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A machine learning based investigation into brain-gut axis

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Abstract:
An increasing amount of scientific evidence suggests the presence of bi-directional relationships between the human brain and gut, which are assumed to be modulated by large colonies of gut microbiome through neural signalling and systemic circulation channels [1,2]. The changes in gut microbial composition are suspected to influence brain function and alter its output. In turn, the brain potentially affects gut related variables including motility, transit time and motor complexes, which lead to certain functional gastrointestinal disorders (FGID) such as Irritable bowel syndrome (IBS). According to an estimate, about 10% of the total world population suffers from IBS, where the bowel habits of patients are altered due to either constipation or diarrhoea or both. However, the exact aetiology of IBS is yet unknown, which impedes its effective clinical management and treatment. A significant overlap of IBS symptoms with other FGIDs further complicate its accurate diagnosis in clinical settings.

In our EU funded BrainGutAnalytics project, we have lodged a data-based inquiry into the brain-gut axis by taking IBS as its special case. We collected large amounts of clinical and biological data from a cohort of IBS patients and healthy control (HC) participants [3]. This data is then processed using a variety of machine learning and statistical modelling techniques to search for unique clinical signatures and biological patterns that can be used as exclusive biomarkers for IBS. Our research is expected to shed new light on the underlying pathophysiology of IBS leading to the development of novel and effective mechanisms for its diagnosis and treatment. A generalisation of our findings on IBS will allow improved understanding and knowledge on both the nature and mechanics of the brain-gut axis.

Scientific area: LIF Life Sciences

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