*Industry:*

On the industry, we can encounter diverse cases where the heuristic methodology is effective to optimize processes and supply chains; although, we also find cases where it doesn’t.

In the factories, the artificial intelligence is used to make real time analysis of the production processes; this is made with the purpose of optimizing the processes and correct errors in advance. An example of this is the project ARKUNE, which was made to optimize the mechanized processes on a factory. When it is implemented, an artificial intelligence analyzed in real time the quantity of generated burr to determine if the burr eliminating process needed to be enacted or not. In these cases, the applicated ontology is the knowledge of the limit of approved burr in each product, as well as the algorithm to determine the amount of generated burr. [W]

Taking this particular case, we can see that the heuristic method is being implemented to carry this process, as the problem is modeled by an algorithm that analyzes the quantity of burr produced by the drill, and once that is determined, it evaluates the burr limit to decide the execution of the next process.

Another example of heuristics on the artificial intelligence used at industries is the one on the color and textile industry. Here artificial intelligence is used on diagnosis of problems and resolution of them. The AI used in this industry uses different methods and implements different approaches of AI to solve the problems. This approaches are Expert Systems, Fuzzy Logic and Neural Networks, but we will focus only on the expert system for now.

Experts System are used to solve problems at the level of the human expert, using the knowledge given to it by an expert on the topic to be treated. A knowledge engineer develops a way to explicitly write this knowledge into the expert system and does it through various iterations. Since there are areas where it is difficult to have complete knowledge and expertise of the objects with which the system will work and ways to solve the problems that may appear, heuristics take a big part of developing an expert system. [S]

It is Heuristic knowledge one of the main ways in which the textile industry develops expert systems for artificial intelligence diagnosis. The expert system and its heuristic knowledge is used on coloring and finding and resolving defects on the textile materials by tracing where the problem may origin and correct the mechanical or electrical system that may cause the problem. This can only be done by using a heuristic of how the textile system works and knowing that a failure in certain system causes certain problems. [Y] The knowledge of how to correct the problems is also an example of how heuristics are useful for artificial intelligences in industries.

Sekisui, a chemical company dedicated to the production of construction materials, decided in 1984 to invest in new technologies and began developing an expert system that could help on the company’s procedures. The resulting system worked on three different aspects: Computer Assisted Design, Consultations System and production control. This expert system helped with each step of the construction process that Sekisui covered, since the design, the decisions made on the materials and pieces used, and finally the manufacturing of them.[S] Expert Systems can be used in different industries and concentration areas, and they work based on heuristic knowledge of the problems to be solve. [S]

Despite the existence of cases and areas where the heuristic method is applicable and works as intended, there are cases where this doesn’t hold true. This is mainly because the heuristic knowledge works perfectly for cyber physical systems in the factory, but when we talk about other systems such as semantic ones it fails to work.

An example of this, are the Chatbots developed by Facebook, where the objective was to test and improve the communication abilities of two artificial intelligences designed to stablish natural conversations. Said program was defined to receive sentences and answer them; nevertheless, there was a moment where the answers stopped to have any semantic logic, which unleashed a barrage of answers without any sense.

In the cases where an artificial intelligence is designed to emulate natural language, the use of the heuristical method is impossible, since the language consists on semantic structures which can’t be represented syntactically (nor numerically) for their analysis, as the meaning is affected by the order and the selected words.

To try and represent this in numerical variables isn’t ideal, as an ontology that can give each word a value and a syntactic meaning doesn’t exist; which makes the heuristic method harder to implement, as there are no values to work with.

Besides this, we saw that not only heuristic knowledge is used on industries that use artificial intelligences in their processes, another common technique is Fuzzy Logic. The fuzzy logic control systems rely on the lack of precise information and making with decisions with that. Since there is a lack of information, heuristic knowledge can’t take part of the processes and make fuzzy logic systems work correctly. [X]

In the Textile Industry we saw that fuzzy logic was also used, the function of these kind of systems is to classify the different kinds of materials and detection of litter and polluters on cotton. This is done because there are different kind of polluters that stick to cotton, so there is not a certain way to know how to identify them. That is one of the main uses in the textile industries of fuzzy logic. This system is so adaptable that a defect detection system based on fuzzy logic is being developed, which means that expert systems based on heuristic methods are not the only option for industries to work with artificial intelligence. [Y]

As we can see in these examples, the heuristic method can’t be applied in all the models or problems, as not all the problems can be modeled in a numeric fashion. Even if an ontology exists for almost all the fields, the artificial intelligence also requires an algorithm to work over said ontology. To try and apply the heuristic method in cases where the algorithms or the ontology are inappropriate, will cause the failure of the model or a wrong answer.

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