https://datathon-japan.jp/2023/

3rd Big Data Machine Learning in Healthcare in Japan@TMDU (Datathon-Japan 2023)

PROGRAM

September 1-3, 2023／Tokyo Medical and Dental University (TMDU)

Co-organized by : MIT Critical Data / NUS / JSICM / ICON / Datathon-Japan

Chair-in-chief : Satoru Hashimoto

Non Profit Organization, ICU Collaboration Network (ICON)

東京医科歯科大学

MIT Critical Data

NUS National University of Singapore | Saw Swee Hock School of Public Health

JSICM

ICON

3RD BIG DATA MACHINE LEARNING IN HEALTHCARE IN JAPAN@TMDU <Datathon-Japan 2023>

September 1-3, 2023

M&D Tower 26F, Tokyo Medial and Dental University (TMDU), Japan

Satoru Hashimoto, Representative Organizer

CONTENTS

ご挨拶　WELCOME MESSAGE

皆様、いかがお過ごしでしょうか？
このたび 3rd Big Data Machine Learning in Healthcare in Japan（Datathon-Japan 2023）を、東京医科歯科大学において、2023 年９月１日（金）～３日（日）の日程で開催する運びとなりました。２日間の日程にて開催した第１回、日本で初めての本格的な開催となった第２回（4 日間) を受け、さらにコロナ禍による３年間のブランクを経ての、３度目の開催となります。
Datathon は、医療で蓄積されたビッグデータを他分野のエキスパートが協力して解析し、得られた統計学的知見を最大限に活用し EBM の構築に寄与することを目的としています。近年この啓発的な試みは、世界各地において頻回に開催され、大きな評価と成果を挙げています。その必要性は議論の余地のないところではありますが、COVID-19 感染症という希代の危機を経験し、日本でも改めて認識されました。統計学的概念の医学・医療への導入という目的に賛同する医師、看護師をはじめとする医療関係者、AI や機械学習にたけたデータサイエンティスト、大学企業で活躍されている統計学者、研究者の方々など、熱意ある多職種の参加そして交流が期待される意義深い研修会です。現在、過去２度の開催にて得られたノウハウと反省をもとに、多方面からのご意見を参考にして、参加者にとってより魅力的なプログラムになるよう、鋭意企画を進めているところでございます。
ぜひ皆様、9 月の東京の地にご参集ください。

Hi, everyone!
We are pleased to announce that the 3rd Big Data Machine Learning in Healthcare in Japan (Datathon-Japan 2023) will be held at Tokyo Medical and Dental University from September 1 (Friday) to 3 (Sunday), 2023. Following the first 2-day event and the second 4-day event which was the first full-scale event of its kind in Japan, after the three-year blank due to the COVID-19 disaster, the 3-day Datathon 2023 will be held for the third time in Tokyo.
Datathon aims to contribute to the construction of EBM by maximizing the statistical findings obtained through the analysis of big data accumulated in the medical field in cooperation with experts from other fields. In recent years, this enlightening experiment has been held frequently in various parts of the world, and has achieved great recognition and success. Although the necessity of this initiative is indisputable, it has been reaffirmed in Japan after the rare crisis of COVID-19 infection. This is a meaningful workshop that is expected to attract the participation and exchange of many enthusiastic professionals, including doctors, nurses, and other medical professionals who agree with the goal of introducing statistical concepts into medicine and healthcare, together with data scientists with expertise in AI and machine learning, statisticians and researchers who are active in university companies, and others. We are now in the process of planning the program to make it more attractive to participants, based on the know-how and experiences we have gained from the past two training sessions, and by taking into account the opinions from various fields.
We look forward to seeing you in Tokyo in next September.

Satoru Hashimoto, MD
Representative Director

FACULTY MEMBERS & FACILITATORS (*Alphabetical order*)

Aoki, Tomonoshin, MD MPH, currently holds the position of Deputy Director in the Health Science Department of the Ministry of Health, Labour, and Welfare (MHLW) in Japan. He is also engaged in the Japanese Government Long-Term Fellowship Program. Having recently graduated from Harvard School of Public Health this past May, he spent the summer as a visiting scholar at MIT. In the fall, he will embark on the System Design and Management Program at MIT, a multidisciplinary course that integrates technology and management for innovation.

Throughout his tenure at MHLW, he significantly influenced health insurance reform in the fiscal year Reiwa 4 (2022 in the Gregorian calendar). His efforts centered around telemedicine, physician workstyle reform, psychiatric medicine, and infertility treatment. Additionally, he played a crucial role in the first phase of Japan's response to the COVID-19 pandemic.

While studying at the Harvard School of Public Health and MIT, he delved into the intersections of policy, digital transformation, and disruptive technologies such as CRISPR. His interest focuses on understanding how these elements interact and finding ways to leverage them for the benefit of individuals and society as a whole.

Bhattacharyya, Anirban is an Intensivist at Mayo Clinic in Jacksonville, where he also serves as Vice Chair of Research and leads the acute care research consortium - the department's research wing. Alongside his medical practice, he brings a master's degree in informatics, reflecting a firm understanding of the interface between technology and medicine. Anirban has a special interest in the potential uses of Artificial Intelligence in ICU practices. He views datathons as fertile grounds for these kinds of innovations, providing the perfect environment to blend data science and critical care for the enhancement of medical practice.

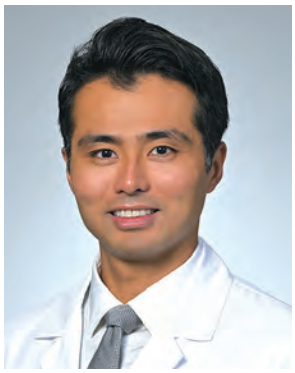
Carrel, Adrien is a master’s student in Advanced Computing at Imperial College London. He received his MEng in Applied Mathematics and Computer Science at CentraleSupélec, Paris, and a BSc in Applied Mathematics at UVSQ while studying in “Classes Préparatoires” at Lycée Hoche, Versailles, in France. Adrien’s research interests include the application of novel mathematics concepts to machine learning and the use of artificial intelligence in critical domains such as healthcare.

Carter, Rickey, PhD is Professor of Biostatistics at Mayo Clinic in Florida. He received his training in biostatistics at the Medical University of South Carolina and has over 20 years of experience with study design and analysis for clinical and translational research. Administratively, he serves as a Vice Chair for the Department of the Quantitative Health Sciences and as the Scientific Director for the Digital Innovation Lab, a machine learning shared resource on Mayo's Florida campus. Dr. Carter has research interests that span clinical trial optimization to the development of digital biomarkers using machine learning techniques. He is an active collaborator and has over 375 peer reviewed publications.

Celi, Leo Anthony has practiced medicine in three continents, giving him broad perspectives in healthcare delivery. He holds a faculty position at Harvard Medical School as an intensive care specialist at the Beth Israel Deaconess Medical Center and is the clinical research director for the Laboratory of Computational Physiology (LCP) at MIT. He also founded and co-directs Sana, a cross-disciplinary organization based at the Institute for Medical Engineering and Science at MIT, whose objective is to leverage information technology to improve health outcomes in low- and middle-income countries.

Ebner, Dan is a Holman research track radiation oncology resident at the Mayo Clinic, with former work at Brown and Harvard Universities within the management and policy surrounding the ethical deployment of artificial intelligence in clinical care. He has previously worked as an independent consultant for the Japanese government, as well as performed translational, clinical, and public health research with teams at Kyoto University, the University of Tokyo, and most recently the National Institutes of Quantum Science and Technology in Japan.

Feng, Mornin is currently a faculty member at Saw Swee Hock School of Public Health and also the Assistant Director of Research at Institute for Data Science at NUS. He is also the Senior Assistant Director of National University Hospital, championing the big data analytics and healthcare AI initiatives. His research is to develop machine learning algorithms to extract actionable knowledge from large amount of data to enable better quality of healthcare. His research brings together concepts and tools across deep learning, optimization, signal processing, statistical causal inference and big data management. Dr. Feng's work was recognized by both well-established journals, such as Science Translational Medicine, JAMA and top international conferences, such as KDD, AAAI and AMIA.



Hashimoto, Daniel, MD MSTR is assistant professor of surgery at the University of Pennsylvania Perelman School of Medicine and secondary faculty in the School of Engineering and Applied Science General Robotics, Automation, Sensing, and Perception Laboratory. He is the director of the Penn Computer Assisted Surgery and Outcomes (PCASO) Laboratory. His work focuses on the development of computer vision algorithms for the analysis of operative video for surgical guidance and feedback.

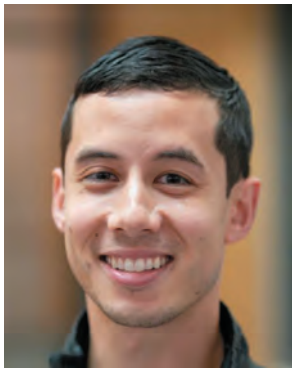
Hashimoto, Satoru is the president of the ICU Collaboration Network (ICON), a non-profit organization established with a mission to advance all aspects of information and communication technology in intensive care medicine.

He has been an intensivist for most of his nearly 40-year career in the hospital of Kyoto Prefectural University of Medicine. He has organized the JIPAD (Japanese Intensive Care Patients Database) project of the Japanese Society of Intensive Care Medicine and the CRoss Icu Searchable Information System (CRISIS), a registry of critically ill patients with the COVID-19 disaster. JIPAD and CRISIS play a central role in the development of databases in intensive care medicine.

Huang, Ling (https://www.researchgate.net/profile/Ling-Huang-50) is currently a Research Fellow at Saw Swee Hock School of Public Health, NUS. Her research is to develop trustworthy AI models for medical data management and analysis and provide actionable suggestions to improve healthcare quality. In particular, she has been publishing on uncertainty quantification, multi-modality information fusion, and trustworthy deep medical data analysis models on well-established journals, such as Information Fusion and International Journal of Approximate Reasoning. Dr. Huang also works closely with high-impact researchers and clinicians in France, China, USA and Austria.

Ichihara, Naoaki (Nao) is an Assistant Professor at Department of Healthcare Quality Assessment, University of Tokyo (UT). He practiced as an invasive/non-invasive cardiologist at Kameda Medical Center and Yokohama City University (YCU) Hospital. Received Ph.D. at YCU Graduate School of Medicine and Master of Public Health (MPH) at Harvard T. H. Chan School of Public Health. Worked for Harvard University Health Services as a Data Analysist/Project Manager. Participated in development of a smartphone app for engaging patients to improve safety of care at Brigham and Women's Hospital. Worked for OpenClinica, LLC., a company that produces an open-source software for clinical trials, as a Senior Business Analyst. At UT, he is involved in statistical analysis for clinical research, health services research, management of clinical registries, development of software tools for analysis, along with education of students. Serves as an external consultant on development and analysis of JIPAD. Also serves as an external consultant on health IT planning at YCU Medical Center.

Itatani, Keiichi is a cardiac surgeon, and a researcher of fluid dynamics. After graduating from medical school and postgraduate course in the University of Tokyo, he is now an attending surgeon in Nagoya City University, performing both congenital and adult cardiac surgery, but his main specialty is adult congenital heart surgery, reoperations after congenital heart repair, where shortage of evidences and experiences are critical due to complex anatomy, hemodynamics and cardiac function. As a researcher of fluid dynamics, he has invented blood flow imaging tools including 4D flow MRI, echocardiography VFM, and developed cardiovascular CFD model for physiological flow and for surgical planning. founded a company named Cardio Flow Design Inc. for software and services of blood flow imaging in 2016, and his adult congenital heart surgery patients routinely undergo novel imaging diagnosis for successful reoperation. He is now investigating the role of heart vortex with mathematical approach with topology, which is a novel challenge to data science.



Kimes, Patrick is currently a statistician at Genentech/Roche where he supports the development of early phase oncology assets and personalized healthcare (PHC) solutions across the heme/onc portfolio. Prior to Genentech, Patrick was a postdoctoral fellow in the Department of Data Sciences at the Dana-Farber Cancer Institute and Harvard TH Chan School of Public Health. He completed his PhD in statistics at the University of North Carolina in 2015, specializing in statistical methods for high-throughput genomics experiments.

Kimura, Hitomi, MD, graduated from University of Tsukuba in 2018. She specializes in nephrology at the Tokyo Metropolitan Doctors Academy, actively engaging in epidemiological and healthcare policy research on Non-Communicable Diseases (NCDs) in Japan and the Asian region at University of Tsukuba Graduate School and Institute for Global Health Policy Research at the National Center for Global Health and Medicine. She received the TGSW Best Research Award in 2017 and earned the Excellent Resident Award from the Tokyo Metropolitan Doctors Academy in 2022.

Kinoshita, Takahiro, physician-scientist, Philips Research North America, is an emergency physician and AI researcher. He holds an MD degree from Osaka University and an MPH from Harvard. Dr. Kinoshita specializes in two key areas: conducting causal inference using real-world data and developing machine learning-based clinical decision support tools. He has been working on machine learning applications for advanced hemodynamic monitoring in the ICU. Additionally, he has delved into the field of causal inference of health technology.

Mae, Kazuki is the president of Japan Management Systems Inc., which provides IT consulting for small and medium enterprises. He is also a board member of AI Business Creation Association and is the chief secretary of Japanese Society for Sarcopenia, Cachexia, and Wasting Disorders.

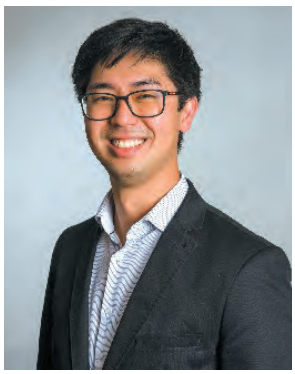
He himself is an IT consultant familiar with wide range of information technologies like IT strategy, information security, software development, and machine learning. He obtained Ph.D. in the University of Tokyo majoring in materials science, and researched computer simulations in materials science as a postdoc in Catholic University Leuven in Belgium and as a research associate in Japan Advanced Institute of Science and Technology using molecular dynamics, Monte-Carlo simulations, and the first-principles calculations. He took the current positions after experienced developing director and CTO in IT companies including public-listed one.

Matos, João is a biomedical engineer and data scientist part of the MIT Critical Data group. João received his MSc from University of Porto, after doing research in Portugal, Belgium, Japan, and Boston. João's research interests include health equity, data-centric machine learning, and data engineering.

Menser, Terri, PhD is a health services researcher with broad ranging research interests that include patient engagement, assessing health disparities and intervening to increase equity and access. Much of her research focuses on system improvement and implementation evaluation efforts to decrease care fragmentation and positively impact patient health outcomes and care team workload. She is currently serving as the Internal Communications Director for the Justice, Equity, Diversity, and Inclusion Special Interest Group with ACTS and is also the Treasurer for the Healthcare Management Division of Academy of Management. She was trained at Texas A&M, completed a postdoc at the Ohio State University, and conducted research at Houston Methodist hospital prior to joining the Kern Center at Mayo Clinic in August 2022.

Minegishi, Yu is an experienced healthcare systems engineer and programmer, with a focus on developing healthcare systems such as electronic medical records and medical administration systems. His specialty lies in the pharmacy and nursing sectors. A stint at a BI tool vendor ignited his interest in promoting data usage in healthcare, leading him to establish the "JDMC Engineers Group" for training data engineers under the Japan Data Management Consortium. As a senior medical information technologist, Yu provides consultancy to medical institutions and healthcare system vendors.

From 2023, Yu accepted a special associate professorship in the Innovation Talent Development Division at Tokyo Medical and Dental University, where he is tasked with fostering data utilization in hospitals. He's proficient in programming languages like Java, C#, JavaScript, and Python, and has expertise in databases, SaaS, and R. His credentials include Senior Medical Information Technologist, Project Manager, IT Strategist, and Level 2 Bookkeeping.



Nakayama, Luis is a retina specialist ophthalmologist and a Ph.D. student at Sao Paulo Federal University. Luis created the Brazilian Multilabel Ophthalmological Dataset, a database of retina fundus photos containing multiple ocular diseases. His research interests include explainability and bias reduction in algorithms, as well as artificial intelligence applications in ophthalmology.

Namba, Toshifumi, MD, is currently a senior data analyst at Cancerscan Inc. He graduated from Chiba University School of Medicine in 2017 and completed his residency program at St. Luke's International Hospital in Tokyo. He is a board-certified surgeon specializing in breast surgical oncology. His interests include preventive medicine, such as cancer screening programs, big data analysis, and machine learning.

Restrepo, Braiam Escobar is a biomedical engineer, data scientist, and an international member of the MIT Critical Data Group led by the Laboratory of Computational Physiology (LCP) at MIT since 2014. Previously, Braiam served as the Director of the Center of Innovation and Digital Transformation at CES University in Colombia and conducted research on continuous non-invasive blood pressure estimation at the RCBE in City University of London. With several of experience as an educator, he has taught computer science and programming courses to engineering and health-related sciences students. Currently, he is involved with a leading AI company, where he is enhancing language processing models to redefine human-machine conversations.

Setoguchi, Soko is a physician scientist, serving as a Professor of Medicine and Epidemiology at Rutgers University. She has extensive experience in healthcare research, focusing on health services and comparative effectiveness. Dr. Setoguchi's expertise also encompasses climate-related health studies, utilizing large databases to examine healthcare outcomes. In addition to her research contributions, she is actively involved in mentoring and education, overseeing the Master of Science in Clinical and Translational Science program at Rutgers and spearheading the Clinician Researcher Track in the Medicine Residency program at Robert Wood Johnson Medical School.

Shimizu, Sayuri is an Associate Professor in the Department of Health Data Science at the Graduate School of Data Science, Yokohama City University, where she teaches courses on real-world data studies and machine learning in healthcare. Her research focuses on health services research and policy using large-scale healthcare administrative data. Previously, she worked as a senior researcher at the Institute for Health Economics and Policy. She is a member of the Ministry of Health, Labour and Welfare's Study Group on a New Regional Medical care Vision and is a specialist for the Promotion of Health Data Utilization in Yokohama City.

Tagawa, Koshiro is a skilled biostatistician who graduated from the University of Tokyo with a degree in Biostatistics and Bioinformatics. Currently, he contributes his expertise at the Center for Clinical and Translational Research of Kyushu University Hospital. He primarily focuses on supporting investigator-initiated clinical trials and statistical consulting including basic and observational research. This involves tasks such as estimating sample sizes, designing comprehensive plans, and conducting thorough statistical analyses.

Tohyama, Takeshi is an assistant professor at the Center for Advanced Medical Open Innovation at Kyushu University. He specializes in cardiology and data science. After graduating from Kyushu University Graduate School of Medical Sciences, he honed his skills in statistics, machine learning, and deep learning at the Center for Clinical and Translational Research of Kyushu University Hospital. There, he assists numerous researchers and conducts his own research in machine learning and deep learning. He is also responsible for managing and analyzing large heart failure registries and is proficient in handling large datasets such as DPC.

Tsuji, Shingo, Ph.D. has got a lot of experience in the wide range of data science fields including bioinformatics, energy data analysis and education. He loves Python and publishes many books so far, and he is interested in applied data science which is a cross disciplinary domain to apply the basic data science skills to various practical issues. Project associate professor at the University of Tokyo, Japan.

Uchimido, Ryo, Assistant Professor in the Intensive Care Medicine, Department at Tokyo Medical and Dental University Hospital, earned his M.D. from Toyama University and his MPH from Harvard T.H. Chan School of Public Health after certification in emergency medicine at Tokyo Bay Medical Center. His current research focuses on transcriptomics and metabolomics in sepsis, aiming to identify treatment biomarkers and speed up sepsis drug discovery, with the goal of enhancing survival rates and patient outcomes.

TMDU Facilitators

Hase, Takeshi
@Institute of Education Innovative Human Resource Development Division
長谷　武志（統合教育機構イノベーション人材育成部門）

Iida, Yoritsugu
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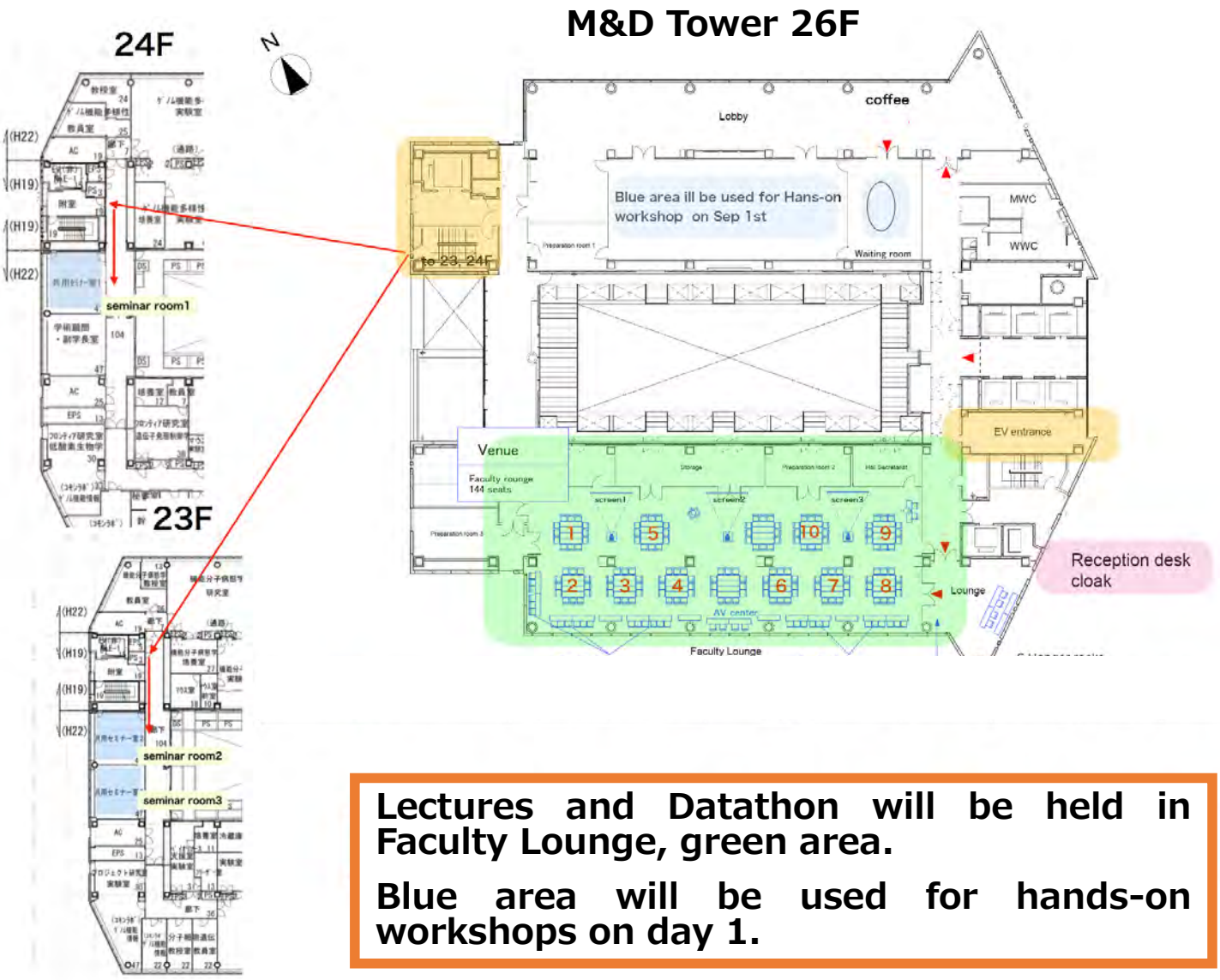
Yamada, Tomoaki
@Department of Medical Informatics
山田　知明（医療情報部）

FLOOR MAP



Lectures and Datathon will be held in Faculty Lounge, green area.

Blue area will be used for hands-on workshops on day 1.

Program-at-a-Glance

September 1st/Day 1

9:00- **Welcome messages**
Hashimoto, Satoru / Tojo, Arinobu

9:10-9:30 **Lecture 1** Celi, Leo Anthony
Building capacity in artificial intelligence through Datathons

9:35-9:55 **Lecture 2** Feng, Mornin
Demystifying complex treatment recommendations:
A hierarchical cooperative multi-agent reinforcement learning approach

10:00-10:20 **Lecture 3** Hashimoto, Daniel A.
Opportunities and pitfalls of AI in surgery

10:25-10:45 **Lecture 4** Nakayama, Luis
Artificial intelligence in ophthalmology:
The landscape and challenges for deployment

10:45-11:05 **Break & Beginners' guide**

11:05-11:25 **Lecture 5** Menser, Terri
Ethical and logistical considerations of artificial intelligence implementation in health care settings

11:30-11:50 **Lecture 6** Kimura, Hitomi
Exploring the self-learning journey for beginner healthcare practitioners: Strategies for data driven insights

12:00-12:50 **Lunchtime lecture 1**
Itatani, Keiichi
Revolutions in medical imaging data handling from the cardiovascular surgery

13:00-13:10 **All about hands-on workshops**

13:20-15:20 **Hands-on workshops Part 1**
WS01
Topological deep Learning: l A new direction for artificial intelligence with healthcare applications
WS02
The potentials of generative AI in healthcare
WS03
Healthcare digital transformation (DX): International comparative analysis of health systems and cases, accompanied by hands-on research demonstrations <Japanese session>
WS04
What do you mean by "adjusting for" confounders? <Japanese session>
WS05
Learning Python with hands-on experience <Japanese session>
WS06
Analyzing administrative data (DPC data) of acute care hospitals in Japan <Japanese session>

15:30-17:30 **Hands-on workshops Part 2**
WS07
Trust deep learning model in healthcare:
From accuracy to reliability
WS08
AI for real world clinical applications:
Considerations and pitfalls
WS09
Ask anything about practical data Science
--- Know your present situation, set your own goal, clarify the process --- <Japanese session>
WS10
Data analysis using propensity score matching <Japanese session>
WS11
ICU outcome assessment using matching methods <Japanese session>

September 2nd/Day 2

9:00-12:00
Critical data workshops and Datathon 2023

12:00-13:00 **Lunchtime lecture 2**
Shimizu, Sayuri
Routinely collected health data in Japan:
Characteristics and data availability

13:00-17:30
Critical data workshops and Datathon 2023

September 3rd/Day 3

9:00-12:00
Critical data workshops and Datathon 2023

Critical data workshop 0: Preparatory materials
Critical data workshop 1: EDA & study design
Critical data workshop 2: Clinical variables selection & feature engineering
Critical data workshop 3: Let's get our model!
Critical data workshop 4: Try to tackle the biases and re-model

12:00-13:00 **Lunch**

13:00-14:30
Last spurt of the critical data workshops and Datathon 2023

15:00-16:30 **Presentation by each team**

16:30-17:30 **Awarding & wrap up**

17:30- **Commemoratve photo taking**

Program

September 1st/Day 1

9:00 Welcome messages

Hashimoto, Satoru *Representative Organizer*
Tojo, Arinobu *Vice President of the TMDU*

9:10 – 13:00 Lectures

9:10 – 9:30/Lecture 1
Celi, Leo Anthony *Division of Pulmonary, Critical Care and Sleep Medicine, Beth Israel Deaconess Medical Center, MIT Critical Care*
- Building capacity in artificial intelligence through Datathons

9:35 – 9:55/Lecture 2
Feng, Mornin *Saw Swee Hock School of Public Health, Institute for Data Science at NUS*
- Demystifying complex treatment recommendations: A hierarchical cooperative multi-agent reinforcement learning approach

10:00 – 10:20/Lecture 3
Hashimoto, Daniel A. *University of Pennsylvania Perelman School of Medicine, School of Engineering and Applied Science General Robotics, Automation, Sensing, and Perception Laboratory*
- Opportunities and pitfalls of AI in surgery

10:25 – 10:45/Lecture 4
Nakayama, Luis *Sao Paulo Federal University*
- Artificial intelligence in ophthalmology: The landscape and challenges for deployment

10:45 – 11:05/Break & Beginners' guide

11:05 – 11:25/Lecture 5
Menser, Terri *Kern Center at Mayo Clinic*
- Ethical and logistical considerations of artificial intelligence implementation in health care settings

11:30 – 11:50/Lecture 6
Kimura, Hitomi *University of Tsukuba*
- Exploring the self-learning journey for beginner Healthcare practitioners: Strategies for data-driven insights
  初学者のためのデータサイエンス

12:00 – 12:50/Lunchtime lecture 1
Itatani, Keiichi *Department of Cardiovascular Surgery, Nagoya City University*
- Revolutions in medical imaging data handling from the cardiovascular surgery

13:00 – 13:10/All about hands-on workshops (small group seminar; 2-hour session)
Celi, Leo/Hashimoto, Satoru/Uhimido, Ryo/Aoki,Tomonoshin

13:20 – 15:20/Hands-on workshops Part 1: HWS01-06 → *see* p.18

15:30 – 17:30/Hands-on workshops Part 2: HWS07-11 → *see* p.21

September 2nd & 3rd/Day 2 & 3

Critical Data Workshops and Datathon 2023
Aoki, Tomonoshin/Namba, Toshifumi/Tohyama, Takeshi

September 2nd/Day 2

9:00 – 12:00/Critical data workshops and Datathon 2023

12:00 – 13:00/Lunchtime lecture 2
Shimizu, Sayuri *Department of Health Data Science at the Graduate School of Data Science, Yokohama City University*

- Routinely collected health data in Japan: Characteristics and data availability
  日本で利用可能な医療管理データ（RCD）：データ特性と利用法

13:00 – 17:30/Critical data workshops and Datathon 2023

September 3rd/Day 3

9:00 – 12:00/Critical data workshops and Datathon 2023

12:00 – 13:00/Lunch

13:00 – 14:30/Last spurt of the critical data sorkshops and Datathon 2023

15:00 – 16:30/Presentation by each team

16:30 – 17:30/Awarding & wrap up

17:30/Commemoratve photo taking

Hands-on Workshops

Hands-on workshops Part 1: HWS01-06/Sep 1 13:20-15:20

HWS01

Carrel, Adrien

Topological deep Learning: l A new direction for artificial intelligence with healthcare applications

Topological Deep Learning and Geometric Deep Learning (TDL/GDL) are emerging fields at the intersection of mathematics, computer science, and artificial intelligence. This workshop aims to introduce participants to the principles and applications of these two fields in the context of healthcare.
First, an introduction to the fundamental concepts will be made. This approach focuses on extending traditional deep learning techniques to handle different data structures such as graphs, meshes, and point clouds. Participants will learn about graph neural networks, higher-order networks, and other architectures. The second part of the workshop will delve into the potential applications these fields in healthcare. The applications include drug discovery, molecule properties prediction and diagnosis of some diseases. Participants will have the opportunity to engage in hands-on activities through a notebook and interactive discussions.
By the end of the workshop, attendees will be equipped with the knowledge to explore these exciting fields further and apply its techniques to tackle real-world healthcare challenges.
Bringing a laptop will be essential for experimenting with the notebook. While some experience in computer science and/or mathematics is beneficial to understand some concepts, the workshop will be designed to be accessible to a wide audience.

HWS02

Ebner, Daniel

The potentials of generative AI in healthcare

An example abstract: In this workshop, we will explore the transformative potential of Generative AI within the context of the Intensive Care Unit (ICU). Participants will delve into the practical applications of Generative AI models, such as GPT-4, to simulate patient health scenarios, predict health outcomes, and generate intervention strategies. We will also cover the ethical implications, data privacy concerns, and decision-making challenges presented by the use of these technologies in the ICU environment. With a balanced blend of theoretical discussions and hands-on exercises, our goal is to inspire innovative approaches for integrating AI into healthcare, ultimately improving ICU patient care and outcomes.

Of note, ChatGPT is able to process Japanese text, but it is not quite as strong at Japanese as it is in English. The workshop can be either English or Japanese, but if a member of your team or one of the AI members in Japan is familiar with a large-language model (LLM) like ChatGPT that focuses specifically on Japan or Japanese healthcare, that could be helpful.
If one does not exist today, it is possible that one will be created between now and the datathon, so it might be something that we have to keep our eyes out for.

＜ワークショップ構成内容を大言語モデル（LLM）により日本語に変換した例＞

ヘルスケアにおける生成型 AI の可能性

このワークショップでは、集中治療室（ICU）の文脈における生成型 AI の変革的な可能性を探求します。参加者は、患者の健康状況のシミュレーション、健康結果の予測、および介入戦略の生成など、生成型 AI モデル（例：GPT-4）の具体的なアプリケーションを深堀りします。また、ICU の環境におけるこれらの技術の利用によって生じる倫理的な意味合い、データプライバシーの懸念、および意思決定の課題についてもカバーします。理論的な議論と実践的な演習を適切に組み合わせることで、我々の目指すところは、ヘルスケアに AI を統合するための革新的

な手法を刺激し、最終的には ICU 患者のケアとアウトカムを改善することです。
注：ChatGPT は日本語テキストを処理することができますが、英語ほど日本語には強くありません。ワークショップは英語でも日本語でも構いませんが、あなたのチームのメンバーまたは日本の AI メンバーの中に、日本または日本のヘルスケアに焦点を当てた大言語モデル（LLM）のような ChatGPT に精通している人がいると便利かもしれません。今日では存在しないかもしれませんが、データソンの間に作成される可能性がありますので、我々が注目しておくべきかもしれません。

*The above was prepared by an LLM. They work pretty well! I think participants will only need a computer with internet access for ChatGPT. Image generation would require a fee but some not-so-good resources are available online. I can also broadcast my computer as an example if a projector or adaptor is available.

HWS03

Aoki, Tomonoshin

Healthcare digital transformation (DX): International comparative analysis of health systems and cases, accompanied by hands-on research demonstrations <Japanese session>

Healthcare digital transformation, or DX, is an emerging global phenomenon with profound implications not just for individual medical practices, but for entire healthcare systems. This transformative process, however, is heavily influenced by the unique structure and policies of each country's healthcare system.

In this interactive workshop, we will delve into the role of DX within various healthcare systems across the globe, with a focus on countries such as the UK, US, and Japan. Drawing on cases, we will analyze how data sharing has been implemented in these different contexts.

This workshop will not only deepen participants' understanding of these processes, but also provide insights into empirical research on institutional design related to DX. Through practical demonstrations and discussion, participants are expected to gain a better understanding of the policy perspectives on DX, its potential, and the nature and challenges of policy research.

This workshop is ideal for policy researchers, healthcare professionals, data scientists, and anyone interested in the intersection of healthcare and technology.

Prerequisites: All necessary materials and code will be provided. While foundational knowledge related to healthcare systems, policy-oriented empirical research, and programming (ideally in R) will amplify your learning experience, the workshop is designed to be comprehensive and beneficial even without prior knowledge in these areas.

医療分野におけるデジタルトランスフォーメーション（DX）：医療システムと事例の国際比較分析及びハンズオンのリサーチ・デモンストレーション" ＜日本語開催＞

医療分野におけるデジタルトランスフォーメーション（DX）は、個々の医療行為だけでなく、医療システム全体にも重大な影響を及ぼす世界的な現象である。しかし、この変革のプロセスは、各国の医療制度の構造や政策に大きく影響される。

このインタラクティブなワークショップでは、英国、米国、日本などの国々を中心に、世界中の様々な医療システムにおける DX の役割について掘り下げる。そして、特にデータ共有を中心とした事例をもとに、これらの異なる状況において、どのように実施されてきたかを分析する。

本ワークショップは、参加者がこれらのプロセスについて理解を深めるだけでなく、DX に関連する制度設計に通じる実証的研究についての洞察も提供する。ハンズオンのデモンストレーションとディスカッションを通じて、参加者は DX に関する政策に対する視点とその可能性、そして政策研究の本質と課題について理解を深めることが期待される。

本ワークショップは、政策研究者、医療従事者、データサイエンティスト、医療とテクノロジーの交差点に関心のあるすべての方に最適である。

前提条件等：必要な資料とコードはすべて提供される。医療システム、政策指向の実証研究、プログラミング（理想的には R 言語）に関する基礎知識があれば、学習効果が高まるが、このワークショップは、これらの分野の予備知識がなくても、包括的で有益になるように設計されている。

HWS04

Kinoshita, Takahiro

What do you mean by “adjusting for” confounders? <Japanese session>

Adjusting for confounders is a pivotal concept in causal inference with real-world data. The first crucial step involves identifying the essential variables required for a balanced and fair comparison-referred to as confounders to achieve conditional exchangeability in the formal language of epidemiology. Numerous causal methods have been proposed to “adjust for” these confounders, including multivariable linear or logistic regression using confounders as covariates, propensity score analyses such as covariate adjustment, stratification, and matching, inverse-probability of treatment weighting, and the g-formula. However, the critical distinctions in underlying assumptions as well as result interpretations are frequently overlooked.

In this workshop, our objective is to define the necessary assumptions for obtaining unbiased effect estimates from non-randomized observational data. Furthermore, we will explore the disparity between “conditional effects” and “marginal effects” and introduce reliable methods that address your causal questions.

We expect all participants to have a basic understanding of R language (not GUIs such as EZR or R commander) or Python. The hands-on session will be conducted using RStudio.

交絡を〝調整する〟ってどういう意味ですか？＜日本語開催＞

リアルワールドデータを用いた因果推論において、交絡因子の調整は非常に重要なコンセプトです。解析の最初のステップにおいては、両群間の適切な比較を行うために必要な因子を見つけ出すことが重要です。これは疫学用語で、「条件付きの交換可能性を担保するための交絡因子を把握する」ことを意味します。しかし、全く同じ交絡因子を用いる場合であっても、様々な異なる解析手法が考案されています。例えば、交絡因子を共変量として用いる重回帰分析や多変量ロジスティック回帰分析、傾向スコア分析（共変量調整、層別化、マッチング）、逆数重みづけ法、g-formula などが挙げられます。これらの方法論はそれぞれ置かれた仮定も違えば結果の解釈も異なるのですが、この重要な論点はしばしば見過ごされているのが現状です。

本ワークショップでは、ランダム化されていない観察データから適切な効果の推定を行うために必要な仮定を概説します。その上で、「条件付き効果」と「周辺効果」の違いについて説明し、因果的な疑問に応えるための方法論について解説します。

なお、本ワークショップは R（EZR や R commander を除く）ないし Python を用いた基本的な解析ができる方を対象としています。ハンズオンセッションでは、講師が RStudio を用いてデータ分析を行います。

HWS05

Minegishi, Yu/Hase, Takeshi/Uchimido, Ryo/Yamada, Tomoaki

Learning Python with hands-on experience <Japanese session>

This workshop is designed to provide a foundation in Python programming. Participants will learn Python syntax, data types, control structures, functions, and modules through practical exercises. The main objective is to grasp fundamental programming concepts and acquire the skills to create simple programs using Python. The workshop follows a hands-on approach, with instructors providing explanations and participants engaging in exercises and tasks. It is suitable for programming beginners and those new to Python, and attendees are required to bring their own laptops. By participating in this Python Introductory Hands-on, participants will gain proficiency in programming basics and acquire the ability to develop basic programs using Python.

ハンズオンで学ぶ Python 入門＜日本語開催＞

このワークショップは、Python プログラミングの基礎を学ぶワークショップです。参加者は Python の文法やデータ型、制御構造、関数、モジュールなどを実際に使いながら学びます。基本的なプログラミングの概念を習得し、Python を使って簡単なプログラムを作成する方法を身につけることが目的です。ハンズオン形式で講師が解説し、参加者は演習や課題を通じて実践的な学習を行います。プログラミング初心者や Python 初学者に適しており、自身のノートパソコンを持参して参加します。Python 初級ハンズオンに参加することで、プログラミング基礎を習得し、Python を使った簡単なプログラム作成のスキルを身につけることができます。

HWS06

Shimizu, Sayuri

Analyzing administrative data (DPC data) of acute care hospitals in Japan <Japanese session>

Japanese acute care hospitals submit data on all discharged patients (DPC data) to the Ministry of Health, Labour and Welfare (MHLW), and a database covering almost all Japanese in acute care has been established. DPC data, which includes inpatient medical record information such as age, gender, disease information, and severity of illness, as well as information on all medical procedures received during hospitalization, is used for clinical epidemiological studies, hospital management, health care quality indicators, and health care policy. In this hands-on seminar, participants will learn about the characteristics of Japanese medical data through analysis of sample data from individual DPC forms and open data.

日本の急性期医療機関の管理データ（DPC データ）を用いた分析演習＜日本語開催＞

日本の急性期医療機関は、退院した全患者のデータ（DPC データ）を厚生労働省に提出し、急性期医療のほぼ日本人全数を網羅するデータベースが構築されています。DPC データは、入院中の患者の年齢や性別、病名、疾患重症度などの診療録情報と、入院中に受けた全ての診療行為情報が記録されているため、臨床疫学研究、病院経営分析、医療の質指標や医療政策に活用されています。本ハンズオンセミナーでは、DPC の個票のサンプルデータとオープンデータを分析することで、日本の急性期医療のデータの特性を学びます。

Hands-on workshops Part 2: HWS07-11/Sep 1 15:30-17:30

HWS07

Feng, Mornin/Huang, Ling

Trust deep learning model in healthcare: From accuracy to reliability

As AI continues to shape various sectors, including healthcare, establishing robust ethics protocols becomes crucial to fully harness its potential benefits. This workshop focuses on a fundamental ethical consideration in healthcare: reliability. Ensuring the reliability of AI models in healthcare is vital to instill trust among clinicians, patients, and regulatory authorities.

In this workshop, we aim to discuss critical challenges and emerging solutions in developing and implementing trustworthy AI models within healthcare settings. Key topics include defining reliability, strategies for developing reliable AI healthcare models, and techniques for validating and evaluating reliability performance. Real-world case studies will illustrate the entire process from data collection to clinical application, providing valuable insights. We invite researchers, clinicians, data scientists, industry professionals, and policymakers to join this workshop and contribute to the advancement of reliable AI models in healthcare.

HWS08

Kimes, Patric/Nakajima, Lui/Motos, Joao

AI for real world clinical applications: Considerations and pitfalls

Over the past two decades, exponential growth in data availability, computational power, and newly available modeling techniques has led to an expansion in interest, investment, and research in AI applications for medicine and clinical practice. However, before AI can be widely deployed in clinical settings, further thought must be given to acknowledge the several pitfalls within the AI lifecycle.

This workshop will guide participants through examples of AI in real-world applications. We will explore topics including the use of AI in drug-diagnostic co-development and the seven-step AI lifecycle, using case studies and examples from oncology and ophthalmology. We will explore challenges, biases, and pitfalls that can arise during this process and discuss possible solutions. No prior experience is necessary; all backgrounds are welcome.

HWS09

Tsuji, Shingo

Ask anything about practical data Science

ー Know your present situation, set your own goal, clarify the process ー <Japanese session>

Data science is one of the most important components for life science research. However, data science itself consists of a bunch of knowledge such as computer science, machine learning, mathematics etc., so the researchers without a computer science background often lose their way to go. In this workshop, I will listen to your any kind of issues about data science and try to solve the problems through intensive discussion. You don't need any preparation except your research goals or current stuck point.

データサイエンスの水先案内 ー現状を知り、ゴールを定め、プロセスを明確にしようー

データサイエンスは生命科学研究にとって欠かせない要素になりました。しかし、データサイエンスそのものがいくつかの分野の融合になっているため、臨床や実験中心の研究者にとっては、なにをどこからはじめて何処へ向かって進めば良いのかわからないこともしばしばあります。本ワークショップでは、データサイエンスに関するあらゆるお悩みの相談にのります。対話を通じて、自分が達成したい目的のためには何が必要かを明らかにしていく予定です。現時点での研究目標やデータサイエンスに関する疑問など、具体的な相談ごとをもってご参加ください。このワークショップは日本語で行われます。

HWS10

Tagawa, Koshiro/Tohyama, Takeshi/Soko Setoguchi

Data analysis using propensity score matching <Japanese session>

In recent years, the use of propensity score matching in analyses has become more prevalent. In this course, the participants will learn the basics of propensity score matching and have hands-on practice.
This workshop is designed to be accessible to beginners. Even if you have no previous analytical experience with statistical software, we encourage you to attend if you are interested.
We will use SAS software for analysis. Please prepare to install the commercial version of SAS software or register to access SAS OnDemand via the cloud free of charge (https://welcome.oda.sas.com/).

傾向スコアマッチングを用いたデータ分析＜日本語開催＞

近年では、傾向スコアマッチングを用いた解析を目にすることがよくあります。そこで本ワークショップでは、基本的な傾向スコアマッチングの説明から、解析を実行するまでを行います。
これまでに解析ソフトを使った経験がない方でも実行できるような内容となっておりますので、ご興味ありましたらぜひご参加ください。
解析ソフトは SAS を用います。製品版の SAS がインストールされた PC または以下の URL より無償のクラウドで SAS を利用できる状態にした PC を持参ください。
https://welcome.oda.sas.com/

HWS11

Ichihara, Nao

ICU outcome assessment using matching methods <Japanese session>

For *clinical registries* to be of value for *improving quality of care*, it is important to define an *outcome measure* that appropriately addresses *differences in patient risks across populations.*
The *O/E ratio* (observed/expected ratio) is used for such purposes. One can obtain a prediction formula for patient death using the entire ICU registry data, apply this formula to predict risks of death for each patient in a specific ICU, sum them up to estimate number of expected deaths at the ICU, and the ratio of the number of observed deaths to that of expected deaths can be used as the

O/E ratio. However, even if ICU-A has a *higher* O/E ratio than ICU-B, it *doesn't mean* ICU-A has a *lower* quality of care than ICU-B (*Simpson's paradox*). The O/E ratio is imperfect as an outcome measure that addresses differences in patient risk across ICUs (risk-adjusted outcome measure).
Alternatively, evaluating outcome of care at an ICU can be understood as *causal inference* in *observational study*, i.e., a measure that represents "*average effect*" of "treatment at the ICU" on "the patients' risk of death." As such, a meaningful outcome measure can be defined using *matching method*, an analytical approach widely used in observational medical research.
This workshop expects participants to be familiar with R. *Matching-based outcome measures* are defined, measured, and summarized using JIPAD data and synthetic data. In addition, *O/E ratios* will be calculated, and compared with matching-based outcome measures.

マッチングに基づく ICU アウトカム評価＜日本語開催＞
診療レジストリのデータを医療の質向上に活かす上で、集団間のリスクの差に適切に対処するアウトカム指標の定義は重要である。
こうした目的で O/E 比（observed/expected 比）が用いられることがある。たとえば、ある ICU レジストリ全体のデータに基づき患者の死亡を予測する式を作製し、これを特定 ICU に当てはめて、その患者集団における実際の死亡数と、予測される死亡数の比として、O/E 比が定義される。しかし、ICU-A の O/E 比が ICU-B より高いことは、ICU-A の診療の質が ICU-B よりも低いことを意味しない（Simpson's paradox）。すなわち、O/E 比は集団間のリスクの差に対処するアウトカム指標（リスク調整アウトカム指標）として、完全ではない。
ある ICU におけるアウトカムの評価は、観察研究における因果推論と捉えることができる。すなわち、アウトカム指標は「ある ICU における治療」の「患者の死亡リスク」におよぼす「平均効果」の指標と考えうる。臨床研究を含め、こうした因果推論に広く用いられる手法であるマッチングに基づき、有意義なアウトカム指標を定義しうる。
本ワークショップは、R の初歩的な知識を有する参加者を対象とする。JIPAD データおよびダミーデータを用いて、マッチングに基づくアウトカム指標を定義し、実際に測定し、可視化することで、有意義なベンチマーキングの手法を学ぶ。あわせて、O/E 比も測定し、マッチングに基づくアウトカム指標と比較する。

Critical Data Workshops

Critical data workshop 0: Preparatory materials

The preparatory workshop provides crucial background information about the inaccuracies of pulse oximeters for populations with darker skin tones. It explains how these inaccuracies can lead to missed cases of hypoxemia, resulting in less treatment and higher mortality rates. The workshop also provides an overview of the Datathon's schedule and recommends literature for the participants to review. Additionally, the participants are prepared for the data analysis.

クリティカルデータワークショップ 0：準備資料

この準備ワークショップでは、肌の色が濃い人々に対するパルスオキシメーターの不正確さに関する重要な背景情報を提供する。このような不正確さが低酸素血症の症例見逃しにつながり、治療の遅れや死亡率の上昇につながることを説明する。また、このワークショップでは、データソンのスケジュールの概要と、参加者が検討すべき文献を推奨する。さらに、参加者はデータ解析の準備を行う。

Critical data workshop 1: EDA & study design

In this workshop, the teams are expected to define the inclusion criteria to build a working cohort and explore the ground truths present in the dataset. The deliverables include a flow chart detailing the inclusion and exclusion criteria and the definition of the machine learning task to be addressed. The workshop also discusses potential pitfalls such as sampling and representation bias.

クリティカルデータワークショップ 1：EDA と研究デザイン

このワークショップでは、作業コホートを構築するための組入基準を定義し、データセットに存在する真実の根拠を探る。成果物には、組み入れ基準と除外基準の詳細を示すフローチャートと、取り組むべき機械学習タスクの定義が含まれる。ワークショップでは、サンプリングや表現バイアスなどの潜在的な落とし穴についても議論する。

Critical data workshop 2: Clinical variables selection & feature engineering

This workshop emphasizes the importance of data preprocessing in the data science workflow. Participants are taught data cleaning, normalization, transformation, and reduction techniques, and they apply these techniques to real-world datasets. The workshop also highlights how to identify and mitigate biases that can be introduced during data preprocessing.

クリティカルデータワークショップ 2：臨床変数の選択と特徴量エンジニアリング

このワークショップでは、データサイエンスのワークフローにおけるデータの前処理の重要性を強調する。参加者はデータのクリーニング、正規化、変換、削減テクニックを学び、これらのテクニックを実際のデータセットに適用する。また、このワークショップでは、データの前処理中に発生する可能性のあるバイアスを特定し、軽減する方法にも焦点を当てる。

Critical data workshop 3: Let's get our model!

This workshop involves splitting the data into training and test sets, defining performance metrics for model evaluation, and developing a machine learning model. The models could predict arterial oxygen saturation values, the gap between arterial and peripheral oxygen saturation, or detect instances of hidden hypoxemia. The workshop also covers grid-search parameter tuning and feature importance assessment.

クリティカルデータワークショップ 3：モデルを作成しよう！

このワークショップでは、データをトレーニングセットとテストセットに分割し、モデル評価のパフォーマンス指標を定義し、機械学習モデルを開発します。モデルは、動脈酸素飽和度値、動脈酸素飽和度と末梢酸素飽和度のギャップを予測したり、潜在性低酸素血症の事象を検出したりします。このワークショップでは、グリッドサーチによるハイパーパラメータの最適化及び特徴量の重要性評価についても取り上げる。

Critical data workshop 4: Try to tackle the biases and re-model

In the final workshop, participants are encouraged to develop their own ideas and solutions to tackle biases and remodel the datasets based on the knowledge and skills acquired from the previous workshops. It promotes creativity and self-guided exploration and encourages participants to address various problems, such as demographic biases, missing patients from the database, developing a good fairness metric, and validating and expanding the proposed models.

クリティカルデータワークショップ 4：バイアスに対処し、再モデル化を試みる

最後のワークショップでは、参加者はこれまでのワークショップで習得した知識とスキルに基づいて、バイアスに取り組み、データセットを再モデル化するための独自のアイデアやソリューションを開発することが奨励される。このワークショップでは、創造性と自主的な探求を促進し、患者背景の偏り、データベースからの患者の欠落、優れた公平性の指標の開発、提案されたモデルの検証と拡張など、さまざまな問題に取り組むよう参加者に促す。

What is Datathon

This event caters to physicians keen on exploring research from a data science perspective and data scientists seeking to leverage their skills to resolve clinical problems. No prior experience in both data science and clinical knowledge is required – just an openness to learn .
Participants will have the chance to network and learn from leading professionals in data science and medicine. The event presents an excellent platform to learn, interact, and contribute to significant advancements in medical research.
Benefits for participants include:

- Learning opportunity: Gain practical experience in data science and understand its application in real-world medical scenarios.
- Expert guidance: Learn from leading academics and industry professionals from globally recognized institutions.
- Interdisciplinary collaboration: Collaborate with physicians, clinical researchers, and data scientists to solve actual clinical problems.
- Networking opportunities: Connect with peers, potential collaborators, and industry leaders.
- Impactful contribution: Apply new skills to real-world problems, potentially contributing to significant advancements in the medical field.
- Career advancement: Boost your skills and open new avenues in your professional or research career.
- Awards and recognition: Top three projects will be recognized, opening the door to potential future opportunities.
- Publication opportunity: Teams are encouraged to publish papers based on their findings.

By participating in this Datathon, attendees will be at the intersection of data science and medical research, potentially driving innovative solutions to real-world problems. This event represents more than just a learning experience; it's an opportunity to make a substantial difference in healthcare.

このイベントは、データサイエンスの観点から研究を探求することに熱心な医師や、臨床上の問題を解決するためにスキルを活用しようとするデータサイエンティストを対象としています。データサイエンスや臨床知識の双方の経験は必要ありません。
参加者は、データサイエンスと医学の第一線で活躍する専門家から学び、ネットワークを広げることができます。このイベントは、学び、交流し、医学研究の大きな進歩に貢献するための素晴らしいプラットフォームを提供します。
参加者には以下のようなメリットがあります：

ー学習の機会：データサイエンスの実践的な経験を積み、実際の医療シナリオへの応用を理解する。
ー専門家の指導：世界的に著名な研究機関の一流の学者や業界の専門家から学ぶ。
ー学際的コラボレーション:医師、臨床研究者、データサイエンティストと協力して実際の臨床問題を解決する。
ーネットワーキングの機会：同業者、共同研究者候補、業界リーダーと交流をもつ。
ーインパクトのある貢献 新しいスキルを現実の問題に応用し、医療分野の大きな進歩に貢献する可能性がある。
ーキャリアアップ：スキルを高め、専門家や研究者としてのキャリアに新たな道を開く。
ー賞と表彰：上位 3 つのプロジェクトが表彰され、将来の可能性への扉が開かれる。
ー出版の機会：各チームは、研究成果を論文として発表することが奨励されます。

この Datathon に参加することで、参加者はデータサイエンスと医学研究の交差点に立ち、現実世界の問題に対する革新的な解決策を推進できる可能性があります。このイベントは単なる学習体験ではなく、実践的なインパクトを与える機会とすることも推奨されます。

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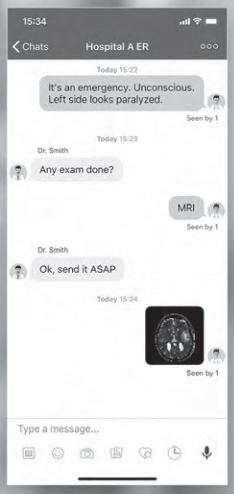

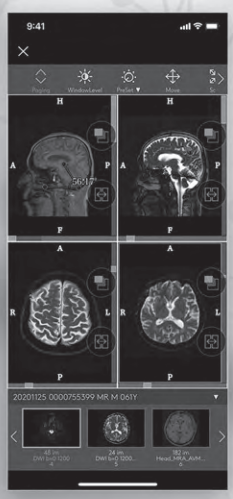

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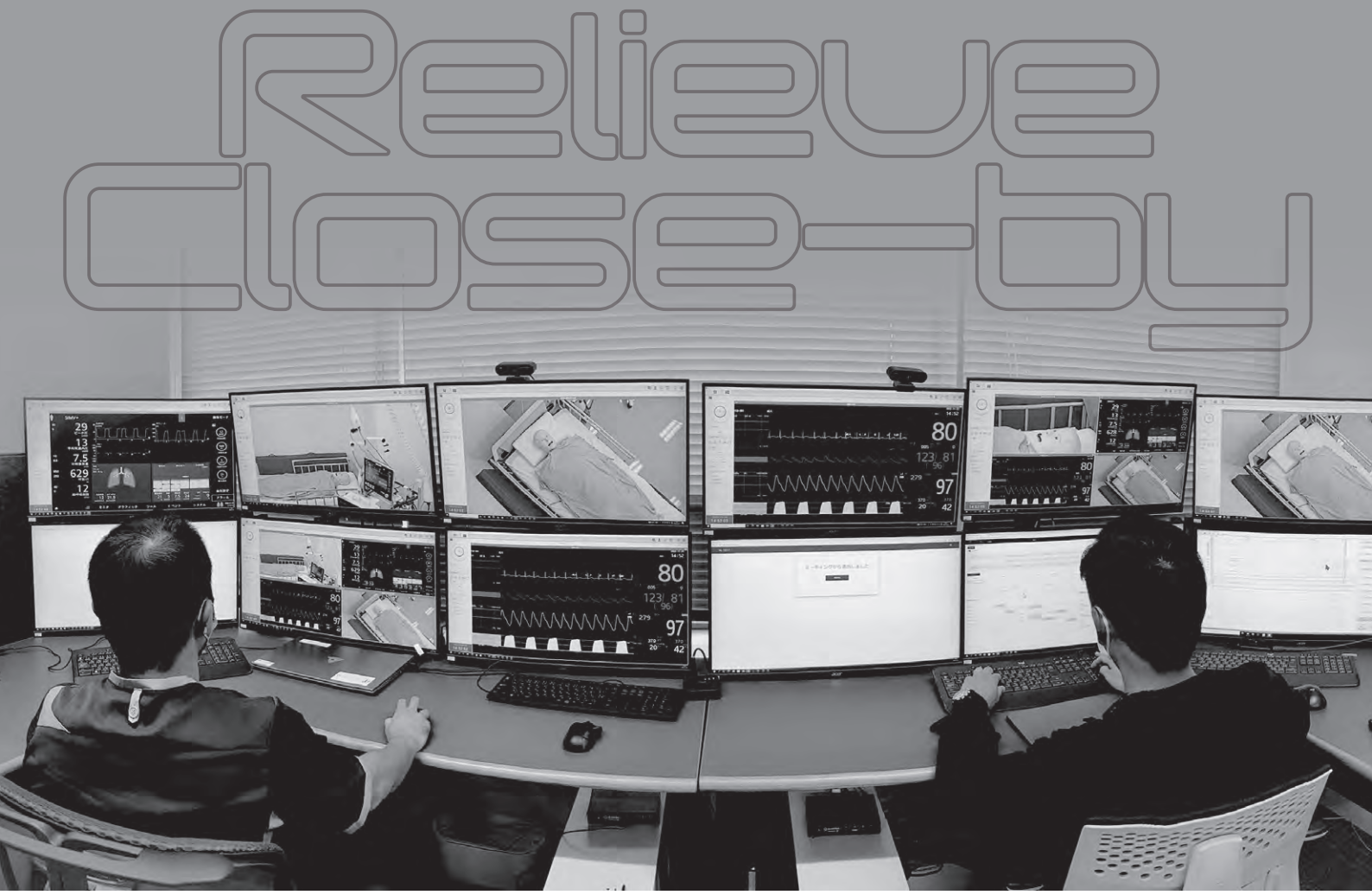

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医療機器認証番号：304AFBZX00072000
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株式会社 Vitaars（旧社名：株式会社 T-ICU）
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