How Do Students Learn Artificial Intelligence in Interdisciplinary Field of Biomedical Engineering?

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ABSTRACT

The Artificial Intelligence (AI) research field is interdisciplinary. In this research, based on students' understanding of the current situation, AI is considered in relation to biomedical engineering, which is one of the interdisciplinary fields. Students expected the effectiveness of AI for society while having ethical and security concerns. Along with the increase in communication speed with large memory capacity and networking, many results have been obtained in the field of biomedical engineering: decoding DNA base sequences and digitizing medical images. On the other hand, security issues are being discussed in information networks: handling of personal genetic information. AI is expected to be used as a means of interdisciplinary communication: interdisciplinary participation is desirable. In the future, attitudes about using AI may become one of the main principles of human society.

Keywords: Artificial Intelligence, Interdisciplinary Field, Biomedical Engineering and Students.

1. INTRODUCTION

The Artificial Intelligence (AI) research field is interdisciplinary. The following subjects have been studied in the field of biomedical engineering [1]. Can computers, memories, and communication systems serve as substitutes for human intelligence? Can we build an intelligent machine that mimics the human brain?

Computers have faster processing speeds, larger storage capacities, and faster communication speeds. Furthermore, networking has progressed. As a result, many achievements have been obtained in various fields. Many achievements have also been obtained in the field of biomedical engineering [2, 3]. The base sequence of human DNA, which was thought to take a long time to decipher due to the large amount of information, has been deciphered. Medical images, which were thought to be difficult due to their large amount of information, were digitized.

Network systems with AI are expected to be applied to dangerous work and long-term continuous work. A network system [4, 5] is also effective when contact between people is restricted [6, 7], such as in a pandemic. On the other hand, security issues are being discussed in information networks. In medical ethics, the treatment of individual genetic information is discussed. In medical care, personal data should be kept separate from the network [2].

How should we deal with AI in the future? In this research, based on students' understanding of the current situation, AI is considered in relation to biomedical engineering, which is one of the interdisciplinary fields.

2. METHODS

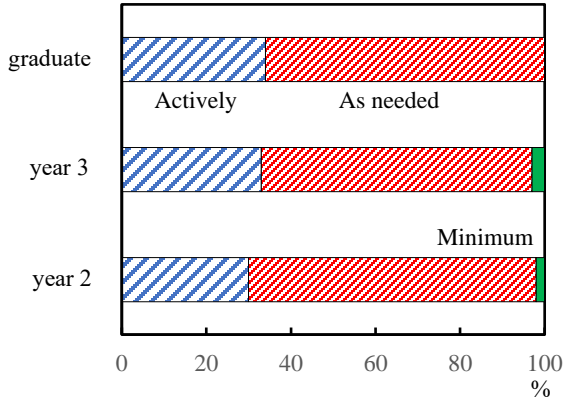Students' opinions were collected for the following questions.

1) Do you want to use AI (artificial intelligence)?
1-1) I want to actively use AI.
1-2) I want to use AI as needed.
1-3) I don't want to use AI as much as possible.
1-4) I do not use AI.

2) I think AI will help human society.
2-1) I think so.
2-2) I don't think so.

3) AI will take over human jobs.
3-1) I think so.
3-2) I don't think so.

4) Is the use of AI necessary for professionals?
4-1) Professionals don't need AI.
4-2) AI is essential for professionals.

5) Which do you prefer, AI answers or human (expert) answers?
5-1) Human (expert).
5-2) AI.

6) AI is abused and should be regulated.
6-1) Agree. It will get out of control.
6-2) Disagree. Difficult to regulate AI. The benefits of AI are greater.

7) AI (artificial intelligence) surpasses human intelligence.
7-1) I think so.
7-2) I don't think so.

8) Your opinion about AI.

The target students for the collection are as follows. 85 second-year students of the Department of Mechanical Engineering, 99 third-year students attending "Biomechanics", and 42 graduate students attending "Advanced Biomechanics". For reference, the opinions of two third-year biomedical engineering students at a Thai university were also collected.
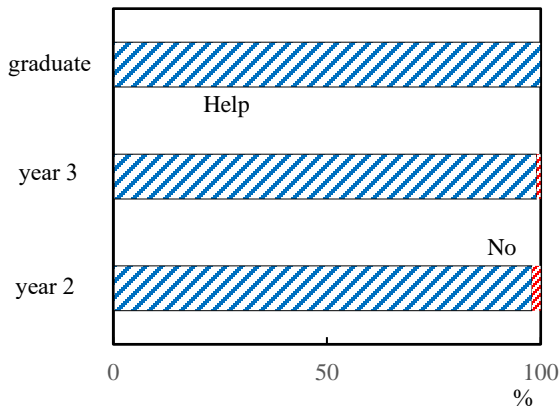
3. RESULTS

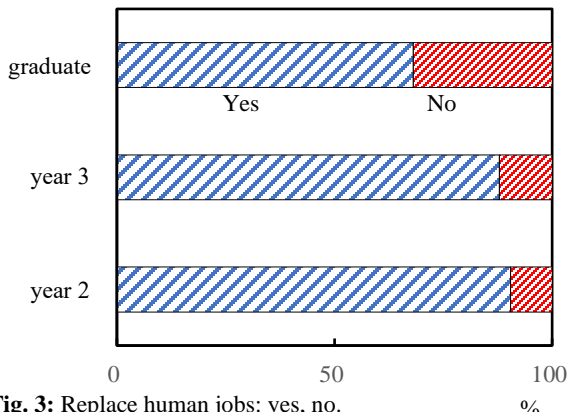Regarding from question 1 to 7, responses from students are as follows.

1) None of the students answered that they would not use AI (Fig. 1). A few students in the lower grades answered that they do not want to use AI as much as possible. About 30% of the students wanted to use AI actively. Most of the students, including Thai students, answered that they use AI when necessary.

2) Almost all students, including Thais, answered that AI would help humans (Fig. 2). Several students in the lower grades responded that AI would not help humans.

3) Many students said AI would take over human jobs (Fig. 3). About 30% of graduate students said AI would not replace human jobs. Opinions were divided among Thais. It was thought that there was an opinion that it differs depending on the content of the work.

4) Many students, including Thai students, answered that AI is necessary for professionals (Fig. 4). The percentage increases as the school year progresses. These answers make us expect advances in AI.

5) About 10% of the students answered that they preferred AI answers over human answers (Fig. 5). Many students, including Thais, said they preferred human answers over AI answers. Does it mean that AI has not yet advanced enough to give priority to AI answers? Is it asking the respondent to take responsibility?

6) In the lower grades, more students answered that the use of AI should be restricted (Fig. 6). However, the majority of graduate students expressed their expectations for the merits of using AI rather than restricting its use. Thais were divided.

7) More than 60% of students believe that AI will surpass human intelligence (Fig. 7). On the other hand, nearly 40% of graduate students, including Thais, believe that AI will not surpass human intelligence.

Regarding question 8, responses from students are categorized as follows in descending order of answers:

a) Concerns about AI:
a-1) Software management of AI:
a-1-1) Absence of responsibility, Liability when a car equipped with AI causes an accident.

Fig. 1: Use AI? Actively, As needed, Don't want to use AI as much as possible.

Fig. 2: Help human society: yes, no.
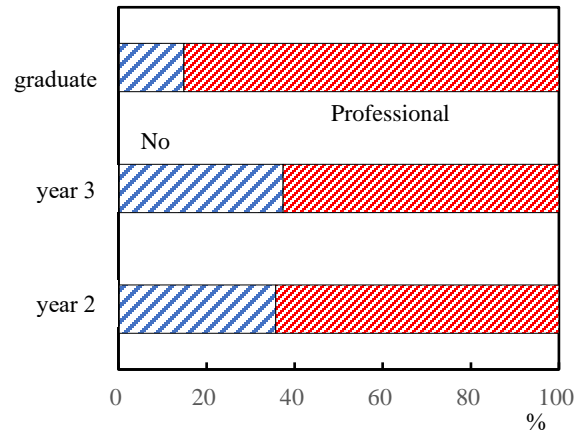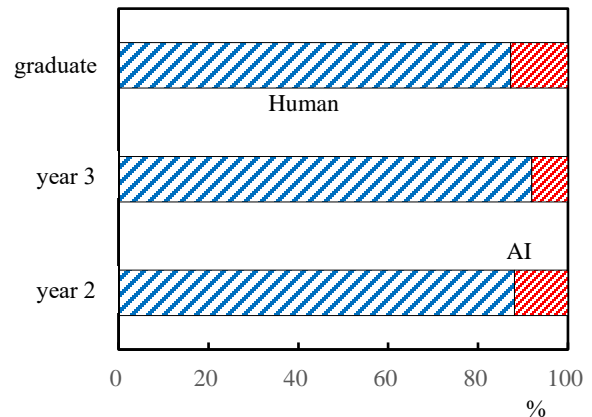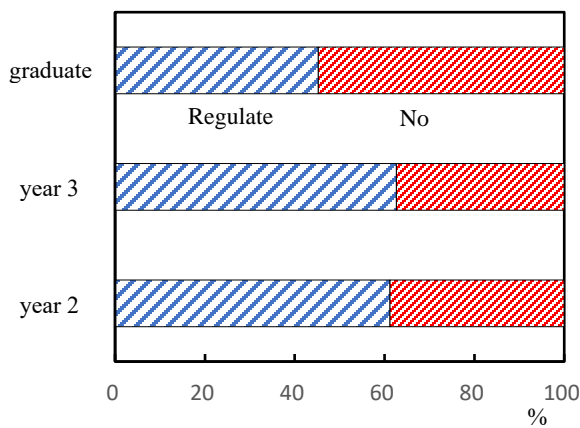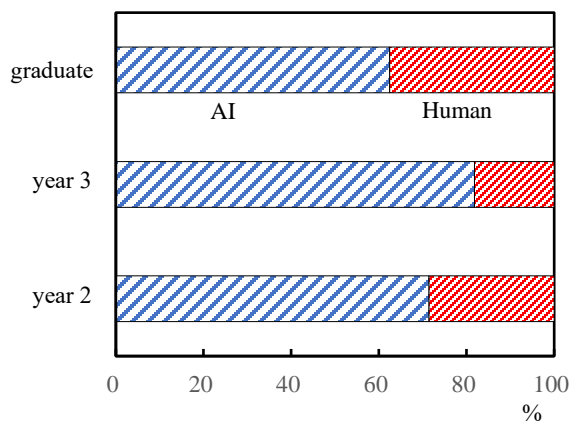

Fig. 3: Replace human jobs: yes, no.

Fig. 4: Necessary for professionals: no, yes.

Fig. 5: Prefer: expert, AI: graduate, year 3, year 2.

Fig. 6: AI should be regulated: yes, no: graduate, year 3, year 2.

Fig. 7: Surpasses human: yes, no: graduate, year 3, year 2.

a-1-2) Possibility of quoting incorrect answers, Unknown sources, Opaque process to results.
a-1-3) Responsibilities of AI users, Responsibilities of organizations using AI.
a-1-4) No copyright on the AI output text, Violation of copyright, Violation of image generation, Infringement of portrait rights.
a-1-5) Information security management is necessary for learning, analysis, and judgment based on a large amount of data.
a-1-6) Require a large amount of data, Infringe on personal privacy.
a-1-7) Leakage of personal information that AI collects and analyzes information entered by individuals and learns confidential information entered.
a-1-8) Diffusion of information of unknown truth, inheritance of past discriminatory data.
a-1-9) Generating harmful programming.
a-1-10) Hacking.

a-2) Effects on humans:
a-2-1) Reduce human ability.
a-2-2) Decrease in thinking ability, Deterioration in internet literacy ability, Deterioration in information gathering ability and logical thinking ability, Loss of judgment in sports coaches.
a-2-3) Teaching tasks lose their meaning.

a-2-4) Decrease in human contact, Increase in unemployment, Temporary job loss.
a-2-5) Answers given by AI are prioritized, obedience to AI, Eccentric ideas not adopted.
a-2-6) Leave everything to artificial intelligence?

a-3) Characteristics of AI:
a-3-1) Information exchange that is difficult for humans to understand, AI cannot be understood by humans.
a-3-2) Ethics? Lack of humanity, AI-dependent judgment criteria,
a-3-3) Biased training data, Response to symptoms with little data, Misdiagnosis?

a-4) AI hardware management:
a-4-1) Initial/operating cost.
a-4-2) Technical trouble.
a-4-3) Maintenance

b) Advantages of AI:
b-1) Characteristics of AI:
b-1-1) Resistant to repetitive work.
b-1-2) Faithful answers based on data, No subjectivity in judgment (fairness).
b-1-3) Checks that do not overlook even the slightest abnormality (medical diagnosis).
b-1-4) No knowledge limitation.
b-1-5) Fast processing, Better performance.

b-2) Individual support:
b-2-1) Self-service, providing deeper information to fans.
b-2-2) Self-health management, Injury prevention.
b-2-3) Useful as a training machine (tutor, private lessons).
b-2-4) No need for classrooms.

b-3) Complementary human society:
b-3-1) Reduction of labor costs and elimination of labor shortage.
b-3-2) Compensation for doctor shortage.
b-3-3) Increase in occupations to support AI technology.

b-4) Specialty of AI:
b-4-1) Simulation.
b-4-2) Presentation of rough contents.
b-4-3) Multiple parallel answers.

c) Dealing with AI:
c-1) Usage rules:
c-1-1) Advance prediction of problems.
c-1-2) Development of international guidelines and norms.
c-1-3) Proper use.
c-1-4) Clarification of the use of AI, clarification of how to use AI.
c-1-5) Is it possible to clarify the source of AI citations?
c-1-6) Software to determine whether text is output from AI.
c-1-7) Presentation by yourself is required (no use of avatars and automated voices?).
c-1-8) User monitoring of the system.
c-1-9) Evaluate for Prejudice.
c-1-10) Overwriting of information should be used only by experts

c-2) Prediction of usage limit of AI:
c-2-1) Creativity, Flexibility, Ethical Judgment, Emotional Understanding.
c-2-2) Human roles shift to more creative aspects.
c-2-3) Collaboration of novelty, intuition and data.

c-2-4) Are robots and AI not enough for nurses and caregivers?

c-3) AI management:
c-3-1) Anonymization of medical data, Free handling of big data in the medical field.
c-3-2) Security.
c-3-3) Protect against cyber attacks.
c-3-4) Set usage restrictions at the root of AI programs.

c-4) Introduction of AI:
c-4-1) Universalization and support for people with disabilities.

d) Sample response from AI as of July 31, 2023:
"It is not a desirable situation for mankind to believe the words of an AI like me without question. While AI has advanced information processing capabilities, it does not have emotions or moral judgment. It is dangerous to believe blindly in opinions."

The responses received from the students are summarized below.

I want to use AI. AI requires expert involvement. Human answers are preferred over AI answers. Use of AI should be restricted. AI surpasses human intelligence.

Concern: AI will take over human jobs? Responsibility for AI responses? Information security? AI degenerate human capabilities? Information ethics? Technical trouble?

Advantages: Personalized support for humans. An answer based on a lot of data. Complementary to human society.

4. DISCUSSION

In the network society, the speed of information diffusion is increasing [8]. In order to predict the impact of technology on society, a multifaceted view is essential [9]. In network systems, it is difficult to completely erase or reset information. AI continues learning (Fig. 8). AI is good at majority voting based on data accumulation beyond time and space. On the other hand, there is a danger that minority opinions will be buried. Non-experts run the risk of judging things based only on the results of majority votes. AI is a whole, and it is difficult to pursue individual responsibility for AI itself. Rather than relying on AI to make decisions, it makes more sense to use it to present options and retrieve data. In order to give priority to more appropriate information, it is necessary to constantly add and overwrite appropriate information (Fig. 9). Experts should take the initiative and get involved in AI. AI is expected to be used as a means of interdisciplinary communication. Communication cannot be carried out smoothly only by listing information. Participation of interdisciplinarian is desirable [10].

It is not easy to restrict the use of technology that has already been developed. Even if restrictions are placed on the use of AI, there is a risk that the restrictions will be violated behind the scenes. We have no choice but to actively use AI and pursue better ways to use AI. It is desirable to actively introduce AI in the field of education as well. Communication between AI and humans is the key. In order to understand the answers of AI, it is important to handle not only the answers from AI to humans, but also the questions from humans to AI as a set. Students should cite answers from AI, including questions to AI (Fig. 10). In the future, attitudes regarding the use of AI may become one of the major doctrines in human society (Fig. 11).
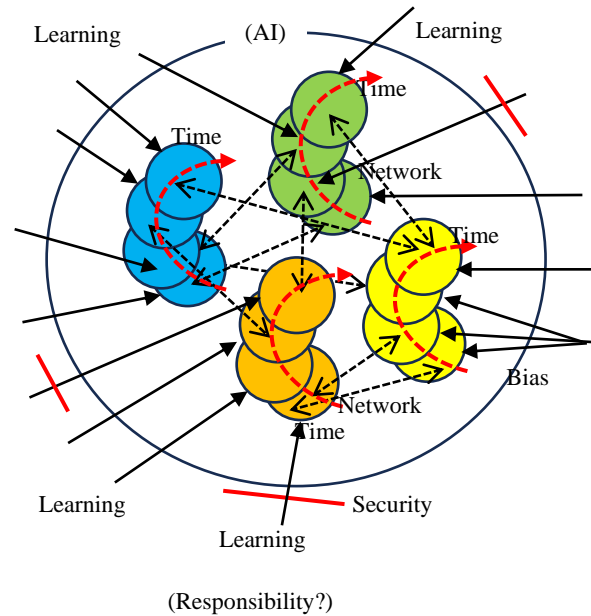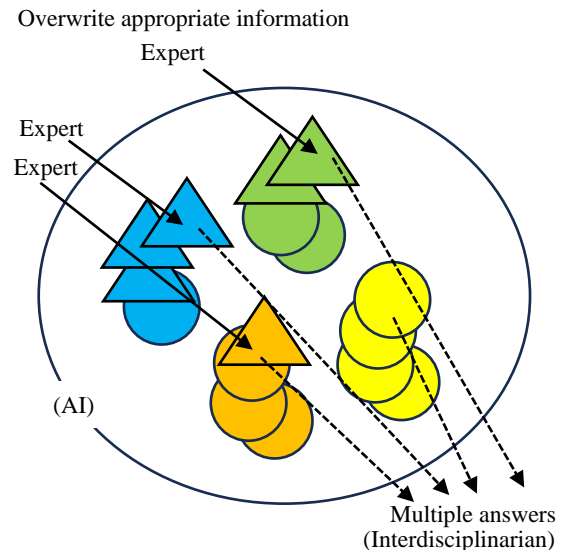

Fig. 8: AI continues learning.

Fig. 9: Overwriting appropriate information; participation of interdisciplinarian is desirable.
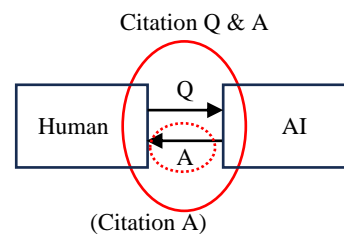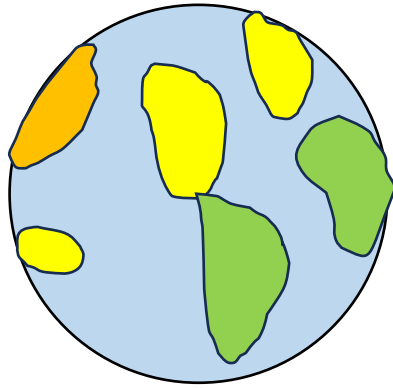

Fig. 10: Students should cite answers from AI, including questions to AI.

Attitudes to use AI

Major doctrines

Fig. 11: Attitudes regarding the use of AI may become one of the major doctrines in human society.

5. CONCLUSION

In this research, based on students' understanding of the current situation, AI is considered in relation to biomedical engineering, which is one of the interdisciplinary fields. Students expected the effectiveness of AI for society while having ethical and security concerns. In order to give priority to more appropriate information, it is necessary to constantly add and overwrite appropriate information. Experts should take the lead in AI. AI is expected to be used as a means of interdisciplinary communication. Interdisciplinarian participation is desirable. In the future, attitudes about using AI may become one of the main principles of human society.

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