Imperial College London

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

Surf 64
ADVANCED OMIC PROFILING AND INTEGRATION
JULY 10-21, 2017 - ANGLET, FRANCE

SURF 64: STATISTICAL LEARNING USING REAL DATA & FEATURING 6-DAYS PROJECTS 4-DAYS LECTURES

Imperial College
MRC/PHE Centre for Environmental Health
University of Pau and Pays de l'Adour
Laboratoire de Mathématiques et de leurs Applications de Pau

MRC-PHE
Centre for Environment & Health

Public Health England   MRC Medical Research Council   Imperial College London   KING'S College LONDON

Contacts:
Dr Marc Chadeau-Hyam   ✉ m.chadeau@imperial.ac.uk
Prof Benoit Liquet   ✉ benoit.liquet@univ-pau.fr

CNRS dépasser les frontières

COURSE OUTLINE

SURF 64 aims to provide a comprehensive introduction to advanced statistical models to perform in-depth OMIICs screening using established methods and their latest extensions, in order to allow the integration of several OMICs profiles measured in the same individuals.

Specifically, the course will develop the theoretical background of these methods, their applicability to OMICs data in epidemiology and Health Sciences, and will feature a large proportion of practical work using real data: 6 full days on a project-driven research exercise and 4 afternoons of practical work.

SURF 64 proposes to build upon a statistical background such as the one taught in the parent Stat-XP course (Imperial College) or the Molecular Epidemiology Course (Utrecht University), and to present necessary extensions of these methods in order to:

- Accommodate complex study designs
- Improve results interpretability
- Handle multiple sets of OMICs data

In addition to regression-based profiling approaches, SURF 64 will also feature detailed exploration of machine learning approaches, including network inference and their practical application to real data.

COURSE OBJECTIVES

SURF 64 will enable research professionals with interest and experience in exploring OMICs data to enrich their methodological knowledge to more advanced techniques that are able to accommodate and exploit the OMICs data complexity in real life settings. To ensure the direct applicability of the methods, the course features practical sessions as well as group work as mini projects using real multi-OMIC data sets.

Participants will be able to run their own analyses at the end of the course (readily usable scripts from practicals will be provided).

COURSE AFFILIATION

SURF 64 is jointly led *by MRC-PHE Centre for Environment and Health, Imperial College* and the *Laboratoire de Mathématiques et de leurs Applications de Pau (LMAP), University of Pau and Pays de l'Adour*. It is a follow-up course from the MRC-PHE Centre for Environment and Health, Imperial College, Stat-XP course and the *Institute for Risk Assessment Sciences, Utrecht University* MEC course, which were part of the dissemination activities of the statistical workpackage of the FP7 EXPOSOMICS project, co-led by ICL and Utrecht University.

COURSE FORMAT

SURF 64 will take place at the UPPA-Anglet Campus in Basque country and will run from the 10th to the 21st July, 2017. The course comprises classical lecture-practical session but also features a full 6-days group work on real data including multi-OMIC data profiles and/or complex study designs. The course organisers will provide these datasets but participant can also submit a dataset they would like to see analysed during the course.

The course comprises a 6 full days group work on real data analysis (including multi omics data) that will be supervised by one contributor and regularly monitored by the teaching staff.

In the first week, established methods will be described together with their extensions needed to accommodate real-life situations. Methods to perform OMICS integration will also be introduced. During that week, participants will apply these methods on proof-of-principle datasets during practicals, and will incorporate them in their analytical plans for the group mini projects on real datasets.

At the beginning of week 2, participants will be asked to summarise and share their main analyses and results, and will be introduced to network modelling, which will be illustrated during seminars, practicals, and real-data analyses (to be implemented into each of the group mini projects).

SPECIFIC LEARNING OUTCOMES

After SURF 64, students will be:

- familiar with most OMICs profiling approaches and their extensions
- able to implement these approaches to analyse real life data, including specific designs, longitudinal data
- able to integrate different OMICs data in relation to an outcome of interest using correlation approaches
- able to infer network topologies for results interpretation and feature selection
- provide results in a reproducible and sustainable manner using open source

TARGET AUDIENCE

SURF 64 will be of interest to academics (students, and researchers), and scientists from the industry (pharmaceutical companies, insurance companies, food industries…). Experience in basic statistics, OMICs data and use of R statistical software is desirable.

Participants should bring their own laptops, and could submit a dataset they would like to analyse during the school.

Up to **30 participants** can register

MRC-PHE
Centre for Environment & Health

REGISTRATION/FEES

LOCATION/ ACCOMMODATION

Teaching will take place at the Biarritz-Anglet Campus of UPPA.
Accommodation is not included in the course fees, but negotiated rental fares are available for flats in Bayonne Student Residence: €200 for 2 weeks rental of a flat (limited availability).

CONTRIBUTORS

IMPERIAL COLLEGE LONDON (UK):

DR MARC CHADEAU-HYAM, Senior Lecturer in Statistical Bioinformatics, Dept of Epidemiology and Biostatistics. Honorary Reader, Utrecht University.

DR GIANLUCA CAMPANELLA, Honorary Research Fellow, Dept of Epidemiology and Biostatistics.

DR DAVID MULLER, Research Associate, Dept of Epidemiology and Biostatistics.

DR SABRINA RODRIGUES, Research Associate, Dept of Epidemiology and Biostatistics

MRS BARBARA BODINIER, Research Assistant, Dept of Epidemiology and Biostatistics.

UNIVERSITY OF PAU ET PAYS DE L'ADOUR, (FRANCE):

PROF BENOÎT LIQUET, Professor in Statistics, Member of LMAP. Affiliated to ACEMS, Queensland University Technology.

UTRECHT UNIVERSITY (NL):

DR ROEL VERMEULEN, Associate Professor, Institute for Risk Assessment Sciences (IRAS). Honorary Professor, Imperial College London.

DR LÜTZEN PORTENGEN, Senior Scientist, IRAS.

DR JELLE VLAANDEREN, Junior Assistant Professor, IRAS.

UNIVERSITY COLLEGE LONDON (UK):

PROF MARIA DE IORIO, Professor in Biostatistics, Dept of Statistical Science.

INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE (INRA-AGROPARISTECH) (FR):

DR JULIEN CHIQUET, Senior Researcher

INSTITUT NATIONAL POUR LA RECHERCHE MEDICALE (INSERM) (FR):

DR CYRILLE DELPIERRE, Senior Researcher, Université de Toulouse

INSTITUT PASTEUR (FR):

DR BENNO SCHWIKOWSKI, Group Head, Systems Biology Group

MRC-PHE
Centre for Environment & Health

PROGRAMME

MONDAY 10, JULY

INTRODUCTION: REFRESHER AND COURSE OBJECTIVES:

9.15-09:30 WELCOME AND REGISTRATION

9.30-11:00 LECTURE 1: *Statistical Challenges in Real Data Analysis*
Speaker: M Chadeau-Hyam

11:15-12:15 LECTURE 2: *Overview of the main OMICs profiling – Learning Objectives*
Speaker: B Liquet

13:00-13:45 LUNCH SEMINAR: *Example from EXPOsOMICS– Experimental studies*
Speaker: M Chadeau-Hyam

14:15-17:30 PRACTICAL: *Refresher on OMICs data analysis in R – Data sets presentation and exploration'*
Tutors: G Campanella, S Rodrigues, B Bodinier

TUESDAY 11, JULY

IMPROVING INTERPRETABILITY THROUGH GROUP PENALISATION:

09:30-11:00 LECTURE 1: *Group penalisation: theory and implementation*
Speaker: B Liquet

11:15-12:15 LECTURE 2: *Tutorial: Penalised and group penalised regression*
Speaker: L Portengen

13:00 -13:45 LUNCH SEMINAR: *Step-by-step application of sgPLS*
Speaker: B Liquet

14:00-17:30 PRACTICAL: *Practicals on grouping – Exploring datasets – Defining the analytical plan*
Tutors: G Campanella, S Rodrigues, B Bodinier

WEDNESDAY 12, JULY

OMICS INTEGRATION:

09:30-11:00 LECTURE 1: *OMICs integration – objectives and intuitive approaches*
Speaker: M Chadeau-Hyam

11:15-12:30 LECTURE 2: *OMIC integration using PLS and Bayesian approaches*
Speaker: B Liquet

13:00 -13:45 LUNCH SEMINAR: *Resampling – Stability analyses*
Speaker: G Campanella

14:00-17:30 GROUP WORK: *Implementing the analytical plan – main analyses*

THURSDAY 13, JULY

INTRODUCTION: REFRESHER AND COURSE OBJECTIVES:

9.30-12:30 GROUP WORK: *Implementing the analytical plan – main analyses*
13:00-13:45 LUNCH SEMINAR: *Risk modelling using high-throughput data*
Speaker: D Muller
14:15-17:30 GROUP WORK: *Reporting on preliminary analyses, formulating sensitivity-stability analyses – Result visualisation*

FRIDAY 14, JULY– SUNDAY 16, JULY

FREE GROUP WORK UNDER SUPERVISION: Each group has the opportunity to report to supervisors and ask for guidance
Preparing the outline of the results obtained in the first week.

MONDAY 17, JULY

RESULTS VISUALISATION:
09:30-10:30 LECTURE 1: *Methodological clarifications on issues encountered in Week 1*
Speaker: M Chadeau-Hyam/ B Liquet
10:45-12:00 LECTURE 2: *Reproducible results using RStudio-RMarkdown and GitHub*
Speaker: B Liquet

13:00 -13:45 LUNCH SEMINAR: *Multiple testing in practice: limitations*
Speaker: L Portengen

14:00-17:30 GROUP WORK: *Results visualisation, interpretation and presentation*

TUESDAY 18, JULY

NETWORK INFERENCE:
09:30-10:30 LECTURE 1: *Introduction to network modelling: Definition – Overview – Topology*
Speaker: M Chadeau-Hyam/ G Campanella
10:45-12:15 LECTURE 2: *Network theory: network and penalisation*
Speaker: J Chiquet

13:00 -13:45 LUNCH SEMINAR: *Application of network models using OMICs data*
Speaker: J Chiquet

14:00-17:30 PRACTICALS: *Network Inference*
Tutors: G Campanella, B Bodinier, J Vlaanderen

WEDNESDAY 19, JULY

FURTHER NETWORK MODELS:
09:30-11:00 LECTURE 1: *Differential networks: Definition and inferences*
Speaker: M de Iorio
11:15-12:45 LECTURE 2: *Sub-network models*
Speaker: B Schwikowski

13:00 -13:45 LUNCH SEMINAR: *Survival & Competing Risk models in high dimensional set-ups*
Speaker: B Liquet

14:00-17:30 GROUP WORK: *Implementing network models*

THURSDAY 20, JULY

NETWORK MODELS IN PRACTICE
09:30-12:30 GROUP WORK: *Implementing network models*

13:00 -13:45 LUNCH SEMINAR: *Utilisation of network modelling in exposome research*
Speaker: M Chadeau-Hyam

14:00-17:30 GROUP WORK: *Reporting on data integration and network models*

FRIDAY 21, JULY

NETWORK MODELS IN PRACTICE
09:30-12:30 GROUP WORK: *finalising analyses – presentation*

13:00 -13:45 LUNCH SEMINAR: *Perspectives: mechanistic investigation and causality*
Speaker: R Vermeulen

14:00-17:30 GROUP PRESENTATIONS

MAPS/DIRECTIONS

VENUE

UPPA ANGLET CAMPUS – PARC MONTAURY