COST Action ML4Microbiome - STSM Awardees presenting at the Conference in Cork, 7-9 June 2023 - Survey Responses –

Summary

Presentation	Name	Institution	Country
In-person	Miodrag Cekikj	Ss. Cyril and Methodius University	North Macedonia
In-person	Jamie FitzGerald	University College Cork	Ireland
In-person	Thomas Klammsteiner	University of Innsbruck	Austria
In-person	Mikhail Kolev	South West University Blagoevgrad	Bulgaria
Videolink	Eliana Ibrahimi	University of Tirana	Albania
Videolink	Paul Stefan Popescu	University of Craiova	Romania
Videolink	Gianvito Pio	University of Bari Aldo Moro	Italy
Videolink	Malik Yousef	Zefat Academic College	Israel

Full Survey Responses

Please provide a brief description (max. 200 words) of the impact of your STSM project below, including aims and outcomes both in terms of science and networking/career development.

In-person presenters (4)

1. Miodrag Cekikj

Institution: Ss. Cyril and Methodius University
Country: North Macedonia

The STSM work represents a comprehensive technical approach in modeling and interpreting the drug-resistance mechanisms from clinical data for patients diagnosed with colorectal cancer. It is introducing a symbiotic bacterial analysis that generated different sets of joint feature combinations, providing a combined overview of the model's predictiveness and uncovering additional data correlations where different genera joint impacts support the therapy-resistant effect. Thus, the research points out the different perspectives of treatment since the aggregate analysis gives precise results for the genera that are often found together in a resistant group of patients, meaning that resistance is not due to the presence of one pathogenic genus in the patient microbiome, but rather several bacterial genera that live in symbiosis. The established methodology can also be used for unseen microbiome data that can help oncologists decide on treatment and post-treatment strategy for immunotherapy and drug resistance understandings. The STSM findings were jointly published in the MDPI Applied Science journal, in the section of Applied Biosciences and Bioengineering, which is also representing the fundamental research topic of my doctoral dissertation published in December,

2022 (https://www.mdpi.com/2076-3417/12/9/4094).

2. Jamie FitzGerald

Institution: University College Cork
Country: Ireland

This STSM, “Human Teaching, Machine Learning – developing a sharable sylabus from the recommendations generated through ML4Microbiome (EU-CA18131)” aimed to develop course material for machine learning, and to strengthen working relations with colleagues in microbiome analysis at Utrecht.

COST Action recommendations to date for machine learning in the microbiome were reviewed and compiled into a list of topics to cover.

Method of delivery was considered in detail, with the decision that markdown documents were more approachable than "live" notebooks hosted through local or server based applications.

To enable both “intensive” and “intermittent” teaching modes, it was decided that portions of the course should, where possible, establish natural beginnings and ends to the separate topics.

A course was structured as 3x 6-hours blocks, each block further subdivided into 2 hours of theory (lecture), with 4 hours of coding / code running / analysis (practical)

Course material was aggregated from available resources, producing a skeleton framework of topics to be covered. Future work plans to populate the material from our existing code, and the resources gathered.

3. Thomas Klammsteiner

Institution: University of Innsbruck
Country: Austria

From a scientific perspective, the STSM allowed me to extend my collaboration with Prof. Blaz Stres and gave me the opportunity to collect and curate microbiome datasets and metadata for a meta-analysis, which is still ongoing. This was my third scientific stay in Slovenia and it further helped me to finalize some unfinished work for my PhD, which I completed later that year. Despite the challenges posed by the pandemic, I was able to connect with other Slovene researchers and expand my professional network. This STSM exemplifies the importance of international scientific collaborations, which foster knowledge exchange, broaden research horizons, and promote interdisciplinary best practices.

4. Mikhail Kolev

Institution: South West University Blagoevgrad
Country: Bulgaria

The principle research question was studying the existing literature, machine learning methods and data availability related to the relationships between gut microbiome and bone health.

The motivation for this choice was the increased evidence that the human intestinal microbiome plays a critical role in the regulation of significant biological processes and the mechanisms underlying numerous complex diseases.

During the STSM a study of the available literature was made. Various microbiome data and clinical characteristics presented in a series of papers were investigated. Technical and analytical approaches that are appropriate for gut microbiome studies of complex diseases were studied. A special attention to the methods of data processing and analyses was paid.

Meetings and discussions with scientist from the Institute of Molecular and Cell Biology, University of Tartu, from the Estonian Genome Centre, University of Tartu were organized.

Work on the preparation of the annual report of Working Group 1 as well as of the planned research paper was done also during an online core group meeting.

Videolink presenters (4)

5. Eliana Ibrahimi

Institution: University of Tirana
Country: Albania

The STSM at NOVA MATH FCT NOVA, Lisbon, Portugal, was a great opportunity to enhance my research expertise and scientific collaborations. During this STSM, I worked with the group of Dr. Marta B Lopes on colorectal cancer (CRC) 16S dataset to optimize generalized linear models (GLM) with LASSO regularization and their parameters for two-class (healthy/cancer) and multiclass (healthy/adenoma/cancer) classification tasks. The results will be presented at a conference in Germany in July 2023. Apart from the research work during the scientific mission, I had the opportunity to participate in several activities organized at NOVA MATH, such as the "II Workshop in Statistics for Health, Public Health and Surveillance Problems", where I had the opportunity to connect with researchers and students working on statistical applications in health.

During the visit, I also had the pleasure of giving a seminar entitled: "Matrix factorization and linear mixed models applied to biological and health data", where I presented my current research projects and had the opportunity to discuss them with interested researchers at NOVA MATH.

This STSM served to create a long-lasting collaboration with Marta B Lopes, and together, we will co-supervise a master's thesis at the Department of Biology, University of Tirana, Albania.

6. Paul Stefan Popescu

Institution: University of Craiova
Country: Romania

The STSM was held at Acibadem University (ACU), 2020-02-03 - 2020-02-17, Istanbul, Turkey and was focused on exploring microbiome datasets. Before having that STSM, I didn't know too much about the microbiome and the relationship between the microbiome and several diseases. During the STSM, I had the opportunity to meet great people who helped me to understand the microbiome and its

role. Besides the general things about the microbiome, I had the chance to experiment and build machine learning models in order to find relations between the microbiome and several diseases, along with predicting some conditions based on the microbiome configuration. During the STSM, five datasets were explored: two of them were public, and the other three were provided by the host based on their collected samples. Analysing the first two public datasets revealed that many papers analysed the data, but few considered a machine learning approach. In the future, I hope I will have more opportunities to learn and do experiments in this direction.

7. Gianvito Pio

Institution: University of Bari Aldo Moro
Country: Italy

The goal of this STSM was to study possible strategies for handling the high dimensionality of microbiome data and the presence of noise, considering the adoption of specific pre-processing approaches for feature reduction/extraction as well as the adoption of specific learning methods that are inherently able to work with high-dimensional noisy data.

Some experiments were performed on the METSIM dataset on the prediction of the value of some indexes representing the presence of Type II diabetes. The results outlined that: i) approaches that are sensitive to the high dimensionality led to poor results; ii) approaches that perform an embedded feature selection cannot effectively handle microbiome data; iii) approaches that are able to handle high-dimensional data did not benefit from additional feature extraction techniques; iv) interestingly, very simple approaches had a significant boost when supported by a feature extraction technique.

This STSM also paved the way towards further collaborations with the host institution on the design of novel ML approaches. Moreover, the researcher collaborated in the context of subsequent STSMs as a host, with other research institutions participating to the COST, which led to very interesting results both from a ML viewpoint and in the analysis of microbiome data.

8. Malik Yousef

Institution: Zefat Academic College
Country: Israel

The STSM allowed me to connect with a researcher from AGU University and meet with her students. Now, we have an established project that we are conducting together. Also, it allows me to work on other projects unrelated to microbiome.