NSAI Standards

Irish Standard Recommendation
S.R. CWA 17492:2020

Predictive control and maintenance of data intensive industrial processes

S.R. CWA 17492:2020

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NSAI	T +353 1 807 3800	Sales:
1 Swift Square,	F +353 1 807 3838	T +353 1 857 6730
Northwood, Santry	E standards@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.ie	W standards.ie

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National Foreword

S.R. CWA 17492:2020 is the adopted Irish version of the European Document CWA 17492:2020, Predictive control and maintenance of data intensive industrial processes

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CEN WORKSHOP AGREEMENT

CWA 17492

January 2020

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English version

Predictive control and maintenance of data intensive industrial processes

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties, the constitution of which is indicated in the foreword of this Workshop Agreement.

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

CWA 17492 was developed in accordance with CEN-CENELEC Guide 29 "CEN/CENELEC Workshop Agreements – The way to rapid agreement" and with the relevant provisions of CEN/CENELEC Internal Regulations – Part 2. It was agreed on 2019-09-24 in a Workshop by representatives of interested parties, approved and supported by CEN and CENELEC following a public call for participation made on 2019-04-04. It does not necessarily reflect the views of all stakeholders that might have an interest in its subject matter.

This CWA has been developed under the Task 8.3 – "Standardization" of the MONSOON (MOdel based coNtrol framework for Site-wide OptimizatiON of data-intensive processes) project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723650 (call H2020-IND-CE-2016-17).

The final text of CWA 17492 was submitted to CEN for publication on 2019-11-18. It was developed and approved by:

- Claudio Pastrone, LINKS Foundation – Chairman
- José Antonio Jiménez Caballero, UNE – Secretary
- André Augé, Rio Tinto (France)
- Dimosthenis Ioannidis, Information Technologies Institute, Center for Research and Technology (Greece)
- Thanasis Vafeiadis, Information Technologies Institute, Center for Research and Technology (Greece)
- Vincent Bonnivard, Probayes (France)
- Bilal Azennoud, Probayes (France)
- Rosaria Rossini, LINKS Foundation (Italy)

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Comments or suggestions from the users of the CEN-CENELEC Workshop Agreement are welcome and should be addresses to the CEN-CENELEC Management Centre.

Introduction

Process industry is characterized by intense use of raw resources and energy, thus providing a context where even small optimizations can lead to high absolute savings both in terms of economic and environmental costs, if they can prove to offer predictable and replicable results. Predictive modelling techniques can be especially effective in optimizing processes in such context, but their application is not straightforward for several reasons including, e.g. the high cost of integrating large numbers of new sensors or actuators into legacy production equipment, intrinsic difficulties in monitoring physical parameters in harsh conditions, interoperability issues among existing IT systems in use, difficulties in monitoring data-intensive processes in a scalable fashion, difficulties in fusing and correlating information collected at different SCADA levels, challenges in defining and computing meaningful KPIs to ease decision-making, etc. Therefore, the deployment of model-based predictive functions in such production environments at a sustainable cost or with enough reliability is not always feasible, resulting in optimization potentials remaining untapped.

In past markets characterized by lower international competition, stable demand, relatively low labour cost and high abundance of raw materials, industry was able to remain viable just through progressive improvements in production technology, organization and logistics. The change in global competition and resources availability calls instead for a drastic re-invention and re-design of production processes and sites. In other types of production environment which are more flexible by nature, new sites can be devised which take into consideration such challenges by design. This is however not possible in capital intensive process industries, where initial investments for new production sites are prohibitive. For this reason, enabling benefits by integrating innovations in the installed process base is a fundamental step to help process industries transitioning from the current model oriented to the production of goods by consuming resources, to newer “circular” models. In this perspective, resource, cost and environmental sustainability is considered, monitored and optimized at all times, resulting in benefits for industries and society as a whole.

1 Scope

This document contains a methodology detailing the machine/deep learning techniques that should be employed, through the different steps to be followed, with the aim to predict industrial processes or equipment drifts and trigger alarms and potentially help to improve overall equipment effectiveness or the workshop performances.

NOTE The triggered alarms are related to the process in such a way a small deviation affecting the production can be detected in advance, but these alarms are not related to safety.

This document can be used as a guide by:

— Manufacturing plant managers: it contains two examples of real use cases that show the possibilities offered by machine/deep learning techniques applied to the control and optimization of manufacturing processes and to the predictive maintenance of plant machinery;

— Data Scientists: The actual use cases shown reflect the problems they will face when applying these techniques in an industrial environment, which has its own characteristics.

2 Machine/Deep learning for data-intensive industrial process

2.1 Machine/Deep learning techniques

Machine learning and Deep learning techniques are a set of methods from the field of Artificial Intelligence, which combine statistics, algorithms, and computer science. They are used to build mathematical models from sets of data, and are applied for a wide variety of tasks, such as speech recognition, image recognition, fraud detection, or product recommendations.

Those models need to be **trained**, i.e. their parameters need to be adjusted, on a so-called training dataset. Machine/deep learning techniques can be divided in two main families:

— Supervised learning, for which the data are “labeled”, i.e. the outputs of the task being modeled are known for those data;

— Unsupervised learning, with unlabeled data, where the algorithm will learn the underlying structure of the dataset.

The main algorithms used in machine learning are the following:

— Linear/Logistic Regression

— Classification and Regression Trees

— Ensemble methods

— Naive Bayes

— K-Nearest Neighbors

— K-Means Clustering

— Support Vector Machines

— Trend analysis

— Neural Networks