

Scientific research improves our understanding of the influence of the 'environment' on human health and well-being. As 'environment' we should understand not only climate, different types of pollution, or how friendly the city design is but also all organisms (microbiome) that are living in our surrounding (city, work, home), 'on us' (skin) or 'in us' (gut). All these together are known as 'exposome'.

Thanks to technological advancement in past years we are now able to study those microbiomes more effectively and learn the ways of how they are affecting us. There are projects focusing on gut microbiome and its connection with diseases (e.g. inflammatory bowel syndrome or ulcerative colitis) while others are studying skin microbiome or what lives in our urban surroundings e.g. public transport systems such as subways.

All these studies, however, are mostly focused on the exploration and uncovering which bacteria/viruses/fungi we do see, what could be their function and what it really means to us and to our well-being. The missing component of those studies is knowledge and understanding of why some species are living together in specific places. The gain of such knowledge is crucial for understanding the complex functions of those microbes and what is their influence on our lives. Microbiomes should be seen as one 'meta-organism' where different organisms are delivering unique functions that provide a self sustainable living environment for them.

In our project, we will aim to discover those unknowns with novel Data Science and Big Data approaches for better understanding of such 'meta-organism', how certain species are contributing to the society, what are the dependencies among them in terms of their or our survival and reveal any visible and discreet connections between them. We will look at selected problems from three complementary views: i) who is there among known organisms, ii) what 'actions' are seen, iii) what is the composition of genetic material found. We will then combine this knowledge and explore it with context-specific information. This novel approach will allow us to discover new functionalities and/or new species that are relevant for the interesting phenomena.