COGNITIVE LINE BALANCING SUPPORT

Recommending Assembly Work to Station Assignment & Dependency Mining based on Historical Data

Pro²Future

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MOTIVATION & GOALS

- Assembly line balancing is a **complex** and **time-consuming** process
- Experts rely on **tacit** knowledge of **prior balancing solutions** and assembly requirements (tasks dependencies, resources availability, etc.)
- **Explicitly modelling** all dependencies is not only a very **costly** (because time consuming) task but also **quickly outdated**.
- Instead, our goal is to rely on **prior balancing solutions** to find similar situations, and produce a baseline balancing solution and learn the assembly dependency graph

Project FactBox

Project Name Line TACT
Project ID MFP II 2.2 CSA
Duration 24 Months

Area 2
Cognitive Robotics and Shop Floors

Project Lead
DI Michael Mayrhofer

APPROACH

- Investigating multiple **metrics** to calculate **similarities** to available balancing solutions of **different products**.
- **Recommendations** of assembly work to **station assignment** based on the calculated similarities.
- On average our approach provides recommendations for **91.5%** of assembly tasks at **82%** precision.
- **Mining** of assembly **dependencies** between tasks based on different tacts and available similar products.
- Assembly task **sequence recommendation**, **inconsistency detection**, and **repair** based on the mined dependency graph.
- Integrating error **feedback** from users.

CONTRIBUTION

Scientific contribution
A novel approach based on structural similarities between assembly tasks of different previously balanced products to recommend task to station assignments and learn assembly tasks dependencies.

Economic contribution
This approach considerably reduces the time and effort currently invested by manufacturing companies to initially balance new processes and rebalance existing ones. The mining approach automatically produces a dependency graph, otherwise outdated, incomplete, or altogether unavailable for manufacturing companies.

PROTOTYPE

Automatically produce a baseline balancing solution

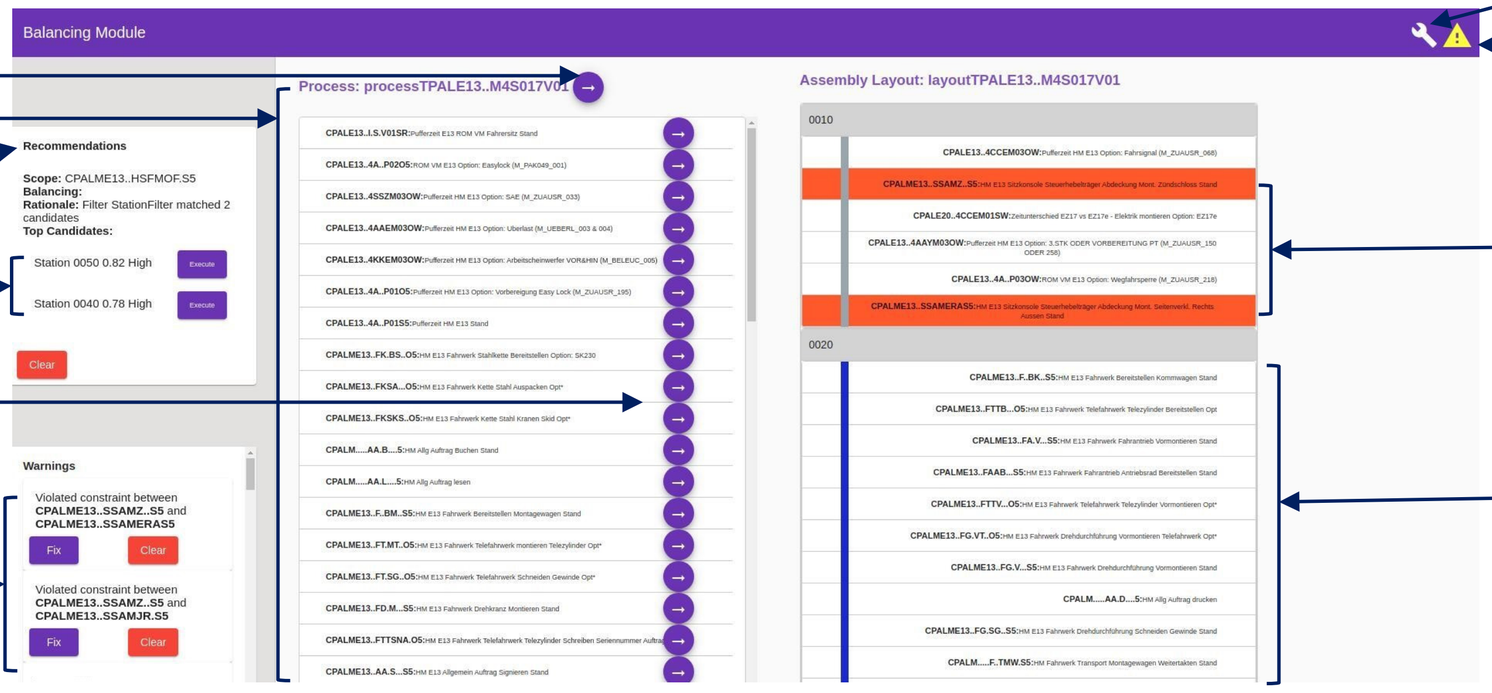
The process to be balanced

Displayed Recommendations

Recommended stations with the estimated accuracy

Request individual recommendations per task

List of produced warnings with individual fix solutions



Automatic warning fix
Enable warnings

Highlighted steps of selected warning violating the leaned dependency graph

List of steps automatically assigned to stations with the visible estimated accuracy

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