Institute for Machine Tools and Industrial Management (*iwb*)
TUM School of Engineering and Design
Technical University of Munich

Research internship: Artificial Intelligence based robust Production Planning

Motivation

Enhancing disruption prevention is crucial in manufacturing companies, given the rising susceptibility to production outages. In industrial practice, disruptions are typically not considered in product planning. Alternatively, surcharges are estimated and added to the planned lead time to account for possible disruptions, usually ranging from 10 to 20 % of the lead time. These surcharges aim to improve on-time delivery; however, extended lead times can deteriorate crucial logistical parameters.

Due to disruptions, manufacturing companies aim to enhance the robustness and high resolution of production planning and control (PPC) through digitalization measures. Artificial intelligence (AI) approaches enable the consideration of probable disruptions at early planning stages. This methodology allows for situation-dependent and data-based decisions regarding lead time buffers.

Most manufacturing companies, especially small and medium-sized enterprises (SMEs), recognize the necessity for ameliorating IT support for PPC activities and duties. For AI-sustained and sturdy production planning, SMEs must contemplate how to foresee disruptions using AI in PPC minus entirely digitized processes in production management and hence without massive troves of data. There is potential to decrease lead times and material inventories by avoiding overly large buffers and improving adherence to delivery dates.

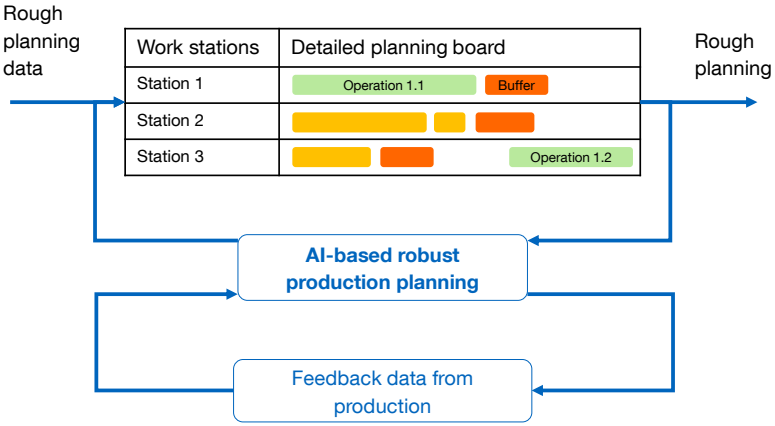
Objective

Considering the specific needs of small and medium-sized enterprises, including the limited data availability, a resilient and AI-driven method for producing planning is undergoing development and validation. The production planning process considers and anticipates interruptions from personnel, materials, operational resources, inventory, process, and IT on a situation-based and preventive level. For this

purpose, it is necessary to consider existing production data, such as movement and machine data, and combine it with data from the operational system landscape. This will enable the use of the information base for production planning and anticipating potential disruptions in the production system. Historical and current feedback data, including quality data, real-time data, and actual production sequences, are used to assess the risk of disruptions in individual operations. Based on this, orders are buffered in advance to compensate for possible disruptions.

AI processes information to make statements on critical orders or workstations and their susceptibility to disruptions. The modeling results serve to create resilient production plans.

In this manner, time buffers can be adequately sized and adjusted to the potential for disruptions to the current planning situation, ultimately reducing lead time and circulation stock via a more precise determination of the buffer. A demonstrator incorporating an AI model utilizing authentic company data demonstrates the viability of the research objective.



Qualifications

- Currently studying or showing keen interest in areas like Computer Science, Operations Research, Industrial Engineering, or related fields.
- Some exposure or a strong interest in AI-based production planning.
- Willingness to learn and use Python for research and practical demonstrations, even if not proficient.
- Demonstrated interest in self-directed learning and an openness to explore unfamiliar topics.
- Ability to convey thoughts and findings effectively in written form and verbally.
- Independent, determined, and structured way of working.
- Solid English communication and writing skills; German is beneficial.

Why *iwb*?

- personal and thematic supervision
- professional perspective at an excellent institute of the TUM

Contact

M.Sc. Julian Stang
Department Production Management and Logistics
Mail: julian.stang@iwb.tum.de
Tel.: +49 89 - 289 15549