Artificial intelligence applied to intravital microscopy of the immune system, 2nd edition
May 16 – 18, 2022

This workshop will cover theoretical and practical aspects regarding the application of A.I. -based methods for the analysis of intravital imaging data.
We will focus on the migration and interaction of immune cells observed *in vivo*, explaining how to get accurate tracking analysis, or how to extract insights from videos without using cell tracking. Moreover, we will discuss the importance of Open Source and Open Data resources in image-driven immunological research.
The topics and tools presented in this workshop can be applied also for other imaging modalities and cell types but a basic knowledge in microscopy is recommended.

Program - check for updated versions at: https://www.immunemap.org/index.php/aiivm

DAY 1: May 16th. Introduction to intravital microscopy (IVM)

Learning objectives. Understanding the applications and advantages of intravital microscopy / Understanding the importance of Open Data research / Practice with the immunemap platform

9:00-9:30: Introduction of the tutors and the course (Pizzagalli DU)

9:30-10:15: Ice-breaker activity (Pizzagalli DU)

10:30-11:30: Technical Introduction to IVM (Morone D)

11:30-12:30: Biological applications of IVM (Virgilio T)

12:30-14:00: Lunch Break

14:00-15:15: Open Data research and presentation of immunemap (Pizzagalli DU)

15:15-15:45: Coffee break

15:45-17:00: Practical session 1: Use of immunemap (Palladino E / Ceni K / Thelen B)

DAY 2: May 17th: Analysis with tracking

Learning objectives. Understanding which type of information can be extracted from IVM data using the classical image analysis pipeline, challenges and new perspectives

9:00-10:30: Classical image analysis pipeline, artifacts, quality requirements (Pulfer A)

10:30-10:45 Coffee break

10:45-12:00: The relevance of cell tracking in life sciences, motility parameters (Pizzagalli DU)

12:30-14:00: *Lunch Break*

14:00-15:15: Practical session 2a: Manual tracking using FIJI/Trackmate (Carrillo-Barbera P), Imaris (Palladino E), immunemap (Ceni K)

15:30 -16:00: Practical session 2b: Facilitating automatic tracking using computer-assisted colocalization (Pizzagalli DU)

16:15-17:00: Practical session 2c: Analysis of motility measures (Pizzagalli DU)

DAY 3: May 18th: Analysis without tracking

Learning objectives. Understanding how image processing and computer vision techniques can be applied to analyze IVM data without the usage of cell tracking

9:00-10:30: From pixels to cell actions (Pizzagalli DU)

10:30-10:45 Coffee break

9:00-10:30: Recent trends in computer vision methods (Pulfer A)

12:30-14:00: *Lunch Break*

14:00-16:15: Practical session 3: Analyzing cell migration without tracking (Motility heatmaps, Action recognition, Optical flow, Colocalization)

16:30-17:00: Conclusion

DAY 4: May 19th: Social activity

09:00 – 12:00: Visit to the castles of Bellinzona

Organizers:
Dr. Santiago Fernandez González - Institute for Research in Biomedicine (CH)
Dr. Diego Ulisse Pizzagalli - Institute for Research in Biomedicine and Euler Institute, USI (CH)

Tutors:
Dr. Pau Carrillo-Barbera – The University of Edinburgh (UK)
Kevin Ceni – Institute for Research in Biomedicine (CH)
Diego Morone – Institute for Research in Biomedicine (CH)
Elisa Palladino – Institute for Research in Biomedicine (CH)
Alain Pulfer – Institute for Research in Biomedicine and ETH Zurich (CH)
Benedikt Thelen – Euler institute (CH)
Dr. Tommaso Virgilio - Institute for Research in Biomedicine (CH)