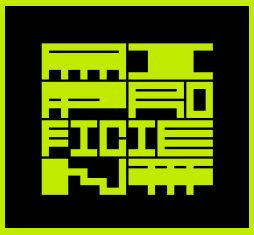

AI·PROFICIENT

Artificial *in*telligence
for improved *pro*duction ef*fici*ency,
quality and mai*nt*enance

Overview

AI-PROFICIENT will develop a technical and business ecosystem to demonstrate the potential for improved performance in production plants, by bringing the advanced AI technologies to production lines and facilitating the cooperation between humans and machines. In this regard, AI-PROFICIENT proposes an evolution from hierarchical and reactive decision making for plant automation towards self-learning and proactive control strategies that take full advantage of integration of advanced AI technologies with production plants. In order to demonstrate improved performance through AI technologies, 3 pilot sites (Continental AG, Ineos O&P Geel, Ineos Phenol) have been chosen in which different use cases have been chosen to improve the performance using different AI technologies. Below are the different use cases of AI-PROFICIENT aimed at improving the performance in production plants through incorporation of AI technology in the production lines.

Use cases of AI-PROFICIENT

CONTI-2: Restart set up

Extrusion restart requires qualified operators that use intuition to determine the best settings to re-launch the extrusion. As a result of relaunching the extrusion some waste (rework) is created and certain time is required to reach extrusion stability. Reducing those is key in the production.

Users will now (with technology being enabled), be provided some support in determining:

- Whether the extruders are in good conditions to be launched
- The optimal settings to use in order to reduce stabilisation time and rework

Operator will be able to provide feedback to the algorithms so that they can be re-trained and improved.

Ethical recommendations for the use case include considering operator workload and formally defining operator control relative to AI. Ethical successes include industrial partner commitment to evaluate new workload in trial stage and operator option to decline AI suggestions.

CONTI-3: Released extrusion optimization

Improvement Statements :

- Deep Learning teacher-student approach
- Working for improving the relaxed conditions of thread
- Being able to identify the relevant cause of non-relaxed thread

Ethical recommendations here included identification of primary users targeted in relation to services proposed. Ethical successes include identification and simplification regarding targeted end users.

CONTI-5: Tread Blade wear

The cutting system is in charge of cutting the tread into single tyre units. This system wears over time and there is currently no way of determining the actual wearing of the blade. As a consequence, unplanned blade replacements and productions stoppage are common in the production line.

- Wear index indicators will be provided so that operators across shifts can have some notion of the current wearing of the blade.
- Simple prognostic models will be provided to maintenance managers so that they can create approximate forecasts and adapt blade scheduled maintenances to avoid production stoppage.

Ethical recommendations here included simplifying by changing proposed end user and instituting transition stages for deployment. Ethical successes include major change in targeted end user and commitment to transition stages.

CONTI-10: Quality analysis

During production process, occasional product deviations out of the desired scope are inevitable. In order to maintain the required quality of the production process, the responsible operators take actions in consultation with the quality manager.

By that, various interventions are meant, depending on the deviation magnitude, from making changes in several control parameters, to even production stoppage. Usually, those actions are not straightforward, and the quality team is obliged to manually compare all the parameters along the whole process line, to identify what caused the issue.

The aim of use case CONTI10 is to automate this process of investigating quality deviations, while monitoring the system, detecting and prognosing anomalies. In addition to previous, Quality analysis and assurance tool will provide decision support to the operator and quality manager, how to perform readjustment of the machine settings efficiently.

Ethical recommendations focused on defining what is expected of operators and de-anthropomorphizing references to AI. Ethical successes include operator opt-out for training phase and rephrasing deliverable wordings more ethically.

INEOS-1: Reactor Stability

Numerical tools are developed to predict influences of process inputs on the conditions inside the reactor, with the aim to help operators select procedures that promote reactor stability.

Ethical recommendations included estimating extra workload for operators and engineers, defining reliability for AI suggestions, and instituting exploratory trial period. Ethical successes include commitment to offline testing phase.

INEOS-2: Image recognition

In the Ineos Geel plant, A human error in adding the wrong additive to the incorrect lot number can lead to a downgraded product. This AI-PROFICIENT case provides continuous monitoring and feedback of labels and feeders selection using image recognition such that Operators' errors related to a manual data input is minimized. Some of the achieved targets include,

- >99% automated input from operator,
- <5% cases require a second photo to be taken (Sometimes a blurry image could also result in incorrect recognition. When it happens, the operator is prompted to take another photo of the label),
- A full prevention of the wrong additive use which can lead to 0% chances of producing a downgraded quality due to use of wrong additive

Ethical recommendations included testing the tablet interface in workplace conditions, providing a carry-on bag for the tablet, and defining responsibility for corrections. Ethical successes include testing under workplace conditions, dedicated carry-on bag for the tablet and better-defined responsibilities.

INEOS-3: Rheology Drift

Specifical rheological characteristics are important quality parameters of the INEOS product. They are sampled quite rare, and therefore, it was hard for the plant to directly correlate process parameters which influence degradation of these characteristics

This use case brought extensive historical data analysis which resulted with the extracting the most influential process parameters on the particular rheological characteristics

With these results, INEOS will be able to apply strategies which will reduce amount of scrap and result with the significant monetary benefits.

PROJECT TITLE

Artificial intelligence for improved production efficiency, quality and maintenance

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DURATION

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