

ML-based stratification of lung dysbiosis types in people with Cystic Fibrosis

Lung Microbiome | Dysbiosis | Patient Stratification | Data Science | Complex Systems

Project description

Bacterial infections cause millions of deaths each year in people with chronic lung diseases, such as COPD, fibrosis, or cystic fibrosis (CF). These lungs show marked dysbiosis - a pathological imbalance of the lung microbiota that causes acute disease exacerbations and enhanced mortality of those patient collectives.

Recently, we have identified three distinct dysbiosis types in an extensive US collection of CF lung microbiome samples that displayed divergent microbiome organization and markedly different treatability^{1, 2, 3}. **In this MSc project**, we propose to establish a ML model to learn ecological dysbiosis properties for patient sample classification. Moreover, the model should be used to quantify the impact of individual Care Centers on the establishment of dysbiosis types and their classification. A successful candidate will help to advance our understanding of complex pulmonary infections and ideally contribute to a scientific publication.

Requirements

- Enthusiasm for microbiome research
- Programming in R or Python
- Experience with ML concepts and their implementation (ideally semi-supervised methods)
- Interest in statistical modeling
- Spoken and written English

Contact details and application

We offer a Master thesis project in a young, computational research lab (<https://innere-med-1.meduniwien.ac.at/widderlab>) at the Research Division Infection Biology of the Medical University. Please send your CV and application to stefanie.widder@meduniwien.ac.at.

We are looking forward to hearing from you!

References

1 Widder, S., Carmody, L.A., Opron, K. et al. Microbial community organization designates distinct pulmonary exacerbation types and predicts treatment outcome in cystic fibrosis. *Nat Commun* 15: 4889 (2024), doi 10.1038/s41467-024-49150-y

2 Widder S., Zhao J., Carmody L.A., et al. Association of bacterial community types, functional microbial processes and lung disease in cystic fibrosis airways. *ISME J.* 16:905 (2022), doi 10.1038/s41396-021-01129-z.

3 Quinn, R.A., Whiteson, K., Lim, Y.W. et al. Ecological networking of cystic fibrosis lung infections. *npj Biofilms Microbiomes* 2, 4 (2016), doi 10.1038/s41522-016-0002-1

