creation of new positions, such as those of AI ethicists and automation managers, but also replaces many existing occupations.

FUTURE OF AI IN BUSINESS AND PRODUCTIVITY

AI's future in business promises to be extremely advanced and revolutionary.

Scientists are building smaller, quicker, and safer AI systems that can operate on-device. Agentic AI is challenging traditional notions of work, and AI agents will serve as virtual coworkers who will plan, utilize tools, and perform tasks on behalf of their systems.
Multi-modal AI systems will be capable of processing text, visuals, audio, and video inputs simultaneously. Business AI in the future may become highly personal, dependable, and deeply embedded in workflow processes. Nations and enterprises across the world are pouring extensive funding into AI governance and infrastructure.

CONCLUSION

The use of AI in business and productivity represents one of the most crucial technological advances shaping contemporary business success. AI delivers the automation, intelligence, and effectiveness necessary for businesses to thrive today, while specific applications allow for the completion of various activities within multiple business divisions. The fast evolution of AI solutions has revolutionized the way companies communicate, operate, market themselves, and formulate strategy.

While problems related to cost, governance, privacy, and change management cannot be ignored, constant innovation is mitigating these difficulties. Going forward, developments in AI technology and advancements in agent design should ensure the creation of even more efficient systems.

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AI and the Future of Environmental Conservation in Kerala

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For many years, human civilization was governed by nature. Humans used rivers to settle, made their livelihood through forests, and their lives depended on the monsoons. However, civilization turned nature into a “resource” over time. The process was fast-tracked by the Industrial Revolution, which provided great technological capacity to humans but made them lose their empathy towards nature. Climate change, extinction of species, pollution, floods, and landslides are issues of our times now. What were once scientific issues far away are now being felt all over the world. Kerala, known for its ecological beauty, is an example of this situation.

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In a strange twist of fate, it is technology itself, which played a role in the damage caused to the environment, that may hold answers now through the use of Artificial Intelligence. AI is capable of processing a vast amount of environmental data through satellite,

drone, sensor, and geographic information system sources almost instantly. Unlike humans, the machines can detect patterns, risks, and changes in the environment at an incredibly fast pace. Various studies carried out by Indians in relation to Wayanad have looked at the possibility of using machine learning, GIS, and remote sensing techniques to locate areas vulnerable to landslides and set up early warning mechanisms. Other possible applications for AI include waste management, river pollution control, floods prediction, and wetland and forest preservation.

But AI itself would be useless without human accountability. It has no morality whatsoever; all it does is magnify whatever human intent behind it exists. AI can help protect our forests, but it can equally assist us to exploit our environment by building unnecessary factories. Thus, environmental conservation is beyond the power of any machine or algorithm, as it requires an ethical approach to solving problems and making decisions about our environment.For example, AI can detect landslides, but we humans must consider whether we need to sacrifice delicate hillsides for monetary gain.

The future of the environment conservation might thus hinge upon the union of ecology and AI. The literate populace of Kerala, its rising technologically capacity, and its rich biodiversity offer great promise for a union between AI and sustainability. In the light of repeated environmental crises in Kerala, however, we have to recognize the dangers of development without ecological balance. AI might turn out to be one of the greatest means available to mankind for saving the environment, but its effectiveness shall finally depend on how mankind learns to wield intelligence responsibly.

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The Importance of Graph Theory in Computer Science: A Comprehensive Survey

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ABSTRACT

Graph theory forms the bedrock of both theoretical and applied computer science due to its ability to provide a mathematical representation of pairwise connections among entities. This paper aims to provide a thorough overview of the applications and algorithms developed based on graph theory within the important areas of computer science such as computer networking, algorithm development, artificial intelligence, and software engineering. In our study, we analyze basic graph theory algorithms like the formation of span trees, calculation of shortest paths, coloring of graphs, and topological sorting, while also considering their applications in routing algorithms, compiler optimization techniques, reasoning in knowledge graphs, and graph neural networks.

In addition to reviewing the current state of research in the area of graph algorithms, this paper discusses the future challenges faced by the field of graph theory and highlights some emerging research trends like quantum graph theory and graph foundation models.

INTRODUCTION

The study of graphs, which are a part of discrete mathematics, has become one of the most significant methods employed in computer science. A graph G = (V, E) is comprised of a finite number of vertices V, as well as edges E that define the relationship between the nodes.

Originating in Leonhard Euler's solution to the Königsberg bridge problem in 1736, graph theory has evolved into an essential tool for dealing with many different problems in computer science.
Graphs have come to play an important role in almost every domain in modern computer science: from operating systems and programming languages to artificial intelligence, bioinformatics, and even the World Wide Web. Graphs are effective abstractions for capturing relationships, dependencies, hierarchies, flows, and so forth

THEORETICAL BACKGROUND

Graphs can be undirected, directed (digraphs), weighted, or any combination of the three. Some important characteristics of graphs are connectivity, planarity, bipartiteness, and chromatic number. Important classes of graphs are trees, DAGs (directed acyclic graphs), complete graphs, and hypergraphs.
Some common representations of graphs in computing are adjacency matrix (space complexity $O(V^2)$), adjacency list (space complexity $O(V+E)$), and incidence matrix. Representation of graphs determines the performance of graph algorithms and is determined by the density of the graph and the type of operations to be performed

GRAPH TRAVERSAL ALGORITHMS

BFS and DFS are two of the fundamental graph algorithms that are building blocks for other algorithms. BFS traverses all vertices level by level in $O(V+E)$ time and is used to calculate shortest paths in unweighted graphs. DFS, which takes $O(V+E)$ time, helps find cycles, perform topological sort, and detect strongly connected components using Kosaraju's or Tarjan's algorithm

GRAPH THEORY IN COMPUTER NETWORKS

Networks can be conveniently represented as graphs with routers, switches, and hosts represented as vertices, while edges represent connections among them with their weights reflecting delays, costs, or bandwidth.

Graphs are essential in the analysis and design of computer networks.

Shortest Path and Routing

The Dijkstra algorithm runs in O((V+E)logV) and calculates the shortest paths from a single source by employing a priority queue. It forms the foundation for the OSPF protocol for routing within IP networks. The Bellman-Ford algorithm works even with negative edge weights and lies at the heart of the BGP protocol for routing between different domains within the Internet. The Floyd-Warshall algorithm finds the shortest distances between all pairs of vertices in $O(V^3)$.

Network Design and Spanning Trees

Minimum Spanning Trees (MSTs) represent optimal solutions to the problem of constructing a network that incurs minimum cost. The two main MST algorithms are Kruskal's and Prim's. Both run in O(E log V) time. MSTs have practical applications in network backbone construction, clustering, and approximations for NP-complete problems like TSP.

Algorithms for maximum flow include Ford-Fulkerson and Edmonds-Karp.

ALGORITHMS AND COMPLEXITY

Graph problems have a very crucial role in computational complexity studies. Some of the well-known NP-complete problems are graph problems including Graph Coloring, Hamiltonian Cycle, Clique, Independent Set, and Vertex Cover. The P vs. NP problem that asks whether all decision problems that admit polynomial time verification also admit polynomial time solution can best be explained using graph problems.

Graph Coloring and Scheduling

Graph Coloring involves assigning colors to nodes such that adjacent nodes do not have same color and minimum number of colors used is known as the Chromatic Number, denoted by $\chi(G)$. Register allocation during compiler design is done by considering variables as nodes and conflicts between them as edges; and then performing Graph Coloring reduces number of registers used

Topological Sort and DAGs

The Directed Acyclic Graph is used to represent dependency between tasks. Topological sorting can be done by O(V+E) time through DFS or using Kahn's algorithm. The topological sorting returns the linear ordering of vertices that is compatible with all the edges in a given graph. It can be used by build systems such as Make and Gradle.

GRAPH THEORY IN ARTIFICIAL INTELLIGENCE

Knowledge Graphs and Semantic Web

The knowledge graph consists of the representation of entities as nodes and their semantic relationship as directed edges with a label on the edge, making it a database of structured world knowledge using a graph model. Applications like Google Knowledge Graph, Wikidata, and DBpedia use graph traversing and inference techniques to provide answers to complex questions and also for recommendation and question answering systems

Graph Neural Networks

Graph neural networks (GNNs) are an extension of deep learning methods applied to graph data through the propagation and aggregation of feature information along edges. GNN architectures, which include graph convolutional networks (GCN), GraphSAGE, and graph attention networks (GAT), have shown state-of-the-art performance in tasks such as node classification, link prediction, and graph classification.

Search and Planning

AI algorithms for search, such as A*, iterative deepening A* (IDA*), and Monte Carlo Tree Search (MCTS), function in a state space graph with vertices as states and edges as actions. These techniques are useful in game-playing programs (chess, Go) as well as robot path planning. Probabilistic graphical models like Bayesian networks and Markov Decision Processes (MDPs) are used in reasoning under uncertainty and reinforcement learning.

SOFTWARE ENGINEERING APPLICATIONS

Compiler Design

In compiler design, the graph representation is utilized throughout the different processes. CFGs depict the execution paths within a program while the liveness analysis, reaching definition analysis, and available expression analysis are defined using graph fixed-points. The call graph provides information regarding inter-procedural dependencies and guides inlining and devirtualization. Program Dependence Graphs are used to achieve slicing and parallelization of programs.

Software Dependency and Version Control

The dependency graphs used by package managers such as NPM, pip, and Maven can be represented in the form of a directed graph, with topological sorting used to determine the installation order of packages and detect cyclic dependencies.

The commit histories on version control systems such as Git can be modeled using a DAG. Social network analysis uses graph algorithms for identifying influential nodes and communities.

CHALLENGES AND FUTURE DIRECTIONS

Graph algorithms, although powerful, still face serious hurdles at today's scale. Graphs formed through social media, genomics, and the Internet may comprise billions of vertices and tens of billions of edges, far surpassing a computer's memory size. Graph processing systems (Pregel, GraphX, PowerGraph) distributed on clusters suffer from communication cost and load balancing issues.

In dynamic graphs, where nodes and edges are continually added and removed, update algorithms must be devised instead of recomputing solutions. The design of streaming graph algorithms and dynamic data structures is an ongoing challenge. Graph algorithms utilizing quantum computing, based on quantum walks and Grover search,

have been discovered to provide polynomial improvements in certain problems, including graph isomorphism and connectivity.

The integration between graph theory and machine learning, especially GNNs and graph transformers, is one of the most promising directions to explore. Interpreting the output of GNN models, scaling up to billion-node graphs, and ensuring resilience against attacks on edges are some unresolved challenges. The development of graph foundation models akin to language foundation models is a nascent objective within the field.

CONCLUSION

Graph theory is one of the pillars of computer science since it serves as an all-encompassing framework for analyzing relationships using an elegant language and efficient algorithms. The use of graph theory can be seen across all levels of computer science from Internet routing to neural network training and allocation of resources for compilers. With increasing data volumes and complex problems, further developments in graph theory include distributed, dynamic, and quantum algorithms, as well as the convergence of graph theory with deep learning.

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PATHWAYS AFTER PLUS TWO

Choosing the right course after Plus Two is one of the most important decisions in a student's life. To guide students towards a bright and successful future, Marian College of Arts and Science organized "Pathways After Plus Two", a career guidance programme aimed at helping higher secondary students explore various academic and professional opportunities. The programme was conducted on 10th May 2026 at St. Thomas Church Parish Hall, Veli, Thiruvananthapuram.

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TECH NEWS

AI-POWERED CYBERSECURITY IS BECOMING A MAJOR CONCERN

AI-powered cybersecurity is becoming a major global concern because artificial intelligence is now being used by both cybersecurity experts and cybercriminals to operate at extremely high speed and scale. Modern AI systems can automatically scan software for vulnerabilities, generate realistic phishing emails, create adaptive malware, and even imitate human voices and videos through deepfakes. Security researchers warn that AI is lowering the skill barrier for cyberattacks, allowing attackers to perform sophisticated operations that previously required advanced technical expertise. Recent reports from Google and IBM indicate that AI-driven attacks are increasing rapidly, with hackers using AI tools to improve malware, automate vulnerability discovery, and target organizations more efficiently than ever before.

Cybersecurity professionals are especially concerned about AI agents gaining access to sensitive systems and confidential data inside organizations. According to recent industry reports, many companies feel unprepared to defend against AI-powered threats despite rapidly increasing investment in AI-based security systems. Studies show that AI is making phishing attacks more convincing, malware more adaptive, and cyber fraud more difficult to detect. Security experts also warn that AI systems themselves can become attack targets, leading to data leaks, manipulation, or unauthorized access.

At the same time, AI is also helping defenders by improving threat detection, automating incident response, and identifying suspicious behavior faster than traditional systems. This has created what many experts describe as an “AI vs AI” cybersecurity race, where attackers and defenders are both using increasingly powerful AI technologies against each other. Researchers believe the future of cybersecurity will depend heavily on developing secure AI governance, stronger defensive AI systems, and better international regulations to manage the rapidly evolving threat landscape.

Source : *Reuters*

SPACE-BASED AI DATA CENTERS ARE BECOMING A REAL IDEA

Space-based AI data centers are becoming a serious technological concept as major companies explore moving computing infrastructure into orbit to support the rapidly growing demand for artificial intelligence. Traditional Earth-based data centers consume enormous amounts of electricity and require massive cooling systems, creating pressure on power grids, water resources, and land availability. To solve these problems, companies such as Google, SpaceX, and NVIDIA are studying the possibility of placing solar-powered AI data centers in space. In orbit, satellites can receive near-continuous solar energy and use the cold environment of space for cooling, potentially making operations more energy efficient. Reports suggest that Google and SpaceX are already discussing projects involving orbital AI computing systems and prototype satellites that could launch within the next few years.

The idea involves building networks of satellites equipped with powerful AI chips capable of processing data directly in space instead of sending everything back to Earth. Startups such as Cowboy Space and Starcloud are also investing heavily in orbital computing technologies and space-based cloud infrastructure. Some experimental systems have already demonstrated basic AI processing in orbit, showing that the concept is technically possible. Researchers believe these systems could eventually support applications such as satellite image analysis, deep-space communication, climate monitoring, defense systems, and future space missions.

However, major challenges still exist before space-based AI data centers become common. Engineers must solve problems related to radiation protection, heat management, communication speed, repair difficulties, and extremely high launch costs. Experts also warn that transmitting large amounts of data between Earth and orbit remains a major limitation. Despite these obstacles, many technology companies believe falling rocket launch costs and advances in reusable spacecraft could make orbital data centers economically viable in the future. Scientists view the idea as a potential solution to the increasing energy demands of artificial intelligence, which are placing growing stress on global electricity systems.

Source : *Reuters*

LINKEDIN MAY CUT 5% OF ITS WORKFORCE

Global chip shortage concerns are continuing as the rapid growth of artificial intelligence is placing enormous pressure on the semiconductor industry, especially the memory chip market. AI data centers require massive amounts of high-bandwidth memory (HBM) and advanced DRAM chips to train and run large AI models, causing demand to rise much faster than manufacturers can increase production. Major companies such as Samsung, SK hynix, and Micron are prioritizing AI-focused chips because they are more profitable, which is reducing the supply of standard memory chips used in smartphones, laptops, gaming consoles, cars, and other electronics. Industry analysts warn that chipmakers may only be able to meet about 60% of AI memory demand by 2027, while shortages and high prices could continue for several years.

The shortage is already affecting consumer technology worldwide. Reports indicate that prices for memory chips have risen sharply, increasing manufacturing costs for products such as PCs, smartphones, and gaming systems. Companies including Sony and Nintendo have warned about rising production expenses caused by memory supply constraints, while some manufacturers are expected to reduce device specifications or raise prices to manage costs. Analysts estimate that AI data centers could consume nearly 70% of the world's memory chip production in 2026, leaving fewer supplies available for regular consumer electronics

To address the crisis, semiconductor companies are investing billions of dollars into new factories and expanding production capacity. However, building advanced chip manufacturing facilities takes years, meaning supply may not stabilize until late 2027 or even 2028. Experts believe the current shortage represents not just a temporary problem but a major structural shift in the global technology industry caused by the AI boom and increasing demand for advanced computing infrastructure.

Source : *Reuters*

AI CHIP COMPETITION IS INTENSIFYING

The competition in the AI chip industry is becoming increasingly intense as major technology companies race to develop faster and more efficient processors for artificial intelligence systems. Companies such as NVIDIA, AMD, Google, Meta, and Broadcom are investing billions of dollars into AI hardware development as demand for AI computing continues to grow rapidly. NVIDIA currently dominates the market with its powerful GPU architectures, but competitors are aggressively trying to reduce that lead by introducing custom AI accelerators and next-generation processors. AMD recently unveiled advanced AI chips such as the MI455 series to compete directly with NVIDIA's Blackwell architecture, while Google is expanding the use of its custom Tensor Processing Units (TPUs) for AI training and cloud computing.

At the same time, Meta is developing its own AI chips and signing massive partnerships with AMD and Broadcom to secure computing power for future AI systems. Reports suggest Meta plans to deploy gigawatts of AI infrastructure using custom accelerators and AMD GPUs to support advanced AI features across its platforms. Many experts believe the AI chip industry has become one of the most important technology battles in the world because AI systems require enormous processing power and energy efficiency. Companies are now competing not only on raw speed, but also on power consumption, scalability, software support, and cost efficiency. Researchers say this "AI chip war" will shape the future of artificial intelligence, cloud computing, robotics, autonomous vehicles, and even consumer electronics over the next decade.

Source : *Reuters*

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