Argonne scientists employ machine learning to accelerate industrial design optimization process

Argonne National Laboratory

Through machine learning, ML-GA technology from the U.S. Department of Energy's (DOE) Argonne National Laboratory can speed up the product development process, cutting months off the time it takes for products to reach consumers.

In manufacturing, the traditional approach to design optimization of a new product involves a lot of experimental testing, evaluating prototypes, and multiple design iterations. One popular optimization method involves genetic algorithms (GA), which use principles of natural selection to identify the design elements that will lead to the best results.

As the volume and complexity of data increase, industry increasingly relies on high-fidelity computer models as virtual representations of real-world devices during the optimization process. This strategy is faster than physical development and testing, but it still can require two to three months to arrive at an optimal design.

Argonne's innovation uses machine learning (ML) models as surrogates for the slower high-fidelity models to improve the GA design optimization process. It takes just days to optimize a design using Argonne's ML-GA method, rather than the months needed using current state-of-the-art methods. Faster optimization, in turn, leads to faster technology development and faster delivery of advanced technologies to consumers.

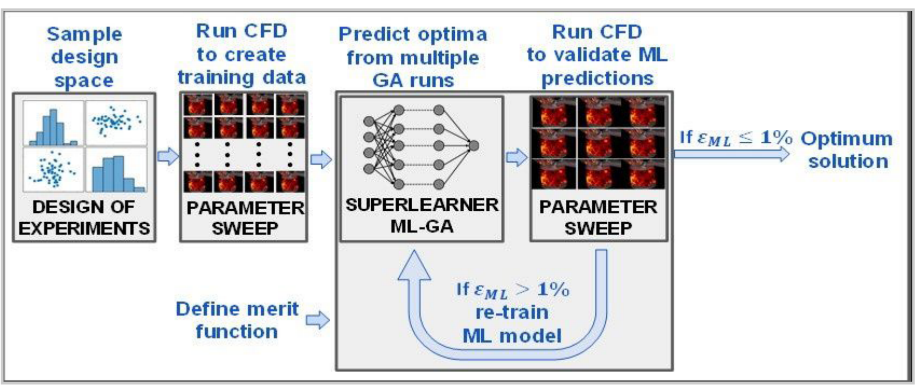
The ML-GA technology was transferred in January 2021 to Parallel Works Inc., an innovative start-up company in Chicago. The technology transfer allowed Parallel Works to integrate ML-GA into its commercial platform as a new add-on package called Learner Works.

This integrated platform has already attracted early adopters and evaluators from a wide range of manufacturing industries, including automotive, consumer goods packaging, and hydrological engineering. In addition, Parallel Works is working with researchers at New York University to evaluate its use in the design of colloidal materials and predicting biophysical properties of proteins.

The technology transfer process, coordinated by Argonne's Science and Technology Partnerships and Outreach directorate, involved two complementary mechanisms.

The first mechanism involved the DOE's Technology Commercialization Fund (TCF) program. Argonne and Parallel Works submitted a joint TCF proposal, which was selected for a funding award in 2018. The TCF program required Parallel Works to enter into a multi-year cooperative research and development agreement (CRADA) with Argonne to formalize the partnership and streamline the technology transfer process.

The second mechanism was a technology license agreement, which provided Parallel Works with rights to commercialize Argonne's copyrighted ML-GA software technology.



Right: *A schematic of Argonne National Laboratory's ML-GA optimization algorithm. (Image courtesy of Argonne National Laboratory and Parallel Works.)*