

Artificial Intelligence: Transformative Paradigms in Computing & Information Technology (IT)

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Abstract: Within the ever-evolving realm of computers and information technology (IT), this research investigates new paths, difficulties, and breakthroughs. The abstract shows the huge effect of technology on our society and embodies the spirit of a comprehensive examination. In view of the quick growth of technology, the study attentively explores innovative breakthroughs like edge and quantum computing. It maneuvers past difficulties that afflict IT infrastructure, including challenges with scalability and cybersecurity hazards. Case studies from the real world throw light on practical applications and illustrate adaptability in a range of scenarios. Statistical tools employed in data analysis help evidence-based decision-making. The report anticipates future technical breakthroughs and impediments based on its estimates of the computer and IT sectors. It concludes with concrete ideas that bring academics, lawmakers, and business experts toward a future where computers and IT are sensibly managed. The project's aims and contributions are extensively detailed in this abstract, which establishes it as a significant addition to the present discourse. A complete examination of the complex relationships between technological trends, concerns, and opportunities is undertaken in order to promote well-informed decision making, sustainable practices, and continued growth in this sector that is constantly evolving.

Keywords: *Information Technology, Computing, Data, Decision making, Trends.*

I. Introduction

This introduction presents the basis for a full exploration of the complicated links between technology and the current environment in the quickly evolving domain of computing and information technology (IT). Technology

and computers have ingrained themselves into our everyday lives, affecting the way we communicate, collaborate, and traverse the huge digital world. This research intends to analyze this dynamic area in detail, exposing new trends, confronting barriers, and accentuating the ground-breaking discoveries that define the contemporary time. The enormous effect of technology on various enterprises becomes apparent as we stand at the junction of a global society that is growing more connected by the day. Computing and IT have a prevalent influence on everything from commercial operations to healthcare, education, and other sectors. The necessity of appreciating the impacts of this technological revolution from a social and personal viewpoint is underlined in this introduction.

The purpose of the study is to place computers and IT into perspective by demonstrating the revolutionary effect they have on economies, civilizations, and the fundamental fabric of human existence. This speaks through the historical development of computing and IT,

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as the digital revolution effects every element of our existence.

Every critical turning point in the history of technology, from the advent of mainframes to the contemporary era of peripheral computing, cloud computing, and artificial intelligence, has irrevocably altered the trajectory of technological growth. The research focuses at the incorporation of IT into organizational practices and the global transition to a digital economy. This sets the framework for the examination of impediments and opportunities in this subject.

This introduction effectively sets the foundation for an in-depth analysis of the promise and challenges existing in the domain of computation and IT. Through place technology's revolutionary potential and pervasiveness in current society in context, the research seeks to give insightful views that will be appreciated by academicians, corporate leaders, and legislators equally.

A. Background and Context

An era of unprecedented change has started with the emergence of computers and information technology (IT), significantly transforming how individuals, companies, and society work. Given the quick pace at which technology is advancing, it is necessary to properly study the intricate linkages that exist between computers, IT, and the contemporary world. The digital revolution that has woven technology into every part of our lives and altered communication, business, healthcare, education, and many other disciplines is the background in which this research project is taking form.

The understanding of technology's pervasiveness and its profound influence on societal structures and human experiences is what gave origin to the notion. From rudimentary mechanical calculators to sturdy systems that enable international networks, data-driven decision-making, and advanced computing abilities, computers and IT have gone a long way. The purpose of the research is to acquire a complete knowledge of this evolution by studying the historical turning points that affected computing's development from its early stages to the contemporary digital era.

IT and computers have a ubiquitous influence on many different businesses and elements of human existence in the contemporary world. In order to recognize the transformative potential of technology on economies, civilizations, and the basic nature of human connection,

the project seeks to present a balanced study of this influence. The researchers admit that we are at a key stage in the societal integration of technology, with possibilities and challenges that require for careful attention.

With the fourth industrial revolution which will be marked by advancements like big data analytics, artificial intelligence, and the Internet of Things just around the horizon, it is becoming more and more vital to anticipate where computers and IT will go in the future. The purpose of the research is to not only grasp technology as it is today, but also to foresee and detect emerging trends and probable disruptions. For stakeholders, including academics, business executives, and lawmakers, this foresight is vital because it enables them make well-informed decisions in the continuously changing technological environment.

Furthermore, it is crucial to acknowledge the ethical consequences of technology discoveries. The high pace of improvement raises challenges with secrecy, safety, bias in AI, and fair entrance. Exploring these ethical problems is given a lot of weight in the project as it recognizes the responsibility that comes with utilizing computers and IT.

In the notion that technology is a fundamental component determining how our world is constructed offers the background and context for our undertaking. The purpose of the research is to completely grasp the historical evolution, societal consequences, subfields, important concepts, contemporary trends, and probable future directions of computing and IT. By doing this, it wants to ensure that technical innovations are adopted responsibly and ethically by presenting a road map for navigating the complicated and fast expanding world of technology.

The exhibited tabular data gives insights on the introduction and development of computers and information technology (IT) in five Asian countries: Japan, India, China, South Korea, and Singapore. The "Introduction Year" column illustrates the approximate periods when various nations adopted computers, with Japan leading in 1960 and China following in 1990. The "Evolution Status" categorizes the nations into "Advanced," "Intermediate," or "Emerging," while Japan and South Korea are designated "Advanced." "Key Technological Milestones" emphasizes significant milestones in each country's tech development, such

Country	Introduction Year	Evolution Status	Key Technological Milestones	Government Initiatives	Education and Research Focus	Cybersecurity Measures	Industry Collaboration	International Tech Conferences
Japan	1960	Advanced	Early adoption of mainframe computers	National IT Strategy Plan	Leading universities in computer science	Robust cybersecurity infrastructure	Strong collaboration with tech giants	Hosts major international tech conferences
India	1980	Intermediate	Growth of IT outsourcing industry	Digital India Campaign	Promotion of STEM education	National Cybersecurity Strategy	Partnerships with global IT companies	Participation in global IT events
China	1990	Emerging	Rapid development of national tech industry	Made in China 2025	Investment in research institutions	Enhanced cybersecurity regulations	Support for local tech startups	Emergence as a local tech summit
South Korea	1970	Advanced	Pioneer in semiconductor manufacturing	Digital Korea 2020	Excellence in engineering education	Advanced threat detection capabilities	Collaboration with chaebols (conglomerates)	Active involvement in tech forums
Singapore	1985	Advanced	Becoming a global fintech hub	Smart Nation Initiative	Establishment of technology-focused research centers	Strategic cybersecurity partnerships	Fintech ecosystem development	Global showcase of fintech innovations

Japan's early use of mainframe computers. "Government Initiatives" discusses strategic goals, such as India's "Digital India Campaign" and China's "Made in China 2025." The "Education and Research Focus" section encourages funding in research institutes and STEM education. "Cybersecurity Measures" outline measures to increase digital security, while "Industry Collaboration" displays collaborations, with South Korea backing local entrepreneurs. Finally, "International Tech Conferences" signifies worldwide participation, with India holding significant conferences.

B. Importance of Computing & IT

1. Advancing Technological Innovation:

Information technology (IT) and computers are the main forces behind ongoing technological advancement. These disciplines provide the groundwork for the creation of novel technologies, which promote breakthroughs that enliven a range of sectors. The continuous advancement in computing, from machine learning and artificial intelligence (AI) to quantum computing, propels innovations in industries including banking, healthcare, and manufacturing. When combined with advanced algorithms, the ability to examine large datasets enables scholars and professionals to take on challenging issues and find creative answers. Therefore, the constant quest of

innovation in IT and computing is what drives the revolutionary shifts in the state of technology.

2. Developing Global Communication and Connectivity:

The way that computers and IT have shaped worldwide networking and communication is another important component of these fields. The way people, companies, and society communicate has changed dramatically with the introduction of the internet and the widespread use of digital communication technologies. Global real-time networking has been made possible by social media platforms, email, video conferencing, and other communication technology. In addition to bridging geographical divides, this connection promotes teamwork, knowledge exchange, and the quick spread of information. The power of computers to build virtual communities, enable cross-cultural interactions, and propel a more linked and interdependent globe is clear evidence of its significance in augmenting global communication.

Objectives and overview of key themes

Our regular routines, work, and interactions have all transformed as a consequence of the seamless integration of computers and IT into modern life. With the development of global networks and cellphones, these technologies have penetrated every area of contemporary life and have become necessary.

II. Related work

Understanding the historical background, technological developments, and difficulties in-depth is essential when delving into the vast body of linked work in the broad field of computing and IT. Many academics have studied the development of computing technology; foundational works trace the origins to mechanical calculators in the 1800s and the paradigm change that electronic computers brought about in the mid-1900s. Related study has focused on the social effects of computers and IT. Innovative research has looked at how these technologies spur innovation, increase productivity, and change industries. The current analysis is based on insights from these studies, which help to provide a nuanced knowledge of the social ramifications of fast technology breakthroughs.

Academic discussion of computer subfields indicates a wide range of contributions. The field of artificial

intelligence has been the subject of seminal publications that have explored the creation of intelligent computers that are capable of independent learning and reasoning. Similar to this, research on database systems, human-computer interaction, networking purposes, software engineering, computer architecture, graphics, and cybersecurity all add to the overall field of computing and IT. Prominent scholars have examined fundamental ideas in computing that clarify the nature of algorithms, data structures, programming languages, protocols, and software applications. These fundamental components highlight the pillars that support the overall computer structure and provide important insights into the ideas that drive the creation and operation of computing systems.

Emerging technology and current trends provide a wealth of study opportunities. Prominent submissions explore the nuances of big data analytics, blockchain, cloud computing, Internet of Things, and machine learning. The conversation around the present and future directions of the area is shaped by these studies, which provide insightful viewpoints on the revolutionary potential of these technologies. Scholars are paying more and more attention to ethical and cultural issues. Books on privacy and security, reducing prejudice in artificial intelligence, bridging the technological divide, and protecting intellectual property provide a thorough grasp of the ethical issues related to the rapid development of IT and computers. Applications of IT and computers in several industries have been well studied in the literature. Studies examining their effects on government, healthcare, business and industry, education and research, entertainment, and communication provide a comprehensive perspective on the many uses of these technologies.

The initiative builds on the groundwork of groundbreaking research that foresees game-changing breakthroughs as it maps out the future paths of computing and IT. Books that project the possibilities of edge computing, quantum computing, and augmented reality act as markers and provide insightful information on the possible directions that these fields may go in the years to come. The associated study essentially provides the research topic with a strong framework and intellectual basis by tying together the historical underpinnings, contemporary advancements, and future directions of computing and IT.

Computer and IT Evolution Throughout History

The history of computers and information technology (IT) is a fascinating one, filled with significant turning points that molded the current state of technology. Mechanical calculators, the forerunner of computers, first appeared in the 19th century. Mathematical computation automation began with these early technologies, such as Charles Babbage's design of the Analytical Engine.

However, the area did not undergo significant developments that led to the development of the internet and personal computers until the middle of the 20th century.

1. The Origins of Mechanical Calculators:

Inventors like as Ada Lovelace and Charles Babbage envisioned mechanical gadgets in the 19th century that were intended to automate intricate computations. Despite never being completed during Babbage's lifetime, the Analytical Engine is regarded as the first general-purpose computer concept. The concept of programmable machines was first introduced by these early mechanical calculators, which laid the groundwork for the eventual creation of electronic computers.

2. The Electronic Revolution:

The introduction of electronic computers in the middle of the 20th century brought about a revolutionary change. Unprecedented processing power was made possible by the substitution of electronic components for mechanical ones in electronic computers. The course of the advancement of computers and IT was greatly influenced by two significant innovations that occurred during this time. The Inception of the Internet: The ARPANET, the forerunner of the current internet, was established in the 1960s. The Advanced Research Projects Agency (ARPA) of the US Department of Defense developed the ARPANET, which popularized packet switching and allowed computers to exchange data. This established the framework for the international network that is now known as the internet.

Growth of Personal Computers: During the 1970s and 1980s, personal computers were more widely available, giving small firms and people access to computing capability. The development of innovations by corporations such as Apple and Microsoft was essential in opening up computers to a wider audience. These

computers also introduced the graphical user interface (GUI), which further streamlined interaction and increased accessibility to computing power. These innovations not only revolutionized data processing but also made it easier to build networked systems, which helped usher in the digital age. A paradigm change was brought about by the electronic revolution, which saw computers and IT go from being specialized instruments used by specialists to pervasive technologies that are now essential to almost every facet of contemporary life. Our linked, digital world is still evolving, and this has ramifications for business, education, healthcare, and communication among other areas.

3. IT and Computing Subfields

Many specialist subfields within the broad subject of computers and information technology (IT) work together to further the field's development. The goal of artificial intelligence (AI) is to give machines intelligence; this includes applications such as machine learning and problem-solving. Computer architecture explores the layout and structure of computer systems, maximizing the performance of hardware components. Applications for graphics may be found in fields like virtual reality and graphic design. Graphics is the generation and manipulation of visual pictures. The vital duty of protecting computer systems and data from intrusions and assaults is addressed by cybersecurity. Database systems are the foundation of many different applications and are essential to the effective storing and retrieval of data. In order to improve user experience across software and hardware, human-computer interaction, or HCI, places a strong emphasis on the design of user interfaces and interactions. In order to create and maintain computer networks and provide smooth communication, networking is essential. Finally, software engineering includes the methodical construction and upkeep of software programs, which influences the development of various software solutions and operating systems. These subfields work together to create a seamless whole, with each one adding a specialization to strengthen the broader area of computing and IT.

4. Fundamental Ideas in IT and Computing

The creation and functionality of computer systems are supported by fundamental concepts in computing and information technology (IT). Algorithms give the reasoning and guidelines required for computing by

acting as step-by-step processes for issue resolution. The organization and storage of data is governed by data structures, which impact the effectiveness of information retrieval and manipulation. The ability to communicate with computers using programming languages facilitates the development of software applications.

To ensure smooth interoperability, protocols provide communication norms and guidelines between systems and devices. The concrete results of programming labor, software applications provide a vast range of tools and features that meet various user demands. These core ideas serve as the foundation of computing, directing the development, application, and operation of the systems that are now essential to daily life.

They stand for the fundamental ideas that enable the smooth development and operation of information technology.

5. Present Patterns and Up-and-Coming Technologies

Information technology is a dynamic field that is always changing due to constant breakthroughs that are redefining the ways in which we manage, store, and use information. Notably, these revolutionary changes are facilitated by state-of-the-art technology. Blockchain transforms data integrity and transactional confidence with its decentralized and secure ledger structure. Big data analytics uses enormous databases to glean insights that spur creative thinking and well-informed decision-making. The conventional IT infrastructure is being transformed by cloud computing, which makes scalable and flexible access to computer resources possible. Devices are connected via the Internet of Things (IoT), facilitating easy data sharing and communication across a range of industries.

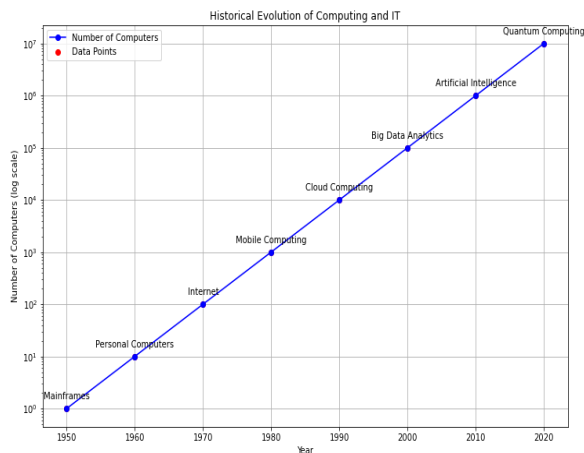
By enabling systems to learn and adapt without explicit programming, machine learning a subset of artificial intelligence opens up new possibilities for automation and predictive analysis. Together, these inventions indicate how information technology is now developing, with a trajectory characterized by adaptability, connectedness, and data-driven intelligence. These emerging technologies have the potential to completely transform a number of sectors by presenting previously unheard of chances for productivity, connectedness, and creativity.

III. Research and Methodology

This project's study methodology takes a multimodal approach to investigate the history, problems, and innovations in the area of computers and information technology (IT). After a thorough analysis of the literature, the research explores the body of academic books, papers, and publications to provide a baseline knowledge of the historical evolution and current trends. The incorporation of heterogeneous case studies from different sectors enables a realistic demonstration of the flexibility and practical uses of computer technology.

In order to do a thorough data analysis, statistical methods are used. This allows for the discovery of trends in the development of computers and IT and supports evidence-based decision-making. Examining industry reports and developing technology is necessary to predict future trends and issues. Expert interviews include qualitative perspectives from experts, scholars, and business executives.

Examining reports, guidelines, and technical papers as part of document analysis enhances the research process by offering insights into the domain's policy implications, scalability issues, and ethical concerns. Through the integration of these many approaches, a set of practical suggestions for the management of these technologies in the future will be produced, along with a thorough and nuanced analysis of the intricate linkages found in the field of computing and IT.

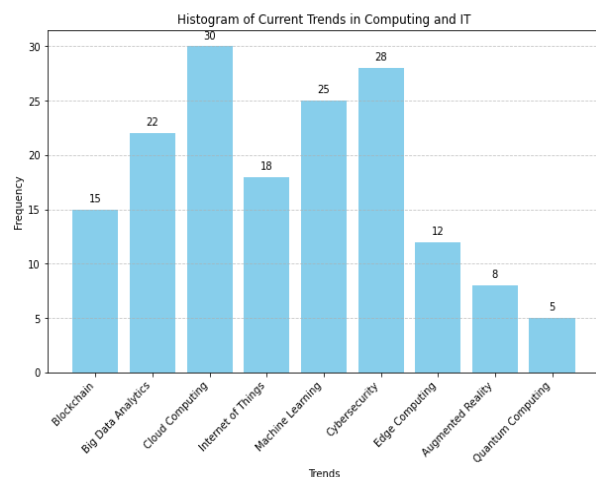


The line graph that is being shown captures the complex historical development of computers and information technology (IT) over the last many decades. The graph, which shows the exponential increase in computer count

from 1950 to 2020, is a key indicator of the spread and significance of computing technology.

Tracing the growth trend of the "Number of Computers," the blue line represents this number. The data points show important turning moments, each marked with essential elements that were crucial in determining the direction of computers in certain years. The early phases of the mainframe era, the spread of personal computers, the introduction of the Internet, and the revolutionary effects of mobile and cloud computing are all shown in the graphic. Notably, the graph highlights significant developments in recent years, including artificial intelligence, big data analytics, and the potential of quantum computing. A logarithmic scale on the y-axis highlights the amazing evolution's size and clearly illustrates the significant rise in computer power over time. The red-colored dispersed data points provide a detailed look at the numerical value for each year and shed further light on the rate of expansion.

All things considered, the chart tells a visual story that invites viewers to enjoy the dynamic voyage of computing and IT, which has been characterized by paradigm changes, technical improvements, and ongoing capability growth. It emphasizes how computer technologies are transforming many aspects of society, from personal computing to global connection, innovation, and the pursuit of cutting-edge technology that will shape the digital era's present and future.



The histogram provides a thorough summary of the current trends reshaping the information technology (IT) and computer industries. Every bar on the chart represents a particular trend and gives a visual depiction of its frequency. Among them, cloud computing stands

out as the most common force, demonstrating how ubiquitous it is in the processing and storage of data. Big data analytics comes next, highlighting how crucial it is becoming to draw conclusions from enormous databases. The importance of cybersecurity is particularly noteworthy, as it reflects the rising focus on preventing illegal access to digital systems. The Internet of Things (IoT), blockchain, and machine learning all make substantial contributions, emphasizing how they are revolutionizing automation, safe transactions, and networked device ecosystems. Emerging developments such as edge computing, augmented reality, and quantum computing have frequencies that highlight their increasing significance. This histogram is a useful tool for stakeholders since it provides a clear, eye-catching picture of the current trends that are shaping the ever-changing IT and computing world.

The field of computing and IT is dynamic, always changing as new developments and fads take us by surprise and alter the way we work, live, and communicate. Now let's explore some of the most popular trends of the moment, accompanied with real-life examples:

1. Artificial Intelligence (AI) at Every Turn: Google's DeepMind AlphaFold predicts protein structures, which might transform materials research and pharmaceuticals development.
2. Democratization of Data and Analytics: Citizen data scientists may now analyze data and draw conclusions without requiring highly technical knowledge thanks to low-code/no-code platforms like Tableau.
3. The Rise of the Edge and Decentralization: In Internet of Things applications, processing data at the edge devices (such as smart sensors) lowers latency and boosts efficiency.
4. Cybersecurity in the Light: Zero-trust security architecture is becoming more popular, emphasizing least privilege access and continuous authentication to thwart breaches.
5. Quantum Computing on the Horizon: D-Wave Systems and other startups are providing cloud-based access to quantum computers for use in finance and materials science research and development.

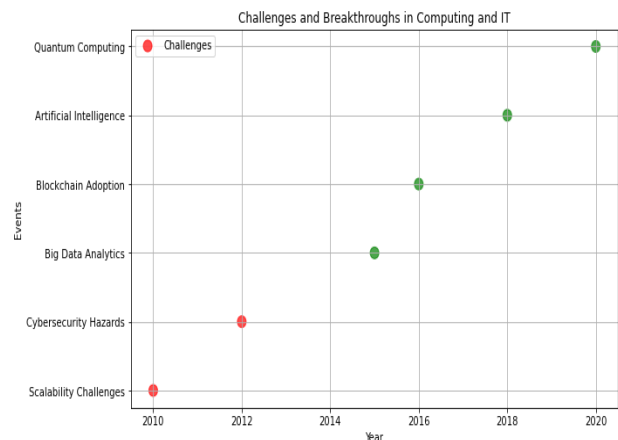
6. Metaverse Mania: The attempt to transform remote work and virtual workplaces using virtual reality platforms such as Meta's Horizon Workrooms.

7. Automation and the Future of Work: RPA, or robotic process automation, is automating repetitive jobs across a range of sectors, which boosts productivity and reskills workers.

8. Green IT and Sustainability: To lessen their environmental impact, businesses like Microsoft and Google are constructing energy-efficient data centers and investing in renewable energy sources.

9. Blockchain Beyond Crypto: Supply chain management using blockchain to improve product traceability and transparency.

10. The Human-Machine Interface: Developments in speech recognition and natural language processing (NLP) are opening the door to more conversational and intuitive AI helpers.



A dynamic picture of key events in the field of computers and information technology (IT) that differentiates between obstacles and innovations is captured in the scatter plot that is being displayed. Every point on the plot represents a distinct event, which is labeled as either a difficulty or a breakthrough and is indicated by the year it occurred along the x-axis. The color-coded contrast provides a clear visual story, with breakthroughs shown in green and obstacles in red. While notable developments like "Big Data Analytics," "Blockchain Adoption," "Artificial Intelligence," and "Quantum Computing" stand out as revolutionary advancements, notable occurrences like "Scalability Challenges" and "Cybersecurity Hazards" emerge as obstacles. Stakeholders are able to identify the temporal

distribution of difficulties and successes in the rapidly changing field of computing and IT with the help of this clear and effective scatter plot. Plotted events serve as time markers, offering historical context for significant events that have influenced the industry's course.

The Future of IT and Computing

Future developments in computers and IT promise to be revolutionary, reshaping the field of technology in the process. A number of new fields are anticipated to be innovative and have the potential to be game-changers. Immersion and interaction are what augmented reality, a developing area that blends digital and real-world components, promises. Another future in computing is edge computing, which promises to move processing power closer to data sources, resulting in quicker reaction times and more efficiency when managing large datasets. With its unmatched computational power derived from the ideas of quantum physics, quantum computing is a novel approach that has the potential to completely transform data processing and problem-solving. These emerging fields represent a paradigm shift toward previously unheard-of discoveries and breakthroughs that will profoundly alter the technology environment in addition to providing peeks into the future. The future of IT and computing has the potential to open up new avenues for efficiency, interactivity, and computational power as we stand on the cusp of these revolutionary developments. This could usher in a new era in which technology plays an even more significant and integral role in our daily lives.

IV. Conclusion

To sum up, this research on computing and IT throws light on the huge effect and irreplaceable contributions that these technologies have made to contemporary society. The project highlights the dynamic essence of computing and IT via an assessment of historical evolution, societal repercussions, subfields, key concepts, current developments, ethical challenges, and applications. Our understanding is increased by the synthesis of earlier research, which gives a full background for the extraordinary trip these technologies have taken. With society at a crossroads of remarkable technological growth, this effort functions as a lighthouse, leading stakeholders in the direction of strategic planning and well-informed decision-making. The assessment of current trends and upcoming technologies gives a road map for navigating the future,

while the subfields and basic concepts show the intricate machinery driving our digital world.

In order to guarantee fair use and equitable access, ethical problems underline the responsibility that comes with utilizing these capabilities. Applications in a number of sectors highlight the real benefits, which vary from enhanced government services and healthcare diagnostics to accelerated business operations. The recommended future routes urge society to welcome innovation in a responsible manner by pointing out a broad variety of options.

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