

2023 SIS MID Module 15: Microbiome Data Analysis

Instructors:

Alexander V. Alekseyenko [Alex] (alexander.alekseyenko@gmail.com)

Michael Wu [Mike] (mcwu@fredhutch.org)

Course materials:

https://drive.google.com/drive/folders/1gyL845_CeYxUUC3N0aQ9IqjCd34P33kr?usp=share_link

Software:

We will use:

RStudio – the latest version you can get

R version 4.3.1 (2023-06-16) -- "Beagle Scouts"

dada2: <https://www.bioconductor.org/packages/release/bioc/html/dada2.html>

phyloseq: <https://www.bioconductor.org/packages/release/bioc/html/phyloseq.html>

and many other packages, which we will install during class.

Monday, July 24

8:00 am – 8:30 am Coffee

8:30 am – 10:00 am Class Session:

8:30 am – 8:45 am Introductions

8:45 am – 9:50 am Lecture 1: Microbiome assays and upstream informatics

10:00 am – 10:30 am Break

10:30 am – 12:00 pm Class Session:

10:30 am – 12:00 am Laboratory 1: Preprocessing sequences with DADA2

12:00 pm - 1:30 pm Lunch Break

1:30 pm – 3:00pm Class Session:

1:30 pm – 2:30 pm Lecture 2: Normalization, QC and alpha diversity Descriptive statistics

2:30 pm – 3:00 pm Laboratory 2: Working with microbiome data in phyloseq

3:00 pm – 3:30 pm Break

3:30 pm – 5:00 pm Class Session:

3:30 pm – 4:30 pm Lecture 3: Beta diversity, visualization and PCoA

4:30 pm – 5:00 pm Laboratory 3: Beta diversity, visualization and PCoA

Tuesday, July 25

8:00 am – 8:30 am Coffee

8:30 am – 10:00 am Class Session:

8:30 am – 8:45 am Questions and review

8:45 am – 9:15 am Lecture 4: Generalized multivariate analysis of variance and multivariate mediation analysis

9:15 am – 10:00 am Laboratory 4: Multivariate testing examples

10:00 am – 10:30 am Break

10:30 am – 12:00 pm Class Session:

10:30 am – 11:15 am Lecture 5: Kernel based analysis

11:15 am – 12:00 pm Laboratory 5: Kernels

12:00 pm - 1:30 pm Lunch Break

1:30 pm – 3:00pm Class Session:

1:30 pm – 2:30 pm: Lecture 6: Univariate methods

2:30 pm – 3:00 pm: Laboratory 6: Univariate methods

3:00 pm – 3:30 pm Break

3:30 pm – 5:00 pm Class Session:

3:30 pm – 4:15 pm Lecture 7: Machine learning with microbiome data

4:15 pm – 5:00 pm Laboratory 7: Clustering and classification

Wednesday, July 26

8:00 am – 8:30 am Coffee

8:30 am – 10:00 am Class Session:

8:30 am – 8:45 am Questions and review

8:45 am – 9:15 am Lecture 8: Predicting metagenomic composition from 16S survey data

9:15 am – 10:00 am Laboratory 8: Working with functional data

10:00 am – 10:30 am Break

10:30 am – 12:00 pm Class Session:

10:30 am – 11:00 am Lecture 9: Networks and Miscellaneous Topics

11:00 am – 11:30 am Laboratory 9: SpiecEasi networks tutorial

11:30 am – 12:00 pm Questions, feedback, references, resources