

Development of Humanities Based Teaching-Learning Contents for Types of Machine Learning

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Abstract

Artificial intelligence education applied with humanities elements is necessary to cultivate learners' humanities knowledge and desirable personality while inducing motivation and enhancing effects of teaching-learning. Proposed teaching-learning contents in this paper aims to educate elementary school learners the principles of artificial intelligence based on humanistic elements such as traditional fairy tales and folk tales. For the development of the teaching-learning content, referring to the current pre-developed elementary and secondary artificial intelligence education content standards by KOFAC, the types of machine learning were selected as a topic. After analyzing several Korean traditional fairy tales, a story similar to machine learning supervised learning had chosen, and it was intended to correspond to individual elements in the artificial intelligence principle. On the other hand, unsupervised learning was planned to learn naturally through activities in which learners group animals in traditional Korean paintings. The worksheet developed for the activity was also converted as an online worksheet for being used in both face-to-face and non-face-to-face teaching-learning situations. A Korean traditional fairy tale "The Fan Merchant and the Umbrella Merchant" has similarity with supervised learning, because a woman in the story predicts preferred merchandise according to certain day's weather. Another humanities element that is expected to maintain the connection of learning and arouse learners' interest is traditional painting. Therefore, the proposed teaching-learning content is designed to experience unsupervised learning process of machine learning using animals in folk paintings as training data. Learners can also access this teaching-learning content in non-face-to-face environment by shared online worksheet. The teaching-learning contents proposed in this paper is expected to not only educate machine learning types, also encourage elementary learners to cultivate sound values so that eventually become ethical AI users.

Keywords: AI Education, Machine Learning, AI Humanities, Non-face-to-face Education, Elementary Education, Computational Thinking

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1. Introduction

Academic Interest and research on artificial intelligence(AI) education are continuing in countries around the world. As artificial intelligence technology develops, the degree of interest in education in artificial intelligence is very high in that it is necessary for humans to use it conveniently[1]. Although there are differences in the policy direction, most advanced countries treat artificial intelligence education as a priority in education policy[2]. However, the more advanced the technology, the more important it is how to use it. Based on this perspective, research on ethical aspects of artificial intelligence education is also being actively conducted, while a wide range of movements are taking place from elementary to university education to bring out humanities elements to artificial intelligence. Therefore, this paper intends to propose teaching and learning contents to find out the machine learning types of artificial intelligence by using traditional fairy tale folktales, which are representative humanities elements, as learning materials and tools.

2. Related Research

2.1. *AI Education based on Humanities*

In a rapidly changing world centered on technological development, changing human mindset is an example of human life taught by humanities such as literature, history, and philosophy, reflecting the view that it is an interpretation of humanities[3]. Demands and research on AI education are growing and attempts to integrate AI education with humanities elements rather than focusing only on technology has become increased. The Ministry of Education and 17 provincial offices of education across the country emphasize the need for AI convergence education, and as an important educational method, the operation of AI based topic oriented convergence projects for elementary and secondary learners are being researched[4]. Nevertheless, there have been not many discussions on humanities review and analysis of education on AI, and research on teaching-learning methods that can examine or educate AI in humanities is currently insufficient[5].

2.2. *Types of Machine Learning*

Types of machine learning include supervised learning, unsupervised learning, and reinforcement learning. Supervised learning is a method that informs the correct answers, that is, the result values for the training data, and then finding out the result value for the newly entered data based on the learning model. On the other hand, unsupervised learning does not inform the result values for training data. This is suitable for showing the structure, characteristics, and relationship between the data itself[6]. Reinforcement learning is a method of learning by recognizing state and selecting an action that can obtain the maximum reward among the actions that can be selected.

3. Methods

For the development of the teaching-learning contents mainly focusing on elementary school learners, first, the content elements of the [Elementary and Secondary Artificial Intelligence Education Content Standards][7] developed by Korean Foundation for the Advancement of Science and Creativity(KOFAC) were explored. According to 'Principle and Application of Artificial Intelligence' field in the content standards, reinforcement learning among the three types of AI machine learning is only dealt with in the advanced high school curriculum. Therefore, supervised learning and unsupervised learning excluding reinforcement learning were selected as the subject of the teaching-learning program for elementary learners.

Table1. Elementary and Secondary Artificial Intelligence Education Content Standards (Partial)

Field	Detail Field	Contents				
		Elementary school 1~4th Grade	Elementary school 5~6th Grade	Middle School	High School (Basic)	High School (Advanced)
Principle and Application of Artificial Intelligence	Machine Learning and Deep Learning	<ul style="list-style-type: none"> · Artificial Intelligence Learning Activities 	<ul style="list-style-type: none"> · Experience for Principle of Machine learning 	<ul style="list-style-type: none"> · Supervised Learning · Unsupervised Learning 	<ul style="list-style-type: none"> · Principle and Application of Machine Learning · Principle and Application of Deep Learning · Classification Model · Implementing a Machine Learning Model 	<ul style="list-style-type: none"> · Machine Learning · Principle of Reinforcement learning · Perceptron and Neural Networks · Deep Network

Subsequently, based on this content standards, 'Artificial Intelligence Class at School', textbooks developed on a trial basis by the Ministry of Education and KOFAC, were examined. Teaching-learning activities in the textbooks are representative examples of how the AI education content standards can be practically implemented in classes. The textbook targeting 1st to 4th graders in elementary school applies the concept of 'artificial intelligence learning play activities' instead of introducing machine learning in earnest. In the textbook for 5th to 6th graders in elementary school, the process of machine learning is briefly explained through 'dog and cat picture recognition program' using a Teachable Machine platform. In the content elements, it is suggested as 'experience of machine learning principles', and the teaching-learning activities presented in the textbook does not explicitly use the terms supervised learning and unsupervised learning. In the middle school textbook, the terms of supervised learning and unsupervised learning are not only introduced, but also the main principles of each method are suggested. However, in both textbooks, process of machine learning is presented only through an educational machine learning experience program such as Teachable Machine.

Therefore, this study attempted to develop an unplugged teaching-learning contents that allows elementary learners to experience the principles of machine learning regardless of the learning environment, while learning AI through a humanities approach. Then the unplugged teaching-learning contents have also converted to online contents, to flexibly cope with the rapidly increased online learning situation after the pandemic.

A humanities element that this study mainly focused on to be applied to AI education for elementary learners is a Korean traditional fairy tale. Traditional fairy tales have a concise plot to apply to classes and have values that can cultivate the proper hierarchy of values. AI education is currently being implemented as an optional subject only at the high school

level in Korea. Considering that AI education will be gradually expanded to all grades of all schools, a traditional fairy tale which will be effective and interesting motivation for learning was selected as a teaching-learning tool. To this end, the main plots and lessons of 50 Korean traditional fairy tales were analyzed, and a story related to the principle of supervised learning was selected. Subsequently, Korean folk paintings used as training data for unsupervised learning were collected from the Korean national museum collection search site, e-museum.

4. Proposed Teaching-Learning Contents

4.1. Teaching-Learning Contents for Supervised Learning

A Korean traditional fairy tale, where the principle of supervised learning can be found, is “The Fan Merchant and the Umbrella Merchant”. Depending on the editions, the tale has been also passed down as “The Fan Merchant and the Wooden Shoes Merchant” or “The Straw Shoes Merchant and the Umbrella Merchant”. The story's plot is that a mother, who was always worried about her eldest son selling fans on rainy days and her younger son selling umbrellas on clear days, changed her mind and became happy every day after hearing her neighbor's advice to think about a thing that would be sold well. Thus, this story also has an instructive element that the importance of positive attitudes and the value of the change of ideas.

In “The Fan Merchant and the Umbrella Merchant”, the mother had concerned every morning because she judged that umbrellas would be sold well on rainy days and fans on clear days. This has similarities with training data and learning models in machine learning in that it could be predicted through the facts observed and learned through life, that is, training data. Based on the model, the mother was able to make a judgment according to the situation when new data was entered. In this case, the data is today's weather. As such, teaching-learning idea from traditional fairy tale will make the learner explore unfamiliar AI principles interestingly and easily through the humanities element. It also aims to be combined with other subjects such as Korean and Morality to provide literature and Character education.



Figure 1. Story Board of Korean Traditional Fairy Tale <The Fan Salesman and the Umbrella Salesman>

Table 2. Correspondence Between Situations in the Story and Artificial Intelligence Instruction

Situation of the Story	Supervised Learning
People use umbrellas on rainy days to avoid rain and fans on sunny days to make cool breeze and be protected from the sun.	A given answer to a problem
The characteristics of umbrella selling days and fan selling days	Discovered Rules through machine learning

The dark clouds are gathering.	A new data
Fans or umbrellas, the item that's going to be sold well today	An answer to a new problem, predicted by the rules found by machine learning

Meanwhile, there can be a limitation of teaching-learning based on physical computing or internet-based coding for lower graders of elementary school who are clumsy with operating computer. Even if it's used for students who are more skilled, AI education is difficult to take place when it requires a lot of time[8]. As such, explaining an AI machine learning type by using a traditional fairy tale has the advantage of being flexibly applied even in learning environments difficult to use smart devices or learning situations for lower-grade learners, because many school sites do not have a physical environment for using AI and big data[9].

4.2. Teaching-Learning Contents for Unsupervised Learning

Following the investigation of the principles of supervised learning, especially classification, through the problem situation in traditional fairy tales, non-supervised learning is approached by utilizing the humanities element of traditional folktales. [Figure 2] shows 25 kinds of animals familiar to elementary school learners in folk paintings collections provided by the website of the National Museum of Korea[10]. Korean folk paintings used in the cards include Painting of Grass and Insects, Painting of Flowers and Birds, A Pair of Pheasants, Ten Longevity Symbols Painting, A Tiger and Magpies, A Mother Hen and Chicks, A Mother dog and Puppies. The given animals become training data and the learners become artificial intelligence executing machine learning, experiencing the process of unsupervised learning directly.

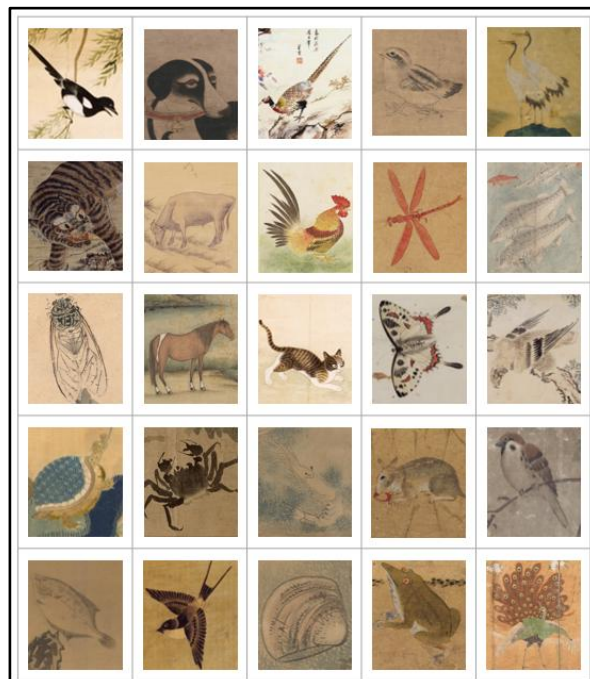


Figure 2. Animal Cards for Teaching-learning Unsupervised Learning

The core characteristic of unsupervised learning compared to supervised learning is that artificial intelligence finds rules on its own in the input data to create a model. Unlike

supervised learning, where training data containing answers were provided, unsupervised learning is self-learning, so different groups are formed according to how clustering is performed. To experience this process, the learners cut all the given animal cards and divide them into two to four groups, which means clustering. Then, with fellow learners, they guess each other's clustering criteria. At this time, it should be noted that there may be differences in individual learners' clustering results and sometimes so that the criteria cannot be guessed. The learners do not need to focus only on correct answers. Numbers of legs, presence of wings, flight availability, where they usually live, presence of a tail can be examples of the criteria for making groups with the given cards. Learners who have become AI should explain that they made groups of training data on their own standards, but at this time, the criteria do not have to be explicitly revealed.



Figure 3. Online Worksheet for Teaching-learning Unsupervised Learning

The online worksheet for the non-face-to-face class was produced using the online worksheet production platform LIVEWORKSHEET. The cards cutting activity in the face-to-face class was implemented as a clustering the cards through drag-and-drop function in the online worksheet. In non-face-to-face classes, it may be difficult to immediately interact with the instructor, and the learners also can access the worksheet with a shared URL without having to take real-time classes with the instructor. Considering these parts, the names of the animals were written on the cards.

4. Conclusion

As the necessity and importance of AI education for young learners are increasing day by day, so is the demand for humanities consideration and knowledge that will lead the development of technology in the right direction. Therefore, in this paper we attempted to develop an AI machine learning principles teaching-learning contents for elementary school students applying humanities elements. The subjects of the contents were supervised learning and unsupervised learning among the three types of AI machine learning, so that elementary school learners who first learned about AI could have a general idea of machine learning.

The main focus of the proposed contents was to make the engineering element of machine learning easier and more interesting to learn through the humanities elements. Accordingly, a traditional fairy tale familiar to elementary school learners and traditional folk paintings in which various animals appear were incorporated into the contents. In addition, while learning about machine learning, various subjects were fused, and the teaching-learning activities were implemented to enable both unplugged and online learning. Through the developed teaching-learning contents, it is expected that elementary school learners will build basic knowledge about AI machine learning, while being interested in traditional culture and further cultivating the right mind through lessons in the story. In the follow-up research, the developed teaching-learning contents will be applied to classes with various learners to verify the suitability and effectiveness of the contents.

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6. References

1. Jungah Yoo. A study on AI Education in Graduate School through IPA. Journal of The Korean Association of Information Education. 2019 December;23(6): 675-687. DOI: <http://dx.doi.org/10.14352/jkaie.2019.23.6.675>.
2. Jeong-Beom Song. Development of an STEAM Education Program Using Artificial Intelligence Tools for Lower Grades of Elementary School. Journal of Digital Contents Society. 2020 December;21(12): 2135-2142. DOI: <http://dx.doi.org/10.9728/dcs.2020.21.12.2135>.
3. Sung-ae Kim, Ju-yeon Park. Artificial Intelligence Education Status and Implications at Liberal Arts Education of Universities. Korean Association of Artificial Intelligence Education Transaction. 2021 August;2(2): 31-38. DOI: <https://doi.org/10.52618/aied.2021.2.2.4>.
4. Seol-Ah Min, In-Seong Jeon, Ki-sang Song. The Effects of Artificial Intelligence Convergence Education using Machine Learning Platform on STEAM Literacy and Learning Flow. Journal of The Korea Society of Computer and Information. 2021 October;26(10): 199-208. DOI: <https://doi.org/10.9708/jksci.2021.26.10.199>.
5. Seungwoo Han, Boyoung Kim. Developing an Educational Model Artificial Intelligence Humanities and Analyzing the Effects of Instruction. The Korean Journal of Literacy Research. 2020 October;12(5): 329-357. DOI: 10.37736/KJLR.2021.10.12.5.10.
6. Daeryoon Park, Joongmin Ahn, Junhyeok Jang, Wonjin Yu, Wooyeol Kim, Youngkwon Bae, Inhwan Yoo. The Development of Software Teaching-Learning Model based on Machine Learning Platform. Journal of The Korean Association of Information Education. 2020 February;24(1): 49-57. DOI: <http://dx.doi.org/10.14352/jkaie.2020.24.1.49>.
7. KOFAC. Elementary and Secondary Artificial Intelligence Education Content Standards.
8. Jeongbeom Song. Development and Validation of Artificial Intelligence Education on the Environmental Education Based on Unplugged. Journal of The Korean Association of Information Education. 2021 October;25(5): 847-857. DOI: 10.14352/jkaie.2021.25.5.847.
9. Education in Kindergarteners to the Second Graders. Journal of The Korean Association of Information Education. 2020 October;24(5): 413-421. DOI: <http://dx.doi.org/10.14352/jkaie.2020.24.5.413>.
10. E-Museum. <http://www.emuseum.go.kr>.