



What ASSISTANT brings you: Interview with Christos Gkournelos on the ASSISTANT project and Real-time control for human-robot collaboration in manufacturing

Christos Gkournelos is a Senior Research Engineer at the Laboratory for Manufacturing Systems and Automation (LMS) at the University of Patras. For the past six years, he is involved in the robotics research domain concentrated on human-robot collaboration in industrial applications. His main scientific interests are focused on applying AI methods for improving the collaboration between humans and robots and on the development of intuitive interfaces for non-expert users. In the ASSISTANT project, Christos and the LMS team lead the developments of real-time control of reconfigurable manufacturing systems.

Félicien: Christos, regarding human-robot collaboration in flexible production lines, several terms are not well known to the public, can you clearly explain the following terms (a) smart interfaces for assisting human operators on the production line and (b) Human intention recognition for seamless human-robot collaboration?

Christos: Before starting to explain the above technological terms, I would like to point out the source of these which is the evolution of the manufacturing businesses towards what is called Industry 4.0. Our goal is to develop efficient, adaptive, safe, and trusted Robots that could work together with human operators. The main objective of the collaboration is to integrate the best of two worlds: strength, endurance, repeatability, and accuracy of the robots with the intuition, flexibility and problem solving of the humans.

With the term “smart interfaces for operator’s assistance”, we are referring to applications that usually run on Augmented or Virtual reality devices and provide advanced functionalities compared to commonly used devices such as touch screens. These tools are responsible for making easier the work of the operators in complex production systems, thus we give great focus on being intuitive and easy to use.

Moving further towards improving the collaboration between the workers and the robots the system needs to be aware of what the human is wanted to do, to adjust the next actions accordingly. The common way of communication between a worker with a system is by directly pressing some buttons, which are installed on the working area and are indicating specific commands like “move to the next operation”. Getting advantage of the AI evolution we are working on the development of a system with the ability to understand how to proceed on the next action by observing the operator. This indirect recognition of human intention provides the information of what the operator requires to adapt and follow their needs for improving their collaboration and eventually the overall productivity.

Félicien: Sounds great, could you tell us why a digital twin is needed for real-time monitoring of the production line? What advantages would industries gain from using this type of technology?

Christos: The digital twin is the technology that provides a digital counterpart of the physical environment. It combines data from many sources into a digital model capable of monitoring the working area in run-time. The ability to monitor and predict the course of the production for resolving any issue that may appear is one of the biggest advantages of this technology. The detailed information that is gathered by the digital twin is used for automating the decision-making process. This functionality improves the flexibility of the system for handling multiple products using many resources which is also an important aspect for the industry.

Félicien: Cool cool, just to point out that in the ASSISTANT project, a digital twin development procedure is currently under study and the result of this research will be published soon. Let's continue our discussion, what are the main challenges to deploy a digital twin for real-time monitoring in a production line?

Christos: One of the biggest challenges for deploying such a big system that receives in run-time a big amount of data from sensors across a wide area is the organization of all the inputs and the modeling of the data. It is a complex problem and there are not yet ready solutions for managing big data from multiple sources that could be used on different levels of decisions. ASSISTANT aims to provide an autonomous system capable of managing data throughout the full life cycle of production. Moreover, another significant challenge is the migration from the currently established methods of controlling a production system, towards the digital twin approach. This transition is rather challenging and depends on multiple factors, especially for big manufacturing companies involving complex operations. For this reason, a great focus is given on the development of solutions that could be easily integrated with the current production systems. The

goal is to perform the minimum modifications on the system for minimizing the investment cost and the deployment time.

Félicien: By balancing these challenges, costs, etc. and advantages to develop a human-robot collaborative production line, do you think it is worthy for companies to opt for this kind of technology?

Christos: Based on recent research results demonstrated in several industry-focused demonstrators, I do believe the human-robot collaboration paradigm will be a major catalyst for flexible manufacturing in factories of the future. The manufacturing sector is under constant pressure to adapt to changing consumer demands. Manufacturers will have to radically change the way they manufacture their products if they are to survive in a rapidly changing global market and human-robot collaboration will help to achieve this.

Félicien: Finally, what do you think of the ASSISTANT project?

Christos: The ASSISTANT project has a very interesting objective which is to fill the existing gap between the established AI technologies and the manufacturing industry. ASSISTANT sees the whole picture of the manufacturing industry from process design to the actual execution. Through this project, the research community will benefit from having the opportunity of experimenting with actual problems coming from the industry while in parallel would provide novel solutions that will benefit the European businesses. I find also extremely important the project's focus on the ethical aspects of the AI applications in the manufacturing sector. To conclude, I would like to mention that AI enhanced robotics systems for smart manufacturing are the future and ASSISTANT is working towards this direction.

Félicien: Thank you Christos.

Christos: Thank you for having me.