جامعة عبد المالك السعدي
Université Abdelmalek Essaadi

Pole for Doctoral Studies
Center for Doctoral Studies
Sciences, Technologies, and Medical Sciences

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

M. EL WAHABI Abdelhamid

Will present here research work with the aim of earning a Doctorate

Doctoral program: Engineer Sciences and Techniques
Discipline: Artificial Intelligence -Industry 4.0-
Specialty: Image Processing, Artificial Intelligence, Deep Learning

On 05/07/2025 at 10H00 at the Hall G of the Faculty of Sciences and Techniques of Tangier, UAE
Under the Theme

Neural Network for Machine Learning: Application to Image Processing in the Automotive Industry

Front of the jury composed of :

First Name & Last Name	Establishment	Designation
Pr. EL HARZLI Mohammed	FST of Tangier, UAE	President
Pr. ASTITO Abdelali	FST of Tangier, UAE	Reviewer
Pr. AIT MADI Abdessalam	ENSA of Kenitra, UIT	Reviewer
Pr. BOULAALA Mohammed	FST of Tangier, UAE	Reviewer
Pr. AZMANI Monir	FST of Tangier, UAE	Examiners
Pr. SOULHI Aziz	ENSMR of Rabat, UM5	Examiners
Pr. HADJ BARAKA Ibrahim	FST of Tangier, UAE	Co-Supervisor
Pr. HAMDOUNE Salaheddine	FST of Tangier, UAE	Supervisor

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Abstract

The adoption of advanced technologies has become paramount in enhancing productivity and efficiency across various industries. Quality control and defect detection are critical aspects that greatly benefit from these technological advancements. However, many industries, including automotive manufacturing, still rely on traditional manual methods for detecting defects and addressing common problems. Addressing this need, many automotive companies currently undertaking a research study that harnesses the power of deep learning. The study centers on the development of an image classification models with the specific objective of accurately categorizing industrial components as acceptable or defective. The primary aim of this model is to automate quality control processes and eliminate the need for labor-intensive human visual inspection.

The rationale behind this automation is rooted in the fact that manual inspection is time-consuming, prone to errors resulting from operator fatigue and inherent limitations in human judgment. To address these challenges, the model being developed must fulfill the stringent requirements of near-perfect accuracy and precision. Our research mainly manifests in four contributions. In the first contribution, we propose a study specifying the famous vision applications in the automotive industry, for which we wish to improve their quality control process. In the second contribution, we propose an in-depth study of the literature on the various efficient algorithms and techniques of deep learning that process images. This study shows that, in the case of various environments and defect cases, the traditional automated vision system (AOI) fails to monitor quality, while deep learning with a good learning process, including a large amount of data and defect cases, can easily identify defects. However, for our application (automotive industry), it makes no sense to produce defects in order to increase the data for model learning, so with this reality (limited data), we are faced with a very high challenge to achieve good generalization of the model after machine learning.

In the third contribution, we propose a methodology encompassing the preprocessing techniques applied to improve the input dataset, the implementation of fine-tuned pre-trained models, and the details of the learning process with our specific tasks (automotive industry applications) such as: • The gluing of the t-coils cap • The soldering of pins • The soldering of inductors • The terminal crimping In the fourth contribution, we focus on the presentation and discussion of our experimental results, evaluating the effectiveness of our approach and models.

Keywords: quality inspection, defect detection, convolutional neural networks, transfer learning, pre-trained, binary classification.