（別紙様式５）

変革を駆動する先端物理・数学プログラム（FoPM）
国外連携機関長期研修　報告書

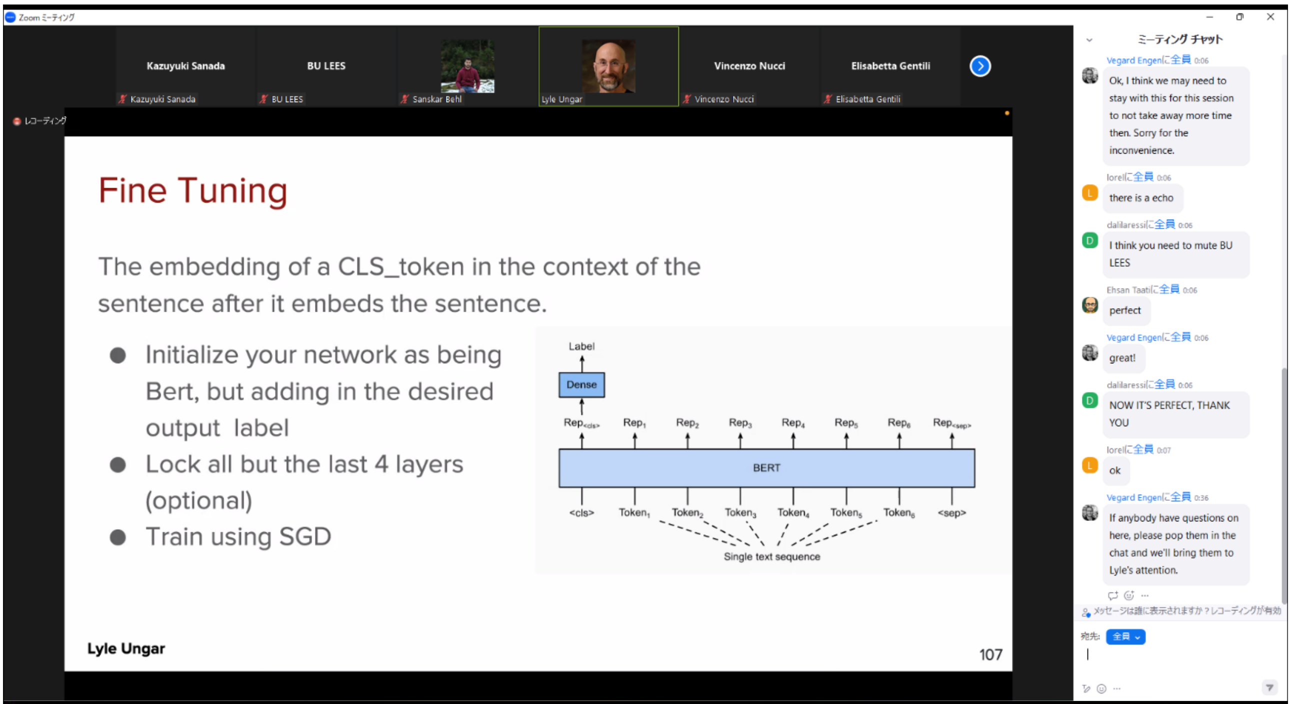
氏　　名	真田　兼行
所属部局	理学系　研究科　 物理学　専攻
受入先	DeepLearn 2023 Winter (Bournemous University, Universitat Rovira i Virgili, IRDTA)
日程	西暦　2023 年　1 月　16 日　～　西暦　2023 年　1 月　20 日

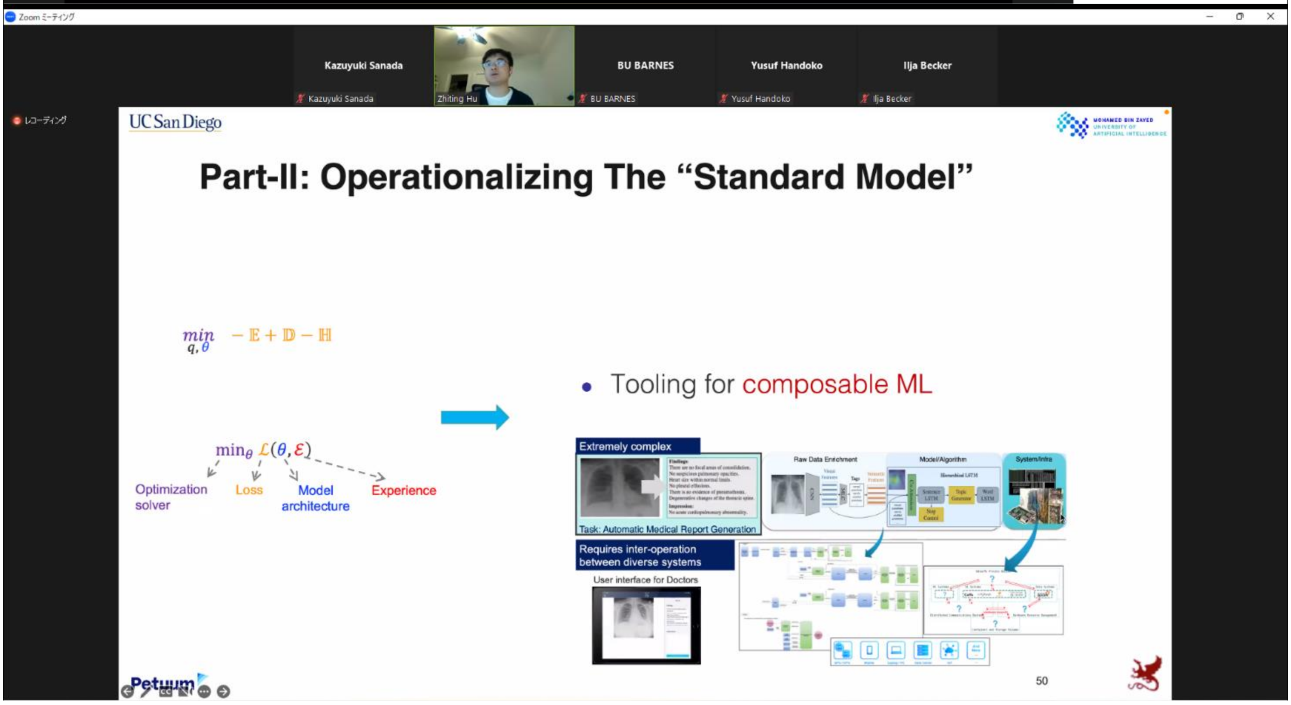
I participated online in DeepLearn 2023 Winter, sponsored by Bournemouth University, Universitat Rovira i Virgili, and IRDTA, as an alternative to overseas training due to COVID-19. DeepLearn 2023 Winter is a winter school on machine learning and deep learning, where students can learn everything from basic concepts and theories to practical applications of machine learning. The reason why I participated in the winter school of machine learning, which is different from my major, is because I believe that gaining knowledge in the field of machine learning will be an advantage in my research, as many studies using machine learning and deep learning techniques have recently been published in my area of specialization, physics.

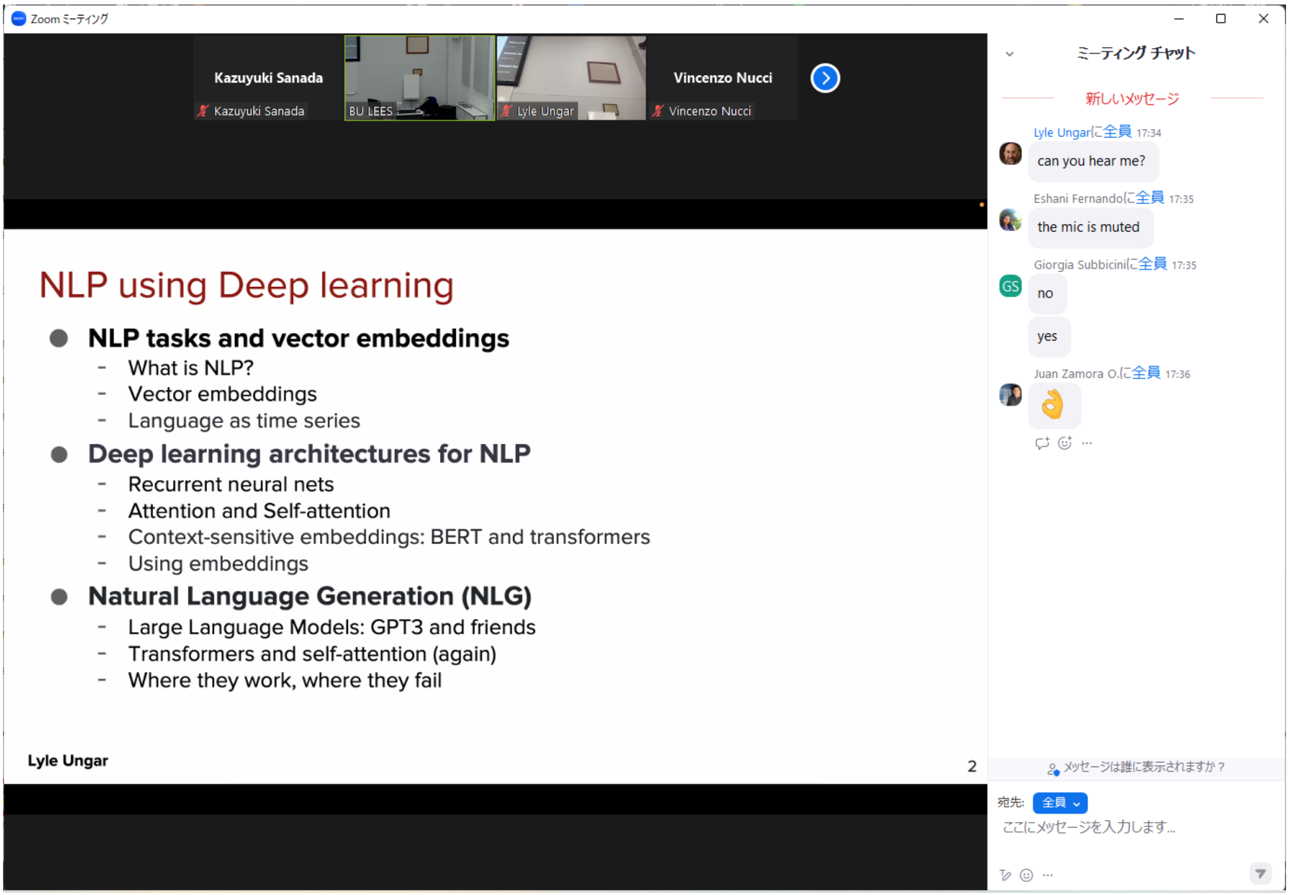
In this school, I attended four or five 90-minute lectures each day for a total of 24 lessons. Other notable courses included an industry session and a research presentation by the University of Bournemouth. There will be three lectures per instructor, and participants will attend eight series for the entire program. Three instructors give lessons simultaneously in different rooms, so it is only possible to participate in some lectures. Still, I can view recordings of all lectures later, including courses I did not attend.

Next, I will describe the specifics of the lectures I received. The first lecture was given by Dr. Joao Gama (University of Porto) on "Learning from Data Streams: Challenges, Issues, and Opportunities." The class was about data streams in which large amounts of data flow and how algorithms can approximate the necessary information at a reasonable speed. In the quantum many-body model, which is my specialty, the size of the matrices to be handled grows exponentially about the system size, so the technique for quickly retrieving necessary information from such large-size data has great potential for application in my research. The second lecture was "Explainable Machine Learning" by Dr. Marco Duarte. In this lecture, he explained how to explain how or why results obtained by machine learning or deep learning were obtained. Since it is difficult to use traditional black-box machine-learning methods in physics and other scientific fields, learning about the algorithms that yield explanatory variables for using machine learning in research was promising. The third lecture is "Information Theory for Deep Learning" by Dr. David McAllester. In this lecture, information theory was discussed mainly from a mathematical aspect. Since I am familiar with mathematics, it helped me understand the concepts behind machine learning. The fourth lecture I attended was "Convolutional Neural Networks and Their Applications to COVID-19 Diagnosis" by Dr. Yu-Dong Zhang. In this lecture, he mainly explained excellent algorithms in a contest called ImageNet Large Scale Visual Recognition Challenge (ILSVRC) and using ImageNet to Diagnose COVID-19. I was unfamiliar with convolutional neural networks, but the basic concepts were followed up, and I gained a better understanding. The fifth lecture is "Anomaly Detection" by Dr. Matias Carrasco Kind. The course dealt mainly with anomalies in classification problems, i.e., how to look for points that cannot be classified into one group. In physics, the classification problem is similar to the problem of drawing a phase diagram of the state of a system. Therefore, machine learning can be applied to drawing phase diagrams whose properties have yet to be well understood. It was explained in detail from a theoretical base, so it was easy for me, a beginner, to understand. The sixth and seventh lectures I attended were Dr. Lyle Ungar's "Natural Language Processing using Deep Learning" and Dr. Karen Livescu's "Speech Processing: Automatic Speech Recognition and beyond," both on natural language processing. I took the course because natural language processing is one of the significant fields in machine learning. I needed to be exposed to it, even though I am unlikely to use it directly in my research. The eighth lecture is "A 'Standard Model' for Machine Learning with All Experiences" by Dr. Zhiting Hu & Dr. Eric P. Xing. The goal of the standard equation is to represent optimization strategies used in machine learning in a single equation. Therefore, this ordinary equation contains the essence of ideas in machine learning. In this lecture, he explained the conceptual standard equations and specific examples of what happens when they are applied to actual machine learning models. Through this lecture, I learned the concept of machine learning. It was the most meaningful lecture in this winter school.

Before attending this winter school, I knew only that machine learning is sometimes used in physics research, but I needed to learn more about its contents. In this winter school, I could learn comprehensively from the basics of machine learning to how it is used. It was worthwhile for me to participate in this school as a FoPM program. It would help me read papers that use machine learning and apply machine learning to my research.






Zoom ミーティング
Kazuyuki Sanada
Kazuyuki Sanada
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Lyle Ungar
Vincenzo Nucci
Vincenzo Nucci
NLP using Deep learning
NLP tasks and vector embeddings
What is NLP?
Vector embeddings
Language as time series
Deep learning architectures for NLP
Recurrent neural nets
Attention and Self-attention
Context-sensitive embeddings: BERT and transformers
Using embeddings
Natural Language Generation (NLG)
Large Language Models: GPT3 and friends
Transformers and self-attention (again)
Where they work, where they fail
Lyle Ungar
2
ミーティング チャット
新しいメッセージ
Lyle Ungarに全員 17:34
can you hear me?
Eshani Fernandoに全員 17:35
the mic is muted
Giorgia Subbiciniに全員 17:35
GS
no
yes
Juan Zamora O.に全員 17:36
メッセージは誰に表示されますか？
宛先: 全員
ここにメッセージを入力します...