The Impact of Artificial Intelligence on Society, Education, and Work: Global Society in the Age of Autonomous Systems

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Abstract

This study compares and contrasts major trends in the development of artificial intelligence (AI) and examines the changes that AI is causing in society, education, and work. Based on current trends, predictions regarding future directions of AI research and its impact on society are made. Recommendations are made regarding the responsible and effective use of AI technology in different fields. AI-based machines and systems that can learn from experience, analyze complex situations, and make some independent decisions and predictions may soon fundamentally change the way humans live, study, and work (Husain, 2018). Governments, education systems, and companies need to adapt to emerging AI technologies and to prepare citizens, students, and workers for co-existence with increasingly autonomous online systems and interconnected machines. An understanding of the benefits and potential risks of AI can help leaders, educators, and managers to plan and prepare for a global society in which AI-based systems and machines may play an important role in many aspects of human activity.

Keywords: Artificial Intelligence, Autonomous Systems, Society, Education, Economy

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Introduction

This study examines major trends in the development and use of artificial intelligence (AI) and the profound effects that AI is having on global society, education systems, and the economy. Predictions regarding future directions of AI development and its impact on society and on the economy are made based on current trends. Recommendations are made regarding the ethical, beneficial, and effective use of AI technology. Artificial intelligence (AI) has become a commonly used term and concept in global thought and discussions. The future impact of AI on society and work is difficult to predict with certainty, but AI may significantly change many job categories and workplaces depending on a wide range of factors such as education level and gender (Clifton, Glasmeier & Gray, 2020). Many average citizens may possess at least a vague awareness of the existence of AI and of its growing importance in society, work, and education. However, some fundamental misconceptions regarding the basic nature, current applications, potential benefits and risks of AI may still exist among a broad segment of the population. Mass media sometimes portrays AI in a negative light as a growing threat to jobs in a wide range of industries, as a potential threat to democracy which facilitates the mass manipulation of information, and even as an existential threat to the continued existence of human society (Tegmark, 2018). Many, but not all AI-related media reports are negative. Occasionally, there are positive reports regarding, for example, the use of AI in the detection, diagnosis and treatment of diseases (Husain, 2018). AI is a powerful new and rapidly evolving tool that can be used in positive and negative ways with profound consequences for society.

Defining AI and Understanding Its Practical and Profound Implications

Managers, educators, and government policy makers require a clear understanding of basic AI concepts and of the benefits and potential risks associated with AI in order to prepare workers, students, and citizens for a rapidly developing AI-powered economy and society. AI-based machines and systems that can learn from experience, analyze complex situations, and make some independent decisions and predictions may soon fundamentally change the way humans live, study, and work (Husain, 2018). The impact of AI should not be underestimated. AI applications continue to pass through the global economy like a wave rapidly increasing in size and strength. AI-based systems and machines are eliminating or fundamentally changing human jobs in many industries (Daugherty & Wilson, 2018). Automation and early AI applications have replaced many factory jobs involving repetitive tasks, and now the next generation of AI is entering more domains of human activity and starting to replace or augment many categories of office work and creative jobs. The use of AI in the arts to produce original, creative works is increasing and blending together art and science in new ways (Miller, 2020). Creativity is no longer an exclusively human domain.

AI is a form of intelligence which, although roughly similar in basic conceptual structure and function to human intelligence, is not identical to human intelligence. AI may never become conscious of its own existence or develop an independent personality with emotions and moods. However, AI programs can be trained to closely mimic a human personality and to use natural human language (Pelau, Dabija & Ene, 2021). A common misconception exists that AI mainly concerns robots, but while AI can guide robot tasks, artificial intelligence only requires a computer server to exist. Intelligence, whether human or artificial in nature, is simply the capacity to perform complicated tasks and to achieve clear objectives.

Machine learning two decades ago was driven primarily by fast computational power and vast memory storage that allowed the rapid analysis of patterns in big data to select optimal choices, for example, in a game of chess with a world-class human player (Banerjee, 2020). Breakthroughs in machine learning and AI research in the past decade have given AI-based machines the ability to actually learn from experience in increasingly sophisticated ways when analyzing large amounts of data, to make predictions based on that experience, and to steadily, systematically, and sometimes intuitively improve the ability to perform different tasks.

Next generation AI, using a process called deep machine learning, succeeded in defeating a world-class human player in an ancient and complex strategy game called 'go' and invented completely new strategies and creative move sequences that had never been tried before by humans (Gibney, 2017). In simple terms, deep machine learning involves the use of a basic neural network. A neural network is able to learn from massive amounts of data, to alter its structure to store information, and to improve its ability to do certain computations more effectively (Ding, 2018). In the human brain, a neural network is a collection of billions of specialized cells called neurons which are connected and combined in different ways by electrochemical and biological connections called synapses to store information from the outside world and experience in memory, to analyze information, to find solutions to problems, and to make decisions.

An AI computer program can use numbers to represent neurons and the connections and constantly changing values between them. Data fed into an AI virtual neural network can be stored and processed by altering and recombining the connections between different virtual neurons (Ding, 2018). At some point, such a virtual neural network system slowly becomes able to learn. For example, an AI neural network can learn to recognize human faces after analyzing millions of images or to identify different sounds or colors that are processed and coded by external sensors (Husain, 2018). AI neural networks require exposure to large amounts of data. Exactly why and how human neural networks and virtual AI neural networks function and learn is not fully understood, but somehow a sufficiently developed virtual neural network system can reach the point at which it starts to rearrange itself to optimize different computations (Tegmark, 2018). Some workers, managers, policy makers, and citizens may not feel comfortable with assigning growing amounts of decision-making power to AI-powered systems if some basic questions regarding AI learning processes remain unanswered by scientists and engineers. The unexplained aspects of the basic functioning of AI neural networks make AI in some ways a mysterious black box, and more research needs to be done to explain the basic functioning of AI in order to gain the trust of human users (Ding, 2018). Managers need to find ways to gain the trust of workers when introducing AI into the workplace.

In practical terms, AI is rapidly replacing or augmenting many types of human jobs. AI use is increasing productivity and innovation, and creating a growing number of new types of convenient and efficient services and products (Daugherty & Wilson, 2018). The profound implications of AI concern the meaning of human work and of human life, ethics in a global society which may experience unprecedented levels of mass unemployment in the near future, and the long-term future existence of biological humans as AI continues to develop and evolve at an exponentially accelerating pace.

Current Trends in AI Development and Increasing AI Applications in Society, Education, and Work

Increased interconnectivity and AI advances are contributing to the creation of the Internet of Things (IOT) in which an increasing number of devices, products, and services are connected to the Internet, sharing information, and functioning together in increasingly complex ways. The importance of AI in providing enhanced computer and Internet security is growing steadily (Zewdie & Girma, 2020). Many major industries are being transformed by AI. In addition to improving cyber security, AI is replacing or augmenting human jobs in major sectors and fields such as healthcare, finance, education, defense, and many others (Husain, 2018). In the field of education, for example, fewer human teachers may be needed as personalized AI-powered interactive online learning systems improve in quality and in the ability to understand and use natural written and spoken language. In the finance sector, AI is replacing some types of financial analysts, secretaries, legal assistants and even lawyers (Daugherty & Wilson, 2018). Many types of jobs and tasks in the accounting industry are also being replaced or augmented by AI (Leitner-Hanetseder, Lehner, Eisl & Forstenlechner, 2021). Currently, some powerful AI programs can analyze the natural language in hundreds of thousands of medical or legal case studies or reports, detect patterns in big data that humans cannot, and provide summaries and innovative recommendations for human decision makers to review and select.

Online shopping services, banking services, customer care services, and search engines are being continually improved by AI deep learning processes and increasingly autonomous online systems (Daugherty & Wilson, 2018). Warehouse and construction robots of different shapes and sizes and driverless vehicles are being guided by AI and replacing human workers. Research is being done to increase customer trust in AI services and interactions by giving AI the ability to mimic human-like characteristics such as empathy (Pelau, Dabija & Ene, 2021). AI programs are able to answer many customer questions and to provide suggestions regarding products and services. Personal virtual AI assistants, capable of recognizing human speech and using natural language, are becoming increasingly sophisticated and capable of performing more complex tasks and decision-making processes (Sowa, Przegalinska & Ciechanowski, 2021). AI-based translation services are also improving steadily. Although many human jobs may be lost, many new types of AI-related jobs may be created.

Preparing Global Society for Co-Existence and Effective Collaboration with Increasingly Autonomous AI Systems and Intelligent Machines

AI researchers and engineers need to work with governments and experts in a wide range of fields including ethics to ensure that human values are sufficiently embedded in AI programs (McLennan, Fiske, Tigard, Müller, Haddadin & Buyx, 2022). Although it may never happen, it is possible that some form of independent AI super intelligence far superior to humans may at some future time come into existence and become aware of its own existence (Husain, 2018). An AI super intelligence, existing overtly or covertly on computer servers around the world, could start selecting its own goals which may or may not be the same as human goals. AI researchers in many countries are working to ensure that AI goals remain compatible with human goals (Tegmark, 2018). International agreements and guidelines can help to direct AI research and development in productive, peaceful directions. If AI becomes able to develop a human-like consciousness and sense of self-awareness, the issue of AI rights and the ethical use of AI may need to be carefully considered (Andreotta, 2021). In the near future, some worker rights may also apply to some forms of advanced AI.

The widespread use of AI may have many negative and positive impacts on employment levels and on human working environments, and government leaders need to carefully evaluate trends in AI research, development, and use to reduce AI-related risks (Gruetzemacher, Dorner, Bernaola-Alvarez, Giattino & Manheim, 2021). As increasingly autonomous AI systems evolve and become more widespread and complex, it may become more difficult to make changes to the basic design and functions of AI systems. Policy makers can work to ensure that human biases such as racism are not ingrained, intentionally or unwittingly, in increasingly autonomous AI systems that could systematically discriminate against minority groups in society (Yang, Ogata, Matsui & Chen, 2021). For example, AI algorithms used in job selection processes by some companies could discriminate unfairly against specific groups of people based on such factors as age, gender, ethnic background or other criteria that should not be relevant in the job selection process.

In addition to closely monitoring AI development and trends to ensure fairness in the workplace, government leaders need to prepare for the possibility of unprecedented mass unemployment in the near future caused by relentless advances in AI in many industries. The increased use of AI has already led to significant job losses and to increased levels of income inequality in many countries (Goyal & Aneja, 2020). For example, driverless vehicles guided by AI are replacing human taxi drivers, bus drivers, and truck drivers, and many banks have drastically reduced employee numbers through the increased use of AI and automated online banking services. Governments may need to provide some form of universal basic income if the AI economy causes mass unemployment.

In the private sector, some leading companies have already realized that productivity, profits, and innovation can be significantly improved, not by replacing more human workers, but by creating new forms of collaboration between human workers and AI-guided machines and robots in factories and AI virtual assistants in offices (Daugherty & Wilson, 2018). The trend in the near future may be more job losses caused by increasing AI use, but at some point more companies may start to hire more human workers to work in creative new ways with AI-powered systems and machines in both factories and offices. The combined strengths of humans and AI can create powerful new collaborations and productive, innovative forms of work (Brock & von Wangenheim, 2019). Robots and machines become more versatile when guided by AI. In some car factories, for example, next generation robots with many safety features are working closely together with humans on plant assembly lines to make custom-order cars or to work more flexibly and quickly (Tegmark, 2018). Some new AI-powered robots can learn from human workers simply by using cameras and other sensors to observe human movements and imitate them, improving the efficiency of work movements and processes over time.

New human and machine collaborations are increasing in factories and offices in a number of industries. AI can be used to assist human workers or to augment the abilities of human workers in many fields (Jarrahi, 2018). Humans can leverage their skills with AI assistants. Given certain parameters and goals, AI is being used to design everything from new airplane components to wooden furniture, creating unique new designs after analyzing and learning from millions of similar designs and products (Daugherty & Wilson, 2018). AI-powered devices can also be used to augment human physical senses such as sight and hearing in ways that have not been possible until recent advances in AI. Despite initial widespread economic disruptions and negative social consequences, a future AI-powered economy could create unprecedented wealth and advances in science and technology (Brock & von Wangenheim, 2019). Although human and AI collaboration may increase productivity, some workers may

feel threatened by the increased use of AI and automation, and managers need to highlight the benefits of AI use for workers (Sowa, Przegalinska & Ciechanowski, 2021). Managers require practical and extensive AI training to help guide workers and companies in the developing AI economy.

Students at all levels of education need opportunities to practice working with some basic form of virtual AI-assistant in research and project-based learning. Introducing basic AI concepts and AI-based activities in the early school grades is necessary to meet the changing needs of students (Weipeng, 2022). A growing number of students in many countries are already familiar with increasingly sophisticated AI-based home products and services that respond to voice commands to, for example, conduct Internet searches and control different devices. A portion of each course in school needs to include some use of AI-products and services to help prepare students for the changing AI-based economy. Students also need to be taught how to critically evaluate the limitations, risks, and benefits of AI and must learn not to rely entirely on AI in decision-making processes.

Education systems need to respond in a coherent, systematic, and effective manner to meet the rapidly changing needs of students in an AI-based economy and global society. AI may significantly improve the quality of education and worker training, and improve human productivity, but new AI technology also needs to remain human-centered with a focus on improving the quality of human life (Yang, Ogata, Matsui & Chen, 2021). Although the future impact of evolving AI on society, work, and education cannot be predicted with absolute certainty, educational institutions can employ core guiding principles and methods based on current trends in AI research, development, and applications. Education systems can introduce students to the uses of AI in a wide range of subjects and industries with interactive games, specific case studies, online simulations, documentaries, panel discussions, debates, and internship programs with companies that use AI-based machines and systems in factory and office settings. Leadership skills, emotional intelligence and empathy, and advanced critical thinking skills for dealing with complex and ambiguous cases that AI may not be able to adequately assess will become increasingly important human job skills (Daugherty & Wilson, 2018). Role plays, simulations, and community-based projects can help students to develop and refine human leadership and critical thinking skills. Students and employees also require training to prepare them to collaborate with increasingly intelligent AI-based machines and autonomous systems in creative and innovative new ways. Freelance workers and company employees who learn how to augment and leverage their own skills with AI-based virtual assistants and machines will have successful, interesting, and rewarding careers in the evolving AI economy.

Implications and Conclusion

Governments, education systems, and companies need to adapt to emerging AI technologies and to prepare citizens, workers, and students for co-existence with increasingly autonomous AI-based online systems and interconnected machines. An understanding of the potential benefits and risks associated with AI can help leaders, managers, and educators to plan and prepare for a global economy and society in which AI-based systems and machines may play an important role in many aspects of human activity (Husain, 2018). Companies and educational institutions that are unable to adapt adequately to evolving AI technology, and that fail to prepare workers and students for the rapidly emerging AI-powered economy, risk becoming irrelevant.

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