FUJITSU

Bayer

Quantum-inspired computing's potential to raise yields

Bayer engaged in a proof of concept with Fujitsu's Digital Transformation services, assessing the power of the quantum-inspired Digital Annealer to solve complex challenges relating to seed production planning and materials campaign scheduling. Bayer strives to create more robust supply chains and richer yields for farmers.

Challenge

As the leader in global seed production, Bayer constantly innovates to ensure the quality and availability of products for farmers. Increasing solution speed and the efficiency of product planning and scheduling are key and limited by conventional solvers.

Solution

Bayer experimented with quantum-inspired computing using Fujitsu's Digital Annealer to increase the number and combination of variables that can simultaneously be processed – thereby optimizing seed production planning and materials campaign scheduling.

Outcomes

- Proven feasibility of more complex campaign scheduling
- Potential to enable more efficient and robust supply

"Quantum computing has the potential to play a vital role in ensuring we can fulfill our ultimate ambition: health for all, hunger for none."

Dr. Ulf Hengstmann, Digital Transformation Lead, Bayer

300
seconds for a high speed hybrid quantum solution

Increasing agricultural efficiency

Bayer Crop Science is always looking for smarter, more efficient ways of working to ensure a stable robust supply of seed for its farmer customers. For example, the complex world of materials campaign scheduling involves huge volumes of data relating to location, cost, yield, and climate. Bayer uses conventional solvers to calculate the variables and optimize production in the most cost-effective and efficient way possible. However, they are exploring whether quantum computing can solve materials campaign scheduling across a global network of production sites, connect integral parts of the production network, and unlock patterns more quickly and precisely to reduce risk and optimize production yields.

"Every variable we add to the equation increases the complexity exponentially, taking more time. However, quantum-inspired computing, which goes beyond binary ones and zeroes, promises to handle a tremendous number of variables," explains Dr. Ulf Hengstmann, Digital Transformation Lead at Bayer. "Fujitsu has been our application management partner for many years, so it was natural to talk to them about their Digital Annealer."

Introducing quantum-inspired computing

Fujitsu's Digital Annealer provides an alternative to quantum computing technology, which is expensive and difficult to run. Using a digital circuit design inspired by quantum phenomena, the Digital Annealer focuses on rapidly solving complex combinatorial optimization problems, without the added complications and costs typically associated with quantum computing methods.

Fujitsu and Bayer carried out two proof of concepts (POCs) to test the platform: one smaller POC looking at seed planning, and a much broader engagement exploring the complex materials campaign scheduling process with close to 1,200 materials, across a global network of locations. They worked in small teams of highly skilled business leaders and operations research scientists, including several PhDs from both organizations. The collective team defined an extensive set of models and decomposition methodologies, while leveraging AI/Machine Learning for the data transformation and pre-processing phase and the Digital Annealer and classical solvers to unlock a solution not previously possible.

"Our vision is an end-to-end connected supply chain, leading to increasing size and complexity of our models. Thus, we are always looking for new technologies and modeling approaches," adds Dr. Stefan Troester, Head of Supply Chain Simulations & Analytics at Bayer Crop Science. "We selected the challenge, outlined the constraints and variables, then discussed with the modelling team. Fujitsu's modelling expertise was impressive. We fed the data into the Digital Annealer and within five minutes we had an optimized solution to our campaign planning challenges." This problem had not previously been solved, earmarking a new approach for sustainable manufacturing through more efficient production lifecycles.

Industry:
Manufacturing

Location:
USA

Website:
bayer.com

About the customer

Bayer is a Life Science company with a history of more than 150-years and has core competencies in the areas of healthcare and agriculture. Its innovative products are contributing to finding solutions to some of the major challenges of our time. The Bayer Group is managed as a life science company with three divisions – pharmaceuticals, consumer health, and crop science. In 2021, the Bayer Group composed of 374 consolidated companies in 83 countries.

1,200+
materials in the campaign scheduling POC

Robust, sustainable supply chains

The quantum inspired Digital Annealer has the potential to transform how Bayer plans its campaigns, enabling a more complete model of Bayer production processes with all the variables to solve problems in seconds. This could, in turn, increase efficiency and make supply chains more robust and sustainable.

"We live in a world with an aging population and diminishing cropland that can support plant life. Within agriculture, a robust supply chain can have a huge impact on food production and, consequently, nutrition," concludes Hengstmann. "Quantum computing has the potential to play a vital role in ensuring we can fulfill our ultimate ambition: health for all, hunger for none."

Customer:

Fujitsu

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