Artificial Intelligence and Grand Challenges for Education

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Abstract

Research on the use of AI in classroom settings dates back to the early days of the field. The need to develop and implement technological solutions to educational challenges has resulted in a corpus of work that expands upon and adds to the study of AI and cognitive science more generally. This article details the grand challenge issues related with AIED and examines the architectural components of an AIED system and their relationships to different parts of AI. The study also emphasizes AI's potential to help schools reach their long-term objectives. Describe the issues they promote, such as one-on-one tutoring for all students, collecting and analyzing data on student participation in their education, providing everyone with access to virtual classrooms, and promoting lifelong learning. Goals leading to the creation of global educational resources and the reuse and sharing of digital educational resources are given, together with a vision and a brief research plan for each problem. Researchers now have the opportunity to analyze massive datasets of instructional behavior gleaned from databases tracking components of learning, influence, motivation, and engagement made possible by AI teaching systems, which are said to be facilitating richer student experiences. Describes a kind of individualized instruction that promotes experiential learning, critical thinking, and formative evaluation at the individual and group levels.

Keywords: Applied computing, Cognitive Science, Education, Grand Challenge Problems, Artificial Intelligence, AIED

1. Introduction

The progress made in the field of artificial intelligence in recent years is quite promising. The area of artificial intelligence is very active, with conferences, research, contests, and other events happening all over the globe. Technologies and their uses evolve and grow at a lightning pace. Furthermore, the ongoing development of smart devices has brought forth considerable ease and innovation to people's academic endeavors, professional endeavors, and personal lives. Many concepts for artificial intelligence may be traced back to robot research. The study of artificial intelligence may benefit from the application of certain technologies in order to model the global state and depict the dynamics of global change. In light of the present state of affairs and the impact of robotics on AI, it makes sense to include relevant practical material, such as robot programming and behavior training, in artificial intelligence curricula to provide students majoring in robot programming with greater enjoyment and pleasure. Simultaneously, you may learn more about the principles and procedures of AI.

The proliferation of Internet-based communication and information resources has significantly altered traditional modes of information intake, dissemination, and acquisition. The development of AI has improved people's daily lives and altered their perspectives on the world. Nowadays, words aren't the only way to convey meaning. Graphics, pictures, sounds, gestures, symbols, and formulae may all be used to communicate meaning in addition to the spoken word. The advancement of AI has provided new opportunities for learning and instruction, allowing students to acquire previously inaccessible competencies. Many academic disciplines have seen a dramatic improvement in their available resources because to advancements in artificial intelligence. Many graduate and postgraduate programs increasingly include artificial intelligence (AI) resources including digital text, video, graphics, and music into their curricula to help students learn and retain more material. The acquired knowledge allows for more complex thought processes including imagination, emotion, and creativity. New approaches to education in the era of AI help students gain more proficiency with digital tools. The use of AI in the classroom introduces a new medium. Students interested in a career in new media should have strong drawing and learning skills, as well as a basic competence with photography. In summary, AI's introduction has opened up a new avenue for educational advancement, but it also necessitates that student up their game in terms of the creative aspect of their professional training. Adding the concept of "trading old for new" to, say, a course on education may be a great way to get students thinking critically and practicing their professional abilities.

The group led by Atiye Karimzadehfini proposed a framework based on "data acquisition and storage," "behavioral modelling and calculation," and "smart" to explain the current state of AI technology in schools and the evolution of classroom teaching behavior analysis methods. Using ST classroom behavior analysis as an example, we can see that the fundamental model of intelligent analysis of teaching behavior is comprised of three "services" modules. Teachers have acknowledged the use of the experimental findings in their daily work. The findings from the experiments may

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be used to aid in teacher introspection, professional growth, and administration. Specific optimization techniques for behavior recognition models are also offered based on the input of educators throughout the application process. Using examples from demand analysis, student characteristic analysis, and gamification, Keith et al. The benefits of AI in the design of educational programs are summed up by their implementation in the creation of instructional programs and assessment frameworks. Davis argued that the integration of dot matrix recognition technology with educational artificial intelligence can perfectly safeguard the behavior and writing habits of educators and students, provide technical support for information-based instruction in the classroom, and spark creative thought about the use of paper and pen. The use of educational data in the classroom.

You should start by reading up on the latest developments and research results in artificial intelligence education by consulting relevant domestic and foreign literature, gathering, and studying data on the state of AI, AI in education, AI as a tool for pedagogical advancement, and related topics from both China and abroad. Second, the case analysis technique is used to examine a real-world example of an AI-based education application. We will then identify which components of teaching will be influenced by AI and how by conducting interviews with professionals and researchers in relevant subjects to get insight into the manner in which AI will transform education. Last but not least, it explains the ways in which artificial intelligence has altered the classroom in terms of materials, atmosphere, pedagogy, assessment, and administration, and it suggests some preventative measures that can be taken. Ways to become better. To improve education, try using AI in classrooms.

2. Literature Review

Fundamental insights into the complexity and process of learning, as well as pointers for further refining individual instruction, may be gleaned from the findings of research in learning science and neuroscience. When students work on challenging and motivating group projects, when they immediately apply what they've learned, and when they receive assistance from a human mentor, they not only learn more, but also receive responses that reflect the mentor's in-depth understanding of the student's background, strengths, and weaknesses, which greatly improves the quality of the student's learning experience. An improved understanding of human cognition, including more powerful constructivist and active instructional methodologies, is necessary for applying these new insights to human learning in digital learning environments. To better understand how individuals learn and how collaborative activity is measured, as well as to construct representations and reason about these new cognitive insights, artificial intelligence approaches are necessary.

The current educational system will have to adapt to the new regulations set by artificial intelligence. Education and AI go hand in hand; while the former facilitates learning and adds to the body of societal knowledge, the latter equips us with the tools to investigate the processes underlying cognition, action, and intelligent behavior.

The graphic below shows how pressing difficulties in education motivate AIED researchers to develop ground-breaking new learning methods. In addition to AIED, the word Intelligent Tutoring System (ITS) is shown in the diagram. Based on the current AI theories, tools, and methodologies, this figure demonstrates how these AIED/ITS systems may be developed.
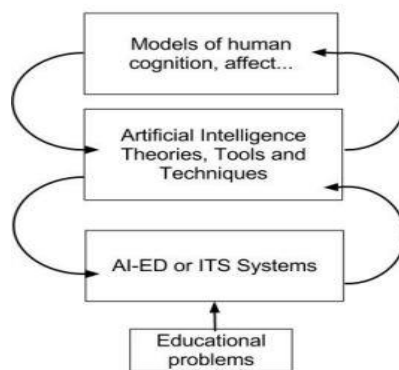

Fig 1: Problem-driven AI research

Studies in AIED have parallels with models of human cognition and other psychological factors including emotion and motivation. The picture demonstrates that these may also motivate basic AI research, and that there is a link between basic AI and the development of models that enhance cognitive comprehension. Human cognitive model

comprehension has further relevance to AIED. Human subjects research plays a crucial role at AIED as they seek to deduce what factors contribute to efficient education. Improvement in learning outcomes is another important metric for assessing AIED systems; this data may be used to refine cognitive models.

There are fourteen "Grand Challenges" that engineers must overcome, according to the National Academy of Engineering. Advanced Personalized Education is one such method. It references effective web-based individualized learning materials and methods, as well as recommender systems that guide students to the best resources for their needs. He mentioned the possibilities of educational data mining to use digital footprints of online learning.

The UK's Informatics Research Council has identified nine significant issues plaguing the field of informatics. Continuous education is one such thing. To achieve this goal, we need to develop tools that enable personalized learning for each student and facilitate meaningful relationships between educators and their students. The difficulty of this situation calls for more efficiency on all fronts. The scope of this Grand Challenge is far wider than that of any of the previous ones. Living Memory is another significant issue in the UK since it acknowledges that our memories shape who we are. Since improved memory is essential for continuous education, better cognition is intrinsically tied to AIED's overarching viewpoint. The third goal is to give people a taste of what it was like to live in the past, which is an ambitious plan for engaging study of the history and culture. Roughly half of these major problems can be solved through AIED studies.

The authors of this article provide short descriptions of five key obstacles confronting schools today:

- A tutor for each student
- 21st Century Learning Aids
- Data Collaboration to Support Learning
- Global access to global classrooms; and
- Ultimate lifelong learning

These difficulties are in line with the overarching objective of making learning more participatory, interactive, collaborative, inquisitive, pervasive, accessible, omnipresent, secure, and convenient for individuals at all times and in all places. The hope is that by setting these problems, significant progress may be made in the field of AI. If any of these major issues could be resolved, it would have a profound impact on the field of education.

3. A tutor for each student

Learning styles must be taken into account while designing a personalized tutor for each student. Research in the field of Learning Sciences (LS) teaches us a great deal about the process of learning and how it can be facilitated in the real world, including how to pique and maintain student interest, how to make complex ideas easier to grasp, and how to make the most of the social and physical features of a classroom environment. Helping students reflect on their own learning, the instructor's role in student development, and more. Applying these insights to the design and construction of systems that can interact organically with students and serve as mentors for individuals and groups in the absence of the instructor is the first great challenge in this area. Interventions are implemented and assessments are constructed to evaluate the validity of theories and to establish new ideas; these procedures are prevalent in LS research, which is mostly design-based experimental research. For instance, group projects are very effective for teaching and learning. (Johnson and Johnson 1994). In the same way that human tutors can infer a student's strengths, weaknesses, challenges, and motivation styles from their interactions with them, so too can today's intelligent teaching software support collaborative and personalised instruction to suit student characteristics (e.g., personality, preferences) and status (influence, motivation, participation; Conati & Kardan [2013], Lester et al. [2013]). (Arroyo et al. 2009). Many modern AIs have the ability to infer pupils' levels of knowledge, metacognition (thinking about thinking), emotion, and motivation.

4. 21st Century Learning Aids

The second major difficulty is understanding that people living in the twenty-first century need different abilities and support than those living in earlier eras. Skills necessary for success in the twenty-first century include those that need thought (such as critical thinking, systems analysis, and creative problem solving), as well as those that require interaction with other people. (from active listening to presentation skills and conflict resolution). and social abilities (which may be broken down into the broader categories of flexibility and self-control/improvement). (Pellegrino and Hilton 2012).

Citizens in a knowledge-based society need to be able to learn new information fast, try different methods of addressing problems often, and successfully collaborate to create new learning communities. Intellectual growth requires exposure to both difficulties and opportunities. In a sector where technological developments occur every few years, this demands instructors to rapidly reevaluate their course materials and delivery methods. For instance, it wasn't until the mid-1990s that the Internet really took off. One-fourth of the world's population is reported to have utilized

its services in 2009, and its many uses are embedded in practically every facet of human existence. modern. Another phenomenon that was on the cusp of mainstream acceptance in 2007 but has since become ubiquitous is online social networking. Many of the sectors in which today's students will eventually work do not yet have names.

Knowledge economies are built on a foundation of lifelong learning and 21st century skill development. The labor market is more favorable to highly skilled employees, according to the available data. (Brynjolfsson and McAfee 2013). Workers with higher levels of education tend to reap the benefits of technological progress while those with lower levels often see their occupations mechanized.

5. Data Collaboration to Support Learning

Understanding individuals, groups, and learning environments requires a third important challenge: exploring and capitalizing on the specific sorts of data accessible in educational contexts. (Baker, Corbett, and Aleven, 2008; Baker, Corbett, and Wagner, 2006). Learning analytics (LA) and educational data mining (EDM) are two academic groups that have emerged to delve into these records. There is a lot of overlap between the two disciplines in terms of their goals and their means. Common aims include encouraging students to evaluate their own progress, determining which students would benefit most from further assistance, assisting educators in developing effective interventions, and bettering existing courses of study. The EDM community, which has its roots in the study of intelligent tutoring systems, tends to focus on more micro-level aspects of cognition, such as the degree to which a student understands a certain subject or the length of time spent solving a problem. Data mining, ML, psychometrics, info viz, and computer modelling are just a few of the other areas from which EDM draws its methodology. Enterprise learning systems (e.g., learning content management systems) are the primary focus of learning analytics researchers who investigate topics like student retention and test scores using a combination of institutional data, statistical analysis, and predictive models to ascertain which students require assistance and how instructors are adapting their practices. The two groups should work together to solve the grey area between cognition and standardized test performance. The goal for both research teams is to build on their existing work to better understand students' strengths and weaknesses and student populations. Skills like critical thinking, self-control, and attentive listening are also essential. Tutoring software, educational games, and courses, etc., should all include data analysis as a core feature. Check the all-around skills of the kids.

6. Global access to global classrooms

Universal, accessible, open, and free at the point of use learning is the goal of the fourth Grand Challenge. At the AAAI Fall 2008 Symposium, the idea of online education was first brought forward. (Cohen 2009). The first step is to figure out what has to be done to make the Internet into a universal school where even the weakest pupils can compete with the brightest ones. It's possible that students might study more effectively in a global classroom than in a traditional setting with a single instructor. Students would have access to an infinite number of potential conversation partners because to this system's constant availability. Having access to so many different materials in one place should greatly improve education. The most recent attempt to realize this idea is still in its early stages. Coursera, Udacity, and Edx, all examples of MOOCs, provide free higher education courses taught by well-known professors and are packed with useful materials. Despite the quality of these online courses, the issue of underequipped classrooms throughout the world has not been resolved. At the moment, massive open online courses (MOOCs) only work for students who already have a high level of expertise and motivation due to a lack of personalization, a lack of research-based content, and a high dropout rate.

7. Ultimate lifelong learning

The fifth and final major difficulty addresses the need for ongoing education over the lifespan. Assuming Grand Challenges 1–4 can be met, the potential outcomes for each challenge will contribute to lifelong education. Challenge two may be closely related to challenge five via the promotion of social learning and adaptable thinking. (21st century skills). The line between school and life should be blurred via pedagogical adjustments that emphasize and facilitate students' real interest in and engagement with their coursework. The difficulty here is in locating relevant materials and connecting like-minded individuals. It also means making materials that are useful to learners at all stages of their development and throughout their lives.

8. Discussion and Conclusion

This article focuses on the ways in which AI may aid in the long-term success of educational initiatives. Tools that improve students' and teams' capacity for experience, reflection, analysis, and theory creation are particularly useful in the service of personalized learning. Most significantly, we hope that AI systems will provide students more rewarding opportunities to consider how they learn. Researchers in the field of artificial intelligence (AI) will soon

have access to a plethora of databases including information on learning, influence, motivation, and social interaction, providing them with new chances to analyze massive datasets of instructional behavior. In order for technology to have an impact on education, it must be embedded in a system that takes into account the content, pedagogy, and environment that are the result of the collaborative efforts of students, instructors, and technology. (Oblinger 2012). In many nations, a person's ability to buy things depends on their level of education. In the United States, for instance, a bachelor's degree holder may expect an average salary that is 80 percent more than that of a high school graduate. (Porter, 2013).

The issues with educational practice in schools should serve as inspiration for researchers in artificial intelligence and education. In providing novel approaches to education, the emergent technologies discussed here pose a serious threat to the status quo. (McArthur, Lewis, and Bishay 1994). The social and political contexts of the policy problems that must be solved are beyond the scope of this article. Computer systems have the ability to assist students succeed and advance the study of the science of learning, which would benefit a large number of students who have the potential to be more successful than in the existing education system. If we don't adopt the new techniques offered by AI technology, not even the most successful students of today will be able to tackle the difficulties of future. Today's pupils are more likely to achieve their academic goals thanks to artificial intelligence technology. We anticipate these innovations empowering pupils worldwide, enlarging educational possibilities, and providing fascinating interactive experiences for people of all ages.

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