Advancing our understanding of complex diseases using AI

STFC Hartree® Centre worked with IBM through the Hartree National Centre for Digital Innovation (HNCDI) to develop an AI-enabled multi-omics integration software to enhance understanding of multi-factorial conditions such as inflammatory bowel disease.

Challenge

Inflammatory bowel disease and bowel cancer are classified as multi-factorial diseases due to the numerous complex biochemical processes that can influence their development. To study these diseases and allow disease prediction and prevention, it is essential to collect and analyse data from multiple biological sources, including genes, proteins and metabolites, a process known as multi-omics. However, due to the complexity and resource requirements of multi-omics analysis, both academia and industry often lack the computing power and software necessary to extract valuable insights from their data. Our team aimed to address this challenge by developing an AI-enabled multi-omics integration software.

Approach

Our team created software that integrates open-source multi-omics data for explainable machine learning analysis. The results offer valuable insights into disease prediction and identify explainable omic features linked to disease onset. The software was tested using inflammatory bowel disease and bowel cancer datasets and, after optimisation, achieved a prediction accuracy of 92%. Additionally, the software enabled the identification of key bacteria in the gut and the chemicals they produce that may contribute to inflammatory bowel disease and bowel cancer. This could potentially assist in expanding our understanding of other multi-factorial diseases faster.

> "This project has provided HNCDI with the capability for rapid AI-enabled multi-omic integration analysis, resulting in novel disease insights for complex disease"

Jennifer Kelly
IBM Research

Credit: Pexels

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Benefits

By identifying key factors that contribute to multi-factorial diseases, we are improving our ability to predict and prevent disease onset. The software offers an automated, high-throughput AI-enabled capability that can accelerate discovery. This tool could drive personalised medicine, improving patient outcomes. Its deployment has the potential to aid disease research by reducing the time from data generation to actionable insights, supporting advancements in life science and healthcare, possibly leading to more effective, targeted treatments.
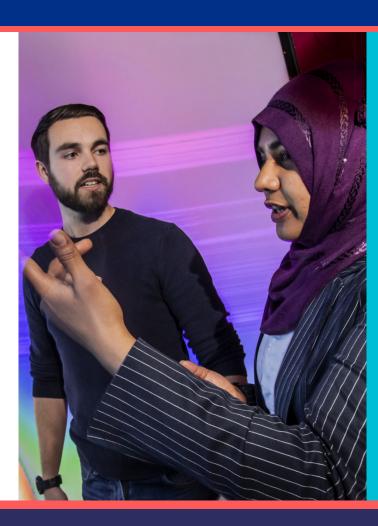
At a glance

- Shortened the time it takes to analyse data and gain a deeper understanding of a disease

- Automated, high-throughput capabilities could speed up research discoveries in life sciences

- AI-enabled software could further personalised medicine by broadening our understanding of multi-factorial diseases

- Paves the way for more effective, tailored treatment options for patients

Who we are

The Hartree Centre was created by UK Government to help businesses and public sector organisations accelerate the adoption of high performance computing (HPC), big data analytics, artificial intelligence (AI) and quantum technologies. We play a key role in realising UK Government's Industrial Strategy by stimulating applied digital research and innovation, creating value for the organisations we work with and generating economic and societal impact for the UK. We are proud to be part of UK Research and Innovation.

What we do

- Boost productivity and innovation for industry
- Offer training and skills development
- Provide insights into future technologies
- Give tailored business development support
- Build bespoke small teams around your project