Optimising neural networks in production control

The Training Factory 4.0 as part of the first globally distributed neural production network at the University of Potsdam / Brandenburg (Germany)

Research / Application Area: Expansion of research into the application of artificial intelligence in production control | Deployment period: 2022

THE CHALLENGE

A neural network is a programme or model for machine learning that makes decisions in a similar way to the human brain. Neural process simulations according to Grum (2022) prove that neural networks (ANN) can work productively and in a process-orientated manner. The University of Potsdam has conducted various research series on how process quality can be improved using neural networks. One of the experiments used distributed neural networks to control various locations around the world with different IT systems and to illustrate frictional losses in global production chains. To this end, simulation tools had to be found that could deliver valid research results and meet the requirements of the University of Potsdam both haptically and virtually.

"With the fischertechnik Training Factory 4.0, we can expand previous research into the control of artificial knowledge transfer as a coordination tool.

Prof. Dr. Grum,
Lecturer

THE SOLUTION

The fischertechnik Training Factory 4.0 was used in combination with other simulation tools and a neural twin to simulate global production control processes. In a series of simulations on jam production, it was assumed that products are manufactured at four different production sites around the world, which have different IT systems (Grum 2024a; Grum 2024b). All processes were analysed, from the procurement of fruit to distribution to the customer. The fischertechnik Training Factory 4.0 was one of four networked haptic production stations. The process was simulated in the system, from storing the fruit and feeding it into the cooking machine for jam production to filling the jars and delivering the products. The haptic model was connected to a neural network (ANN - Artificial Neural Network). This allowed series of tests and experiments to be carried out that produced valid results and revealed production inefficiencies (Grum, 2024a). Furthermore, management interventions were derived from these that can avoid such inefficiencies (Grum, 2024b). Future research will therefore focus on the empirical testing of ANN instructions and corresponding management interventions that arise in real real-time productions.

Sources:

Grum, M. (2022). Construction of a concept of neuronal modeling. Springer Nature.

Grum, M. (2024a). Researching Multi-Site Artificial Neural Networks' Activation Rates and Activation Cycles. In International Symposium on Business Modeling and Software Design (pp. 186-206). Cham: Springer Nature Switzerland.

Grum, M. (2024b). Managing Multi-site Artificial Neural Networks' Activation Rates and Activation Cycles: Experiments on Cross-Enterprise, Multi-site Deep Learning Systems. In International Symposium on Business Modeling and Software Design (pp. 258-269). Cham: Springer Nature Switzerland.

FIT FOR FUTURE WITH FISCHERTECHNIK!

The production of tomorrow is a subject of research, industry, and higher education. It describes the transformation towards agility, customer orientation, artificial intelligence, and Industry 4.0. This gives rise to a variety of challenges influenced by technological developments, societal changes, and global trends. Addressing these challenges requires a holistic and proactive approach from companies that invest in innovation and employee training to successfully shape tomorrow's production and remain globally competitive.

Therefore, our approach is: Understand the small before implementing on a large scale. With fischertechnik simulation models, you prepare yourself for the future, create sustainable learning experiences in vocational education and university studies, overcome hurdles presented by seemingly complex transformations, and conduct research on future topics.

"Based on the experiments, we were able to identify inefficient processes in neural production control and derive management interventions to harmonise the neural structure."

Prof. Dr. Grum,
Lecturer

THE RESULT

By conducting the designed experiments, the effects of inefficient knowledge flows under ANN-based Industry 4.0 systems can be systematically analysed. This enables not only the identification of weak points, but also the development of targeted strategies to optimise knowledge flows and improve overall productivity.

fischertechnik

www.fischertechnik.de/simulation

fischertechnik GmbH
Klaus-Fischer-Str. 1 , DE - 72178 Waldachtal
Tel. +49 74 43 / 12-43 69, Fax +49 74 43 / 12-45 91
E-Mail: info@fischertechnik.de