FF4EuroHPC Success Story

High-Performance Computing Enhances Treatment Precision in Breast Cancer

Organizations

CHOSA is a UK SME developing techniques to predict outcomes of treatments with anticancer drugs in patients using molecular models based on data from cell cultures exposed to drugs and selling this as a service to health providers.

AH-HMU from the Hellenic Mediterranean University has a deep experience in molecular pharmacology and cancer biomarker identification.

JADBio is a Greek SME developing the JADBio automated Machine Learning (autoML) platform for biomedical tasks, providing life-science professionals with effective and easy analysis of molecular and clinical data (RNA, genomics, etc.) with an accessible user interface.

End User

CHOSA
INTELLIGENT CYTOTOXICS

Domain Expert

HELLENIC MEDITERRANEAN UNIVERSITY

Technology Expert

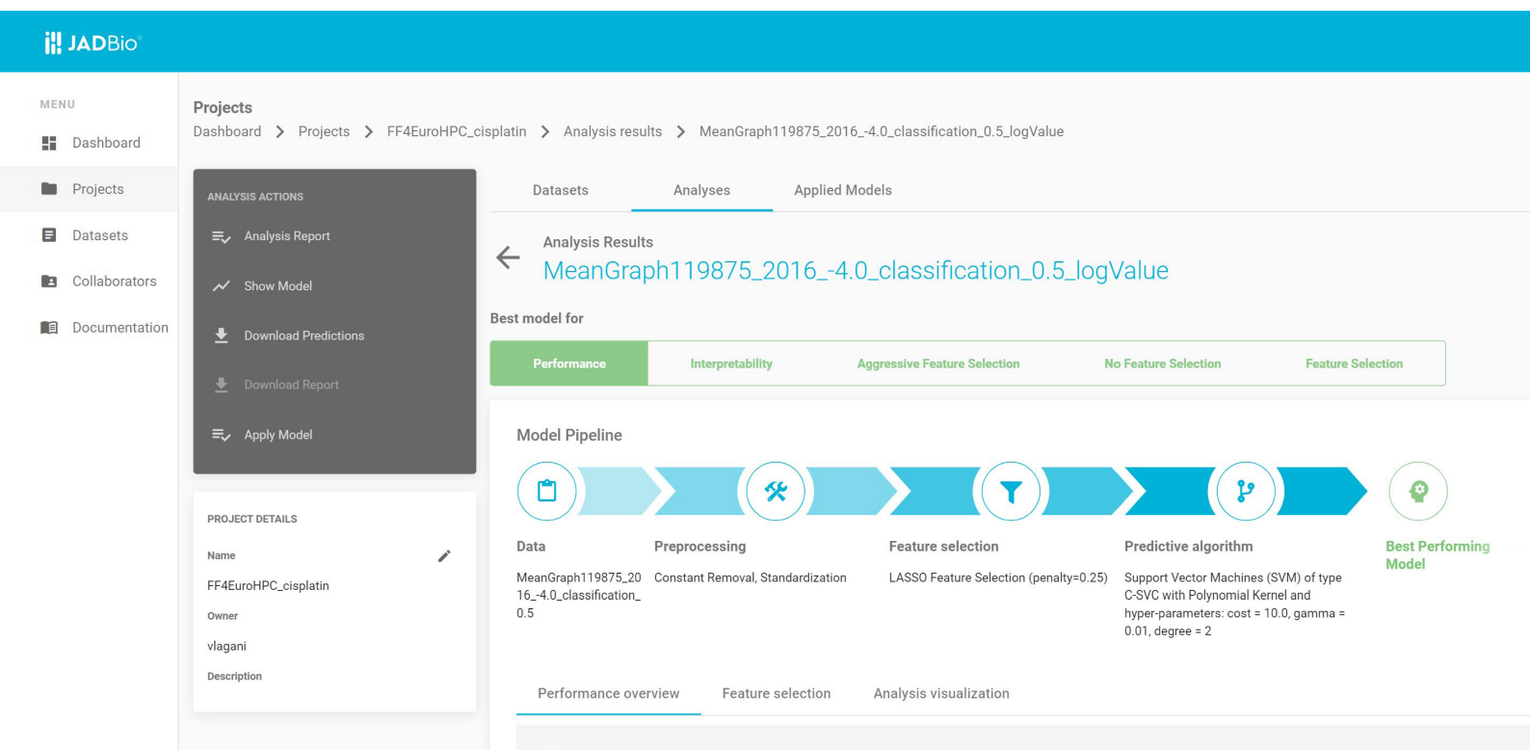
JADBio®

The Challenge

Breast cancer continues to be a major health issue with 2.3 million annual breast cancer cases and 685,000 annual deaths globally. Many cancer patients fail to respond to their treatment, resulting in heavy human and economic loss. This lack of efficacy is mainly attributed to host/tumour variations at the genetic and molecular level, which clinical practice still struggles to address.

The emergence of new genomic technology combined with digitalization has delivered treatment regimens that assess the DNA, RNA, protein, and metabolites in the individual patient's tumour and integrate those into therapeutic decision-making. However, current technologies focusing on just one or a few genetic biomarkers or using complex ex vivo laboratory tumour models are predictive of treatment outcomes only in highly selected cases and difficult to implement effectively.

CHOSA's aim is to implement an easy-to-use and intelligent platform which can identify the drugs most likely to achieve high effectiveness in each individual patient based on the specific patient's molecular profiles.



Industry Sector
Healthcare

Technology used:
HPC, ML

The Solution

The experiment carried out extensive analyses of a huge volume of publicly available data. The NCI-60 data set links 60 human cancer cell lines representing different types of cancer to the anticancer activity of over 50,000 compounds. Using specific quality criteria, which were defined at the start of the experiment, 5,986 compounds out of those over 50,000 were selected for further analysis, including 335 drugs that are FDA-approved or in trials. Using the JADBio autoML platform and HPC resources, ML models for the selected compounds were built to predict the anticancer efficacy of each compound. As a means of early validation of the ML models, biological text mining was carried out independently. It revealed eight specific models which are particularly interesting for breast cancer, all of which were among the promising models also identified by ML. After further validation, the models will be used to set up a complete platform called 'Allied Intelligence for Drug Accuracy' (AÏDA) which predicts the efficacy of different cancer drugs for each individual patient, based on their biopsy readings. Clinicians will receive a report listing a large number of relevant drugs that highlight those most likely to work for a given patient's cancer.

The Impact

The AÏDA technology has a huge potential to support clinicians in their choice of treatment. No similar solutions exist at the moment and therefore AÏDA has the opportunity to become a first-in-market product that can truly revolutionize the way cancer patients are treated.

CHOSA is planning to focus on breast cancer initially. With a breast cancer incidence of over 780,000 in 2018 in the EU and USA alone, there is a huge market potential to be exploited with such a commercial response prediction test – even using very conservative assumptions. The market launch is expected in mid-2024 in Germany and Nordic countries, where 23,000 cases of breast cancer are newly diagnosed per year, offering a business potential of up to €69m, based on an anticipated price of €3,000 per service.

Beyond those initial targets, the business model is highly scalable and the system can be applied to any tumour type and any drug that has demonstrated toxicity.

Besides direct economic and clinical benefits, all partners will enjoy increased visibility in the biomedical market and scientific community, generate new intellectual property, and foster company growth. The HPC-based solution can play a role as a use case for promoting other diagnostic/prognostic/predictive applications in the field of personalized medicine, fostering wider application.

Benefits

- CHOSA targeting a USP in a market worth €69 million in Germany and Nordic countries leads to an expected additional turnover of several million Euro from mid-2024.
- More cancer patients with limited disease get the right treatment which could be lifesaving.
- More cancer patients with advanced disease live longer by avoiding ineffective treatments.