AI Convergence Education Programs Combined with Humanities Elements

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Abstract

Artificial intelligence (AI) is accelerating its development through the convergence of various fields and studies. Among them, the convergence of AI and humanities draws attention from academia. Therefore, this paper shows the results of developing AI Convergence education programs by combining humanities elements. The first of the educational programs proposed in this paper combines Unhaeduchangjipyo, an ancient document of Korean historical value, to teach the expert system, one of the applications of AI. The document's concept is similar to the modern expert system because Unhaeduchangjipyo exemplified how to cope with infectious diseases. This program was developed for middle school students and deals with the topics of how to analyze problems with infectious diseases, designing medical-related expert systems, and developing expert systems through programming. The second educational program incorporates popular paintings of Monet's, and a fairy tale, Goldilocks and the Three Bears. Students can easily understand supervised learning with the paintings. Moreover, Goldilocks, which has become a symbol of just the right state without any shortage or remaining, is an example of an appropriate dataset related with overfitting and underfitting. This program was developed for elementary school students and includes the types of machine learning, the understanding of overfitting and underfitting, and the game of the principles of overfitting and underfitting. We hope to provide implications for AI humanities and AI convergence education through this paper.

Keywords: AI humanities, AI convergence, AI education, machine learning.

1. Introduction

Artificial intelligence (AI) has established itself as a core technology for change in all areas of society, and converges with various technologies to trigger the fourth industrial revolution. The fourth industrial revolution is bringing about technological innovation in industry and society by hyper-connecting people and things, time and space. AI, dubbed the most disruptive technology of all time, will lead us to a completely different world than ever before. The development of AI and Internet connection ushered in the super intelligence era (Brunette, E.S. et al., 2009). The convergence of digital and analog worlds, the virtual world and the real world, products and services, and humans and machines are taking place. AI refers to technologies, software, and computer systems that use computers and machines to mimic human intelligence (Glikson E. et al., 2020). Therefore, it is essential to understand the humanities, which promote understanding of humans, to develop, use, and advance AI. Although AI is converging with various fields, the convergence of AI and humanities attracts attention from various fields. To not become a useless human in the era of destructive and innovative AI, it is necessary to understand AI and possess humanities literacy. Therefore, this paper presented the results of developing an educational program that combines AI with the humanities. The programs proposed in this paper aim to enhance the understanding of AI based on humanistic thinking.

2. Background

AI Humanities

The convergence of the humanities and AI is a natural phenomenon that cannot be avoided. In the humanities, a discipline that explores human thought and culture, the natural sciences and social sciences mainly use empirical approaches, but rather a critical and logical way of thinking. On the other hand, AI is a discipline that started with a desire to make machines look like humans. Therefore, in the AI humanities, it is crucial to analyze how AI technology affects human culture when it is with humans and how to cope with the influence. AI humanities is an interdisciplinary study with AI as the content and the humanities as a method (Kim, H. et al., 2019). It can be seen as a study that defines human activities and values in the AI era. AI formed by machine learning and deep learning encompasses speech and image recognition, natural language recognition, robotics, and expert systems (Deloitte, 2018). While the humanities collectively refer to subjects related to human beings, such as literature, history, art, music, philosophy, Et cetera. Looking at AI from the perspective of the humanities serves as an essential foundation for using AI as a technology that benefits humanity.

515

AI Convergence in Education

Convergence refers to the process and form in which two or more elements are combined to transform into a unified concept. If we look at convergence in education, it means the process of establishing common concepts for a specific purpose and solving problems together. Convergence in education refers to establishing common concepts for a specific purpose and solving problems together. AI convergence can be interpreted from two perspectives. One is the convergence of several subjects centered on AI. It is a form of teaching that views the principles and concepts of AI as core contents and introduces some concepts such as mathematics and morals. Ali, et al (2019) proposed AI education designed around constructivism, ethics, and creativity for elementary and secondary school students. They developed a robotic toolkit for children's AI education, AI + Ethics training related to data bias, and educational games with AI robots (Ali, et al., 2019). Another example is teaching by accepting the concept of AI in various subjects. In the state where teachers of various subjects have acquired basic knowledge about AI, they bring the concept of AI to the content of their own subject education and teach it from a new perspective. Lee, et al. (2021) developed a curriculum for elementary science teachers to teach machine learning concepts (Lee, et al., 2021). Convergence education centered on AI can be made through a collaboration between teachers of other subjects centered on AI specialized teachers. AI convergence education in this paper is included as a form of education that converges humanities knowledge focused on AI.

3. Strategies to Adopt Historical Documents into IT Humanities Concept in Education

Overview of Procedures

To increase the understanding of technological principles combining humanities, we developed artificial intelligence and humanities programs based on To increase the understanding of technological principles combining humanities, we developed artificial intelligence and humanities programs based on the hyper-blended practical model (Choi & Park, 2021; 2022). The approach allows teachers to deliver their lessons regarding on-time technology issues in online and/or offline settings. Herein in this section as one of those programs, we suggested the artificial intelligence and humanities program focused on expert systems. It included three modules "Analyzing the problem of infectious diseases through Unhaeduchangjipyo," "Designing an expert system for medical counseling on the diseases," and "Creating the expert system by programming." Unhaeduchangjipyo is a historical document written by Heo, Jun (1546-1615), who served as a physician during the reign of King Seonjo of the Joseon Dynasty in Korea; and he also published momentous books regarding traditional Korean medicine such as natural herbal remedies that were easily attainable by residents. Since Unhaeduchangjipyo illustrated how non-medical experts should cope with variola epidemics, we exploited the historical content connected to producing a programmed system to support whom wonder about the infectious disease and need expert advice. The program comprised the four modules with embedded learning activities described below (see Table 1).

Table 1. Scope and Sequence of the Artificial Intelligence and Humanities Program for middle school students

Module	Topic	Main tasks and activities
1	Analyzing the problem of infectious diseases through Unhaeduchangjipyo	•To figure out the problematic situation of an epidemic from the historical text of Unhaeduchangjipyo •To understanding the principle of expert systems •To analyze the problem of infectious diseases
2	Designing an expert system for medical counseling on the diseases	•To make a process modeling to attack a problem •To produce rules of inference •To explore tools to make artificial expert systems
3	Creating the expert system by programming	•To create a medical counseling program using the principle of expert systems •To share the learner outcomes of expert systems •To find practical examples of expert systems in the medical field
Note. Time is assigned approximately 1 to 2 hours per module excludes participants' self-directed learning time.		

Specific Examples of the Activities using the Historical Documents

The activities in the developed program focused on the understanding of the process of expert systems using Unhaeduchangjipyo as storytelling materials, reference data to analyze, or resources for knowledge base in an expert system (Fig. 1).
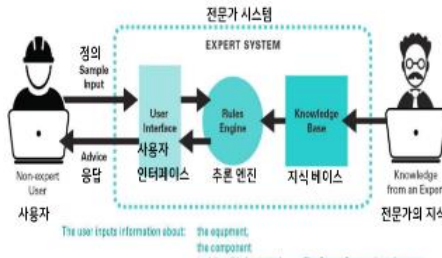

Storytelling	Reference data	Resource for knowledge base in an expert system
Participants can figure out problems in variola epidemics from the story of Heo, Jun.	Participants can read and analyze the physician's note from the historical text of Unhaeduchangjipyo.	Participants can create a medical counselling expert system based on the knowledge and inference.

Fig. 1: Examples of the Teaching Materials for IT Humanities Using the Historical Document

517

According to previous studies, the adoption of historical sources in the teaching of scientific and technical concepts has the potential to support learners in effectively comprehending complicated ideas (Kim, 2016; Janica, 2020). Because every culture has its indigenous knowledge caused by residents who have lived and interacted with the mutually surrounded nature for a long time, traditional knowledge contributes to facilitating learners in terms of acquiring knowledge based on contextual information (Lee & Shin, 2017). Moreover, the trend of convergence across various fields that had been conventionally considered to be hard to assimilate was applied in those educational activities in Fig. 1. When an educator designs integrated lessons using history, selecting appropriate historical materials and content fostering learner interest and competencies can take an imperative role in leading successful lesson outcomes (Kim, 2016).

4. Strategies to Adopt Paintings and Fairy Tales into IT Humanities Concept in Education

Overview of Procedures

In this section, we suggested the artificial intelligence and humanities program focused on overfitting and underfitting. The three modules for the program are "Learning about the types of machine learning," "Exploring the concept of overfitting and underfitting," and "Playing with the principle of overfitting and underfitting." The main learning topics of the program include artificial intelligence, machine learning, supervised learning, unsupervised learning, underfitting, and overfitting (see Table 2).

Table 2. Scope and Sequence of the Artificial Intelligence and Humanities Program for Elementary School Students

Module	Topic	Main tasks and activities
1	Learning about the types of machine learning	•To understand the Meaning of Artificial Intelligence •To Learn the concept of machine learning •To Explore supervised learning in machine learning •To Explore unsupervised learning in machine learning
2	Exploring the concept of overfitting and underfitting	•To guess the learning topic from the fairy tale "Goldilocks and Three Bears" •To learn about the concept and cause of underfitting •To learn about the concept and cause of overfitting
3	Playing with the principle of overfitting and underfitting	•To review the concepts and causes of overfitting and underfitting •To play by applying the principle of overfitting and underfitting

Specific Examples of the Activities using Notable Paintings and Fairy Tale

The three types of machine learning are supervised learning, unsupervised learning, and reinforcement learning. Module 1 focuses on comparing the differences between supervised and unsupervised learning. As fruits are familiar with young learners, we provided various fruit pictures as training data for artificial intelligence. Learners try to derive the essential features of certain fruit by looking at different pictures. For example, various apples have common features of being spherical, red, and hollow at the top with a stem. This corresponds to the result of machine learning about apple labels in supervised learning. Then we show Monet's still life to the learners, who is also well-known to elementary learners.
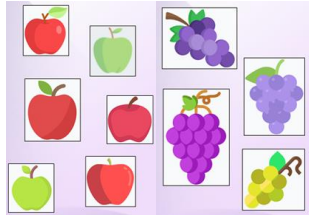
Examples of training data	Apples and Grapes (Claude Monet, 1840)	Baskets of Apples (Claude Monet, 1880)
Participants should discover common features from training data with given lables.	Participants observe famous Artist's paintings to think about output data in previous supervised learning models. They realize how AI distinguish input data.	

Fig. 2; Examples of the Teaching Materials for IT Humanities Using the Paintings

Meanwhile, the overfitting and underfitting are frequent problems situations that can occur during the AI machine learning process. Underfitting is a case where machine learning must be done more sufficiently to improve model accuracy. On the other hand, overfitting shows very high accuracy against training data, but the accuracy is significantly lowered with test data. This phenomenon is similar to the story plot of "Goldilocks and Three Bears" in that machine learning should not be excessive or insufficient. Accordingly, AI education combined with the humanities element of traditional fairy tales was conceived.

5. Conclusion

In order to cultivate competent people with the capabilities necessary for the upcoming future society, artificial intelligence education and convergence education are areas where interest and research are increasing in the educational field. Therefore, we developed artificial intelligence convergence education programs that integrated humanities elements. We introduced an historical document, Unhaeduchangjipyo, for teaching-learning expert system. Artistic and literary materials, Monet's paintings and "Goldilocks and Three Bears", are used to explain types of machine learning, overfitting, and underfitting. We hope that research on

effective artificial intelligence convergence education will be activated so that various learners can easily and interestingly learn about AI.

6. Acknowledgement

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520