

Education in the Age of Artificial Intelligence

# How Will Technology Shape Learning?

The age of Artificial Intelligence (AI) is here! Higher education needs to prepare students for a world in which AI plays an increasingly dominant role. What are the jobs that can be replaced easily? How would higher education be affected in the age of AI, robotics, machine learning, and automation? How can higher education excel and flourish in the age of AI? Read on...



**Keng Siau**

Chair of the Dept. of Business and Information Technology (BIT)  
Missouri University of Science and Technology, USA

Advancement in Artificial Intelligence (AI), robotics, machine learning, and automation has started to replace many structured, routine, and repetitive jobs. McKinsey Global Institute's Report (2017) estimates that by 2030, automation may displace between 400 million and 800 million individuals and these individuals will need to switch job categories and learn new skills. That is up to one-fifth of the global work force! MIT's Daron Acemoglu and Boston University's Pascual Restrepo (2017) found that each additional robot in the US economy reduces employment by 5.6 workers, and every robot that is added to the workforce per 1,000 human work-

ers causes wages to drop by 0.25 to 0.5%.

AI is an information technology-based computer system or machine that has the ability to complete tasks that usually require human intelligence and logical deduction. AI can be classified into Weak and Strong AI. Weak AI, also known as artificial narrow intelligence, focuses on specific narrow tasks. One example of Weak AI is the self-driving car. It is specialized for a specific task. Another AI category is the Strong AI, also known as artificial general intelligence. Strong AI is a machine with consciousness, sentience, and mind, and this machine can apply intelligence to more than one specific problem. Strong AI has been characterized as a threat to mankind by many prominent researchers and industrialists such as Stephen Hawking, Bill Gates, and Elon Musk. In this article, we focus on Weak AI as the central issues and challenges posed by Strong AI are somewhat different. In the rest of the article, AI will refer to Weak AI.

The chief challenges posed by AI are job losses which will result in the up-heaval of the society. A report published in February 2016 by Citibank in partnership with the University of Oxford predicted that 47% of US jobs are at risk of automation. In UK, it is 35%. In China, it is 77%. Across OECD, it is an average of 57%. In the past, technology advancement has consistently generated more new jobs than it destroys. Many are wondering if this time will be different!

There are about 3.5 million professional truck drivers in the US and another one million taxi, Uber, school bus, and transit bus drivers. Driverless trucks from companies such as Otto and Budweiser have successfully delivered goods in 2016 and 2017. Many companies such as DHL and Pizza Hut will be experimenting with driverless trucks. This is only one example and the job replacements and displacements by AI have already begun and it is expected to accelerate significantly. What types of jobs are in danger?

Job tasks can be classified into structured and unstructured tasks as well as routine and non-routine tasks. Structured tasks can be clearly defined and described, and they can be broken down into smaller and more manageable tasks. Unstructured tasks rely on intuition, judgment, and experience. Routine tasks are unvarying tasks that involve strong regularities or are done at specified intervals. Non-routine tasks are performed infrequently, irregularly, or for the first time.

Jobs that involve tasks that are routine and structured are easy to automate and will be replaced by AI soon (if not already). For example, job positions such as telemarketers, retail salespeople, insurance underwriters, claims representatives, loan officers, credit analysts, bank tellers, truck drivers, fast food cooks, and financial analysts are most likely going to be hit the worst by AI. For jobs that are structured but not routine, it may not be cost-effective

to automate. Jobs that involve unstructured tasks are difficult for AI to learn and are much harder to replace. For example, job positions that are related to merger of companies, and professions such as psychiatrists and psychologists are not easy to be replaced by AI as each case is unique. How will higher education be impacted in the age of AI?

**AI will impact higher education in a number of ways. Two key areas are curricula and enrollment.**

To avoid job loss, in addition to the hard skills, students will need to learn skills that are not easily learned by AI. Skills that enable students to augment and complement AI are needed. Competing directly with AI is futile. Machine can compute faster, operate 24/7, and continuously improve (theoretically, in perpetuity).

Further, the average life expectancy at birth of the global population in 2015 is 71.4 years. Although higher education has been evolving and updating the curricula from time to time, higher education is still regarded as archaic from many perspectives. The teaching materials, the way of evaluating students' performances, and the boundary for theoretical knowledge and experiential learning are still mostly coming from the historical system. This legacy setup may not be effective and efficient in the AI age.

Undoubtedly, a strong background in traditional hard skills such as writing, mathematics, and science always have their places in academic and career worlds. Soft skills such as creativity, problem-solving, collaboration, communication, interpersonal skills,

leadership, empathy, and adaptability are becoming more and more critical as these skills are still beyond the purview of most AIs in the near future. These soft skills will be vital for humans to excel and to have a role in the future work place. It is, thus, important for higher education to help students develop these soft skills, which will require a complete analysis and revamp of existing curricula. These soft skills are not generally the emphasis of Science, Technology, Engineering and Mathematics (STEM) disciplines and are more closely aligned with the focus of liberal arts and humanities degrees.

Another obvious impact of AI on higher education is enrollment. The fast changing landscape in the AI age will

come may not be sufficient for people to pursue higher education. Even enrollment in various majors may see drastic changes in the AI age. Liberal arts and humanities majors such as philosophy, psychology, sociology, and language literature may become more popular as these areas are more 'AI-proof'. In short, status quo in higher education is not an option.

**How can higher education stay relevant in the AI age?**

Over the next few decades, human jobs will be cannibalized by AI and AI will outperform humans in many job functions. Higher education institutions must transform how and what they teach. A new academic discipline called human literacy or 'humanics' was proposed by Joseph Aoun to complement technological literacy and data literacy disciplines. Humanics builds on human strengths such as creativity, entrepreneurship, ethical thinking, and cultural agility

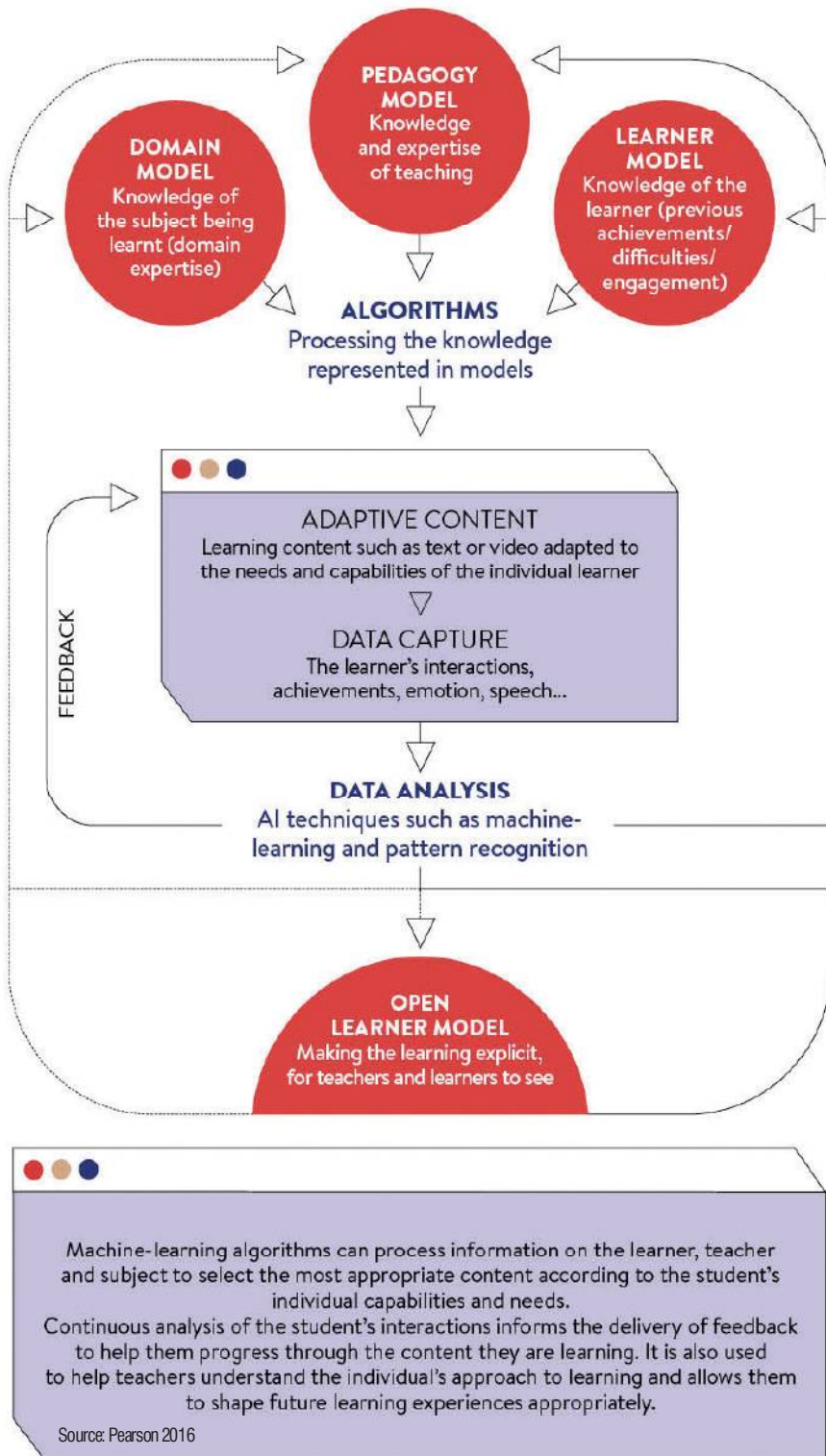
**Higher education institutions must provide life-long learning opportunities to their students and alumni to re-educate and retool. Workers may prefer employers over colleges for additional education.**

impact enrollment at higher education institutions and enrollment in various majors. In many western countries, the government funding for higher education is declining and many institutions need to rely heavily on enrollment to sustain the operation of the institutions. At the same time, student loan interest rates are going up in the US. Some are predicting that up to 50% of colleges in the US will collapse by 2030. Universal basic income, a basic living stipend, has been proposed as an answer to automation. If automation starts to replace many jobs and resulting in a net job loss, the enrollment at higher education institutions will be severely affected as universal basic in-

to distinguish humans from AI. Technological literacy will enable students to appreciate and embrace technologies, and understand how AI works. Data literacy is another important pillar. Many argue that data analytics will be the top skill students should learn in school. The founder of Alibaba and e-commerce titan, Jack Ma, said "in the next 30 years, artificial intelligence will outpace human knowledge". Companies will be looking for students with expertise in data analytics since this skill requires independent thinking, various data interpretation techniques, and analytical thinking. AI cannot easily acquire this skill set.

Higher education can and should embrace AI as well. AI can help create intelligent classrooms and smarter learning environments. Jill Watson, Georgia Tech's first AI teaching assis-

	Routine	Non-Routine
Structured	Easy to learn and program	May not be cost effective to automate
Unstructured	Not easy to learn or program	Not cost effective to learn or program or automate



textbooks to support personalized learning. Personalized learning refers to a diverse variety of educational programs, learning experiences, instructional approaches, and teaching strategies that can better satisfy the distinct learning preferences and interests of individual students. Studies have shown that personalized learning strategies enable students to achieve greater academic progress.

With the expected replacement of many jobs by AI and the creation of new job categories, retraining and skills development will be needed to prepare the displaced workers for other careers. A job for life is a thing of the past. Lifelong learning is a reality. To continue to succeed in the workplace, workers will constantly need new knowledge and acquire new skills. Higher education institutions must provide lifelong learning opportunities to their students and alumni to re-educate and retool. Workers may prefer employers over colleges for additional education and there are opportunities for higher education institutions to partner with companies and organizations to provide retraining. Courses can be taken in modules and these modules can be collected for a certificate or degree. Online and distance courses can address the needs for retraining and skill enhancement for working professionals, and provide a less disruptive approach, compared to on-campus education, to lifelong learning.

The AI age is going to be unsettling, transformative, and revolutionary. Many jobs will become obsolete and new jobs will be created. To succeed in the AI age, humans need to leverage and strengthen the traits that distinguish humans from robots. One can either adapt and excel in the AI age or risk becoming redundant. Higher education has a critical role to play in the AI age. Higher education must rise to the challenge to prepare students for the AI revolution and enable students to successfully surf in the AI age. ■

tant, was developed to handle the high number of forum posts by students for the online Knowledge-Based AI class. Students in the course were not aware that Jill was not a real person. Other classroom-based AIs include Teacher

Advisor, Thinkster Math, Brainly, and Mika. With AI, for example, instructors can create textbooks and exercises that are customized to individual student. Content Technologies, Inc. is a company using deep learning to produce custom