CASE STUDY MOTORCYCLE COMPANY

THE CLIENT

The company is one of the leading companies in the motorbike manufacturing sector, constantly striving to maintain its leadership by improving its products and production processes.

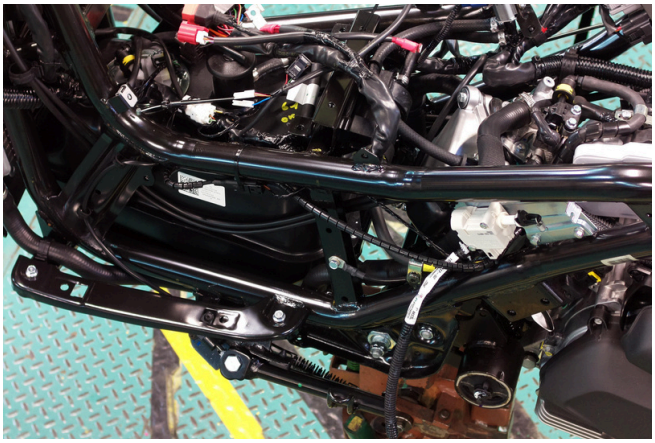
REQUIREMENTS

For the assembly of motorbikes, the company has expressed the need to implement a system for the automatic detection of wiring defects of the power, brake and electrical systems, based on photographs taken directly on the production line.

THE PROJECT

The system for the automatic detection of wiring faults was realised using ADR-Flow, our system developed for this purpose, divided into two modules: the edge module and the cloud module. The edge module, i.e. the part of the system that is in direct contact with the production line, has been configured with the presence of:

- a control station, which manages the interaction with the operator via a graphic and audible user interface, and a barcode scanner that allows the vehicle to be identified. This also organises the sending of photos and metadata to the remote server (cloud module);

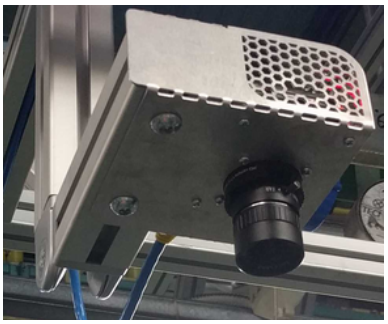


- three “smart” cameras, which are real computers (Raspberry in this case) with powerful built-in features that allow them to perform automatic fault detection in real time.

The cloud module, on the other hand, consists of a virtual machine that has the task of:

- receive, record and analyse the images;
- allow specialised technicians to search for the images, display and classify them manually, i.e. tell whether they represent a defect or not, in order to use them for training and continuous verification of the performance of the neural networks;
- support data scientists in their training activities of the neural networks;;
- provide the system manager with a dashboard to keep him/her under control by means of simple graphs and tables with the breakdown of defects over time, the sequence of image acquisition on a daily, weekly or monthly scale, the analysis of the speed of the line over time and that of the goodness of the recognitions performed.

Once trained, the neural networks are sent to the respective cameras for them to perform the recognition in real time.



Camera for automatic defect recognition

RESULTS

The company's needs for industrial productivity have been met with great results and advantages, such as:

- improvement in output quality;
- greater efficiency and therefore lower cost of the production process;
- possibility of activating continuous improvement processes in production, thanks to the learning capacity
- brought by these techniques;
- possibility of performing in-depth analyses on the causes of defects with the opportunity, therefore, to better engineer the process itself.

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CASE STUDY INDUSTRIAL FISHING

THE CLIENT

The client is an Italian consortium of fishermen engaged in selective open-sea fishing, with close attention to water quality and species selection to ensure wholesomeness and authenticity. At the same time, they are committed to environmental sustainability and the delicate balance of the marine ecosystem..

REQUIREMENTS

The request was to create an automatic fish species recognition system for the Mediterranean Sea, specifically to distinguish between anchovies and sardines—both types of "blue fish"—based on images of the catch taken by dedicated cameras..

THE PROJECT

The system was developed using ADR-Flow, our supervised machine learning support system, which demonstrated its full flexibility and adaptability to very different situations. As always, ADR-Flow is made up of two modules: an edge module and a cloud module.
Since the goal was not yet clearly defined, and the idea was simply to explore what could be achieved, we imagined that the edge module would function as a mobile station designed so that fish could be laid out on a surface to be photographed, or could move along a conveyor belt, in such a way that:

- the control station could manage interaction with the operator through a graphical and audio user interface, which also organizes the sending of photos and metadata to the remote server (cloud module);
- the only “smart” camera, which is in fact a computer (a Raspberry in this case) with built-in powerful features, could recognize the fish species in real time, highlighting the fish in different colors depending on their species.
- The cloud module, on the other hand, is built in a fully standard way as a virtual machine, with the following functions:
- receive, record, and analyze images;
- allow specialized technicians to search, view, and manually classify images—indicating whether each fish in the image is an anchovy or a sardine—for use in the training and ongoing evaluation of neural network performance;
- support data scientists in training the neural networks;
- provide the system manager with a dashboard to monitor everything through simple graphs.

Once trained, the neural network is sent back to the camera to perform real-time recognition. The key difference between this case and others—such as defect recognition—is that here, different neural network models were used, specialized for this type of recognition, and that manual image classification was performed using visual prompting systems.

Alici e sardine pescate

Riconoscimento dei pesci effettuato per distinguere la specie

RESULTS

The results of the experiment were excellent and met the client's expectations.
The system was able to correctly distinguish between anchovies and sardines, and could potentially enable the automation of the fish sorting process in the future.

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CASE STUDY PACKAGING COMPANY

THE CLIENT

Selene is an Italian company that produces flexible packaging for industrial use and is involved in various stages of the production chain, such as recovering pressed bags from customers and collection centers, recycling, washing, regenerating high-quality raw materials, and producing products combined with virgin and recycled polymers. Selene's production approach is focused on sustainability and environmental and social responsibility.

REQUIREMENTS

The company had several requirements to improve and optimize the production flow. Specifically, it needed to achieve:

- lighter packaging; reduced thickness;
- excellent performance;
- high quality;
- environmental sustainability, using recycled plastic material (PE).

The specific need was to perform much more accurate checks on incoming materials, which, although of good quality, had much more variable characteristics compared to new materials, and to take action if necessary.

THE PROJECT

In this case, ADR-Flow, our Open Source system supporting the automatic recognition of industrial production defects based on Deep Neural Networks (DNN) and Machine Learning algorithms, demonstrated its flexibility and adaptability. In this context, we decided to apply it to the pilot extruder, which was already used to evaluate incoming materials but manually, requiring an operator to be engaged for hours. The pilot extruder is fed with a sample of the batch to be verified, after which the quality of the extruded material must be assessed.

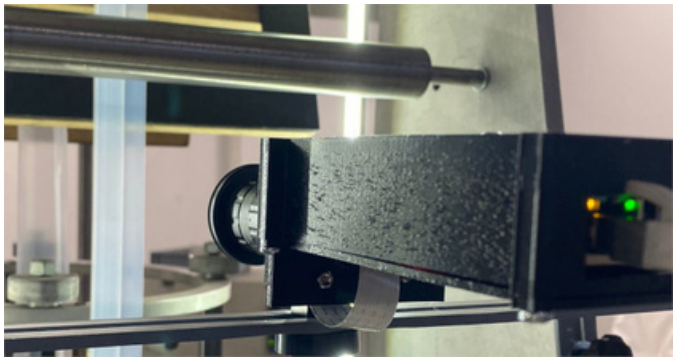
The edge module of ADR-Flow, the part of the system directly interacting with the pilot extruder, was configured with the following components:

- a control station that manages interaction with the operator through a graphical user interface, allowing identification of the batch under examination; it also organizes the sending of photos and metadata to the remote server (cloud module);
- an "intelligent" camera, essentially a computer (Raspberry, as in other cases) with powerful built-in functionalities that enable real-time automatic recognition of defects in the extruded material.

The cloud module, on the other hand, consists of a virtual machine tasked with:

- receiving, recording, and analyzing images;
- allowing specialized technicians to search, view, and manually classify images, determining whether they represent a defect or not, to use them for training and continuous performance verification of neural networks;
- supporting data scientists in training neural networks;
- providing the system manager with a dashboard to monitor the system through simple graphs and tables showing defect distribution over time, the sequence of image acquisition on a daily, weekly, or monthly scale, analysis of recognition accuracy, and, at the end of acquisition, an evaluation of the quality of the examined batch.

Once trained, the neural networks are sent to the respective cameras to perform real-time recognition.



RESULTS

The workflow has been improved and optimized: now the operator only needs to start the process and monitor it occasionally while performing other tasks. Additionally, this has enabled the creation of a classified photo archive that allows precise tracking of the various batches of incoming materials.

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