





# BORSA N. 34 DAUSY

# D.M. 352/2022

# Co-finanziata da: CNH INDUSTRIAL ITALIA S.p.a. Tematica: "Predictive Maintenance and Anomaly Detection for Agricultural Tractors Components"

## Research theme title:

Predictive Maintenance and Anomaly Detection for Agricultural Tractors Components

### Contacts:

Prof. Sauro longhi

e-mail: <a href="mailto:sauro.longhi@univpm.it">sauro.longhi@univpm.it</a>

## Curriculum of DAUSY:

C3 AS for Monitoring and Security

#### Hosting University/Research Centre

Università Politecnica delle Marche

#### Department:

Department of Information Engineering via Brecce Bianche 12, 60131 Ancona - Italy <u>https://www.dii.univpm.it/node/391?language=en</u>

#### **Prospective Supervisors:**

Prof. Sauro Longhi (<u>sauro.longhi@univpm.it</u>)







#### Description:

The new technologies that the industrial revolution 4.0 has provided to autonomous systems have allowed to improve and automate different aspects of the systems, particularly thanks to the big amount of data now available to analyze and predict the system behaviour. This knowledge can improve the system monitoring and control and give an important contribution to develop better decision-making strategies and to optimize maintenance and costs for the autonomous systems.

The research activity aims to develop methodologies for the analysis of data from multiple sources (sensors onboard, data lake, etc.) in order to plan actions to be taken to improve the reliability and optimize the performance of the system components, while ensuring the safety of the people involved and the correct functioning of the components themselves.

Thus, the main challenges will lie in defining efficient techniques (data-driven and / or model-based) for predictive maintenance and anomaly detection for mechanical components aimed at predicting and preventing faults and anomalies.

The research will be applied to real scenarios provided by CNH Industrial Italia SpA.

#### Specific Information:

Applicants must hold a master's degree, preferably Engineering, with a good background in relevant areas of interest (i.e., probability and statistics, system identification, systems and control theory and machine learning). Proficiency in both spoken and written English is required. Coding and teamwork skills are encouraged.

#### References:

[1]. M. Kordestani, M. Saif, M. E. Orchard, R. Razavi-Far and K. Khorasani, "Failure Prognosis and Applications—A Survey of Recent Literature," in *IEEE Transactions on Reliability*, vol. 70, no. 2, pp. 728-748, June 2021, doi: 10.1109/TR.2019.2930195.

[2]. S. Vollert and A. Theissler, "Challenges of machine learning-based RUL prognosis: A review on NASA's C-MAPSS data set," *2021 26th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)*, 2021, pp. 1-8, doi:10.1109/ETFA45728.2021.9613682.

[3]. Samy, I., Postlethwaite, I., & Gu, D. W. (2011). Survey and application of sensor fault detection and isolation schemes. *Control Engineering Practice*, *19*(7), 658-674.

[4]. Hwang, S. Kim, Y. Kim and C. E. Seah, "A Survey of Fault Detection, Isolation, and Reconfiguration Methods," in *IEEE Transactions on Control Systems Technology*, vol. 18, no. 3, pp. 636-653, May 2010, doi: 10.1109/TCST.2009.2026285.

[5]. Wang, W. Q., Golnaraghi, M. F., & Ismail, F. (2004). Prognosis of machine health condition using neuro-fuzzy systems. *Mechanical Systems and Signal Processing*, *18*(4), 813-831.

[6]. Isermann, R. (1984). Process fault detection based on modeling and estimation methods—A survey. *Automatica*, *20*(4), 387-404.

#### Type of scholarship:

DM 352/2022 – Industrial Project

#### Study and research period outside the Hosting Institution:







DM 352/2022 – Industrial Project

• 6 to 18 months of the study shall be performed at:

Hosting company

o CNH INDUSTRIAL ITALIA SPA

Viale Delle Nazioni 55 - 41122 Modena (MO), Italy

https://www.cnhindustrial.com/it-IT

• 6 to 18 months of the study shall be performed as a research period abroad at:

Hosting institution

o Universite de Lorraine

CRAN UMR 7039, CNRS - Faculté des Sciences et Technologies - B.P. 7023954506 VANDOEUVRE-LES-NANCY, FRANCE

www.cran.univ-lorraine.fr/