BIBA

Methods for Planning and Control

AUTOLERNEN

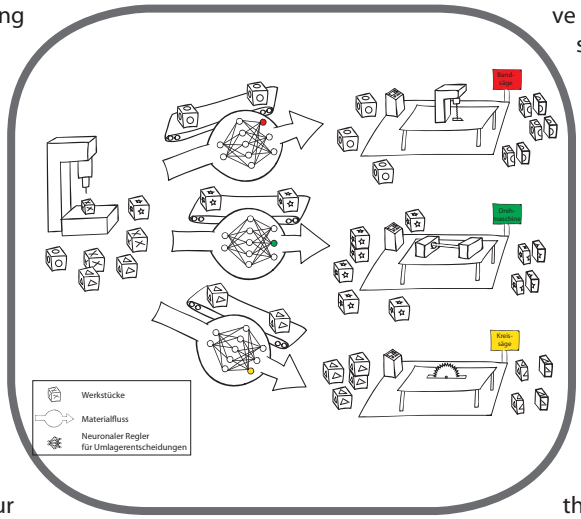
LONG TERM BEHAVIOUR AND CONTINUOUS LEARNING OF NEURAL NETWORKS

Today's production processes are subject to continuous changes. The complex and dynamic production environment is defined by multi-variant and individual customer products that are merely manufactured for a short period of time. This results in serious challenges concerning the flexibility and the efficiency of production planning and control systems. Consequently, well established approaches reach their limits. In order to stay competitive, companies depend on the further enhancement of methods and concepts for these systems. In this context, methods of artificial intelligence are increasingly in the focus of research. Embedded in decentralized control structures, bio-inspired approaches proved their applicability in production planning and control.

Founded by

DFG

Artificial neural networks represent one of these approaches. Being mathematical models of neural systems, they are able to learn from experience and can adapt flexibly to changing conditions. Like their natural counterpart, they are characterized by fast and parallel data processing. Due to their little modelling and calculation effort, they find versatile use in the field of production, for example in machine control or the prediction of delivery dates. However, shortcomings concerning the quality of long term learning prevent a widespread application in production planning and control systems. Therefore, the DFG funded project "Long term behaviour and continuous learning of neural networks - AutoLernen" analysed the learning behaviour of various neural networks by long term experiments. The goal of this research project was to obtain sound insights concerning the durability and the maintenance required with regard to the application in the long run. From the collected data, automated approaches were deduced that ensure the efficiency of the continuous learning process. Besides the selection of suitable networks and the task specific modelling of the respective networks, the collecting and editing of the training data as well as the defining of a close to optimal ratio between the long-term and the short-term memory was part of the research. The comparative evaluation of potentially suitable network types and configurations was carried out by long term simulation experiments with a duration of up to five years. Ranging from a simple model with nine machines to a real scenario derived from a regional manufacturer of production systems, material flow scenarios of job shop manufacturing with differing degrees of complexity represented the basis of the analysis. At this, neural networks acted as controllers in inventory and capacity based control circuits. Furthermore, they were used as instruments for prediction in the context of a superior control strategy. Based on the results of the experiments, a situation adaptive production control concept based on neural networks was developed.



The Bremer Institut für Produktion und Logistik GmbH (BIBA) at the University of Bremen is divided into two departments, the department of „Intelligent Production and Logistics Systems" (IPS) and the department of „ICT applications for production" (IKAP). Based on distinct fundamental research, the BIBA focuses on application-oriented research and industrial contract research for national as well as international customers in the fields of logistics services, automobile, aviation and wind energy.

CONTACT

FLORIAN HARJES
Tel.: +49 (0) 421 218 50102
Fax: +49 (0) 421 218 50003
haj@biba.uni-bremen.de

JEANETTE MANSFELD
Tel.: +49 (0)421 218-50125
Fax: +49 (0)421 218-50003
man@biba.uni-bremen.de