

Progress report 2022

Artificial Intelligence in Healthcare

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Course Outline

- To maintain and further develop the quality of a society with a declining birthrate and an aging and shrinking population, we believe that rational and efficient social management using data based on Information and Communication Technology (ICT) and Artificial Intelligence (AI) technologies is necessary. This course aims to develop ICT/AI technology as a foundation for new medical services in collaboration with the Department of Planning and Information Management, University of Tokyo Hospital. In addition, we aim to create a support base for young researchers working in this field, and to contribute to medical advances by promoting joint research that transcends departmental and university boundaries.

Research Activities

Development of technology for extracting information from medical records

- If information such as disease names, symptoms, and diagnoses can be extracted from the text of electronic medical records and transformed into structured data, then such data could be statistically analyzed. We have developed a text corpus of case reports consisting of approximately 350 cases of rare and intractable diseases with detailed annotation information, and have been developing high-performance machine learning models to extract information from medical texts. We have also made our corpus available to researchers after obtaining copyright permission for reproduction of the texts.

Research using information extracted from text

- With the support of JST, we are developing a platform for discovering drugs with new efficacy

by applying the above-mentioned technology to natural language processing and statistical analysis of massive medical records. We are also applying this platform to the field of cancer therapy, aiming to discover drugs with new efficacy.

Development of an interactive system for guidance on medication administration

- It may be possible to reduce the burden on medical staff and capture changes in patients that medical staff may have observed, by interviewing patients in advance. We are conducting joint research with companies to develop a text-based dialogue system that allows the user to dig deeper or change the topic depending on the other person's response, rather than inputting standardized information in a questionnaire.

Educational Activities

- In addition to overseeing research advising for doctoral students in the Department of Social Medicine, Graduate School of Medicine, we conducted lectures on machine learning and natural language processing regarding medical imagery, as part of "AI and Medicine" lectures in the fourth-year medical school (M2) and professional master's program in the School of Public Health (SPH), Medical RWD Human Resource Development Project for working adults (University of Tokyo), and Medical Education Project to foster the interface between AI technology and rheumatology (Japan College of Rheumatology). Additionally, we have served as instructors in the Healthcare Executive Program (University of Tokyo), and we have contributed to the training of management executives for hospitals with high public presence, including university hospitals.

Future Outlook

- Research activities include the development of corpora for natural language processing as a fundamental technology and machine learning methods to utilize them, as well as developing technologies to utilize medical data. We also aim to develop more intelligent dialogue systems based on language comprehension. As an educational activity, we aim to broaden our human resource base through lectures on more general artificial intelligence techniques for entry-level medical professionals.

Journal Publication

1. Kage H, Shinozaki-Ushiku A, Ishigaki K, Sato Y, Tanabe M, Tanaka S, Tanikawa M, Watanabe K, Kato S, Akagi K, Uchino K, Mitani K, Takahashi S, Miura Y, Ikeda S, Kojima Y, Watanabe K, Mochizuki H, Yamaguchi H, Kawazoe Y, Kashiwabara K, Kohsaka S, Tatsuno K, Ushiku T, Ohe K, Yatomi Y, Seto Y, Aburatani H, Mano H, Miyagawa K, Oda K. Clinical utility of Todai OncoPanel in the setting of approved comprehensive cancer genomic profiling tests in Japan. *Cancer Sci.* 2023 Jan 5. doi: 10.1111/cas.15717.
2. Kawazoe Y, Shimamoto K, Yamaguchi R, Nakamura I, Yoneda K, Shinohara E, Shintani-Domoto Y, Ushiku T, Tsukamoto T, Ohe K. Computational Pipeline for Glomerular Segmentation and Association of the Quantified Regions with Prognosis of Kidney Function in IgA Nephropathy. *Diagnostics.* 2022; 12(12):2955.
3. Emiko Shinohara, Daisaku Shibata, Yoshimasa Kawazoe. Development of comprehensive annotation criteria for patients' states from clinical texts. *J Biomed Inform.* 2022 Oct;134:104200.
4. Kawazoe Y, Shimamoto K, Shibata D, Shinohara E, Kawaguchi H, Yamamoto T. Impact of a Clinical Text-Based Fall Prediction Model on Preventing Extended Hospital Stays for Elderly Inpatients: Model Development and Performance Evaluation. *JMIR Med Inform* 2022;10(7):e37913
5. Hayakawa J, Seki T, Kawazoe Y, Ohe K. Pathway importance by graph convolutional network

and Shapley additive explanations in gene expression phenotype of diffuse large B-cell lymphoma. *PLoS One.* 2022 Jun 24;17(6):e0269570.

6. Ryota Nishimura, Mai Miyabe Hirabayashi, Takashi Yoshino : Baseless-Rumor Alert Bot to Promote Reliability of Information, the *IPJSJ Journal*, Vol.30, No.1, pp.2-14 (2022).

Social activities

- We participated in the HL7-FHIR (Fast Healthcare Interoperability Resources) Implementation Study Working Group, which was established under the Next Generation Healthcare Recording System Common Platform Study Group of the Japan Association for Medical Information, and we proceeded with the implementation of HL7-FHIR in Japan.
- As a part of the Working Group for Core Center for Cancer Genome Medicine of the Ministry of Health, Labor and Welfare, we were in charge of infrastructural development for implementing genomic medicine for cancer at the University of Tokyo Hospital.
- As a part of the Working Group for the ICD10-compliant Standard Disease Name Master Review Committee, we developed the standard disease name master.