ADVANCED CONTOL SYSTEMS IN INDUSTRY 5.0 ENABLING PROCESS MINING

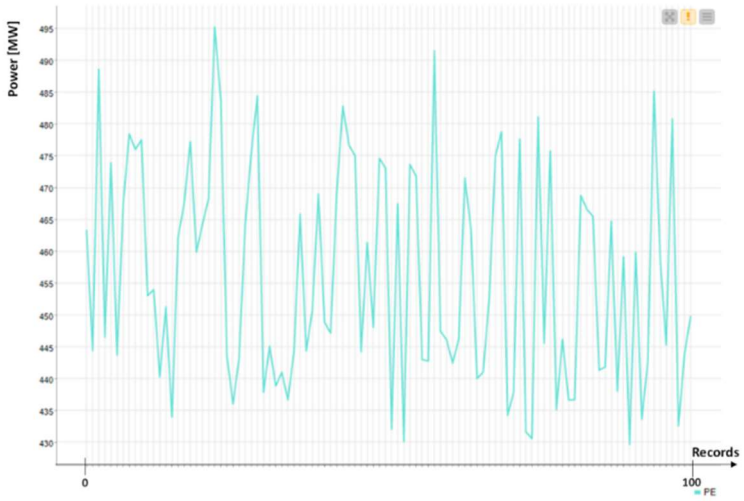
Artificial intelligence is constantly evolving and reinventing itself. Today, AI makes it possible to go deeper into all sorts of things, for example by increasing production processes within Industry 5.0 through Process Mining. There are two main objectives of the concept of Process Mining:

- ⇨ The first objective is to increase the intelligence of machines with numerous computer tools.
- ⇨ The second objective is the decision-making autonomy of the machines.

In this study, two examples are used to understand the intervention of Process Mining: one in the food sector and the other in the energy sector.

- Let's take the example of the food sector (roasting food): The food product goes through many ovens to cook. Thanks to the process mining approach, the temperature of the furnaces is updated. If the temperature is not correct, the AI detects it and finds a solution to solve the problem so that the temperature is as adequate as possible.
- Let's take energy production as an example: Energy is produced in a power plant. The energy produced is indicated by artificial intelligence. If the production is not correct, the AI detects it and finds a solution to fix the production problem so that it goes back to normal.

Figure 1: Produced energy power: first 100 records of the dataset.



This graph shows the production of electrical energy made by artificial intelligence. Artificial intelligence constantly updates processes and increases production through process mining.

Source: Alessandro Massaro, MDPI, 10 November 2022.

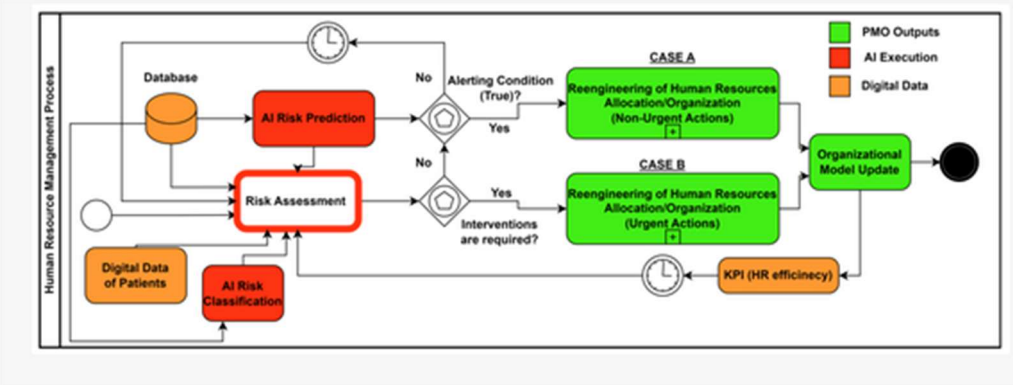
PROCESS MINING ORGANIZATION (PMO) MODELING AND HEALTHCARE PROCESSES

Process improvement in the healthcare sector is essential. Thanks to artificial intelligence, innovative technologies and the Process Mining Organization, processes are continuously improving. The Process Mining Organization, also known as PMO, is a tool that increases process management in the medical field, especially in hospitals. To complement this tool, business process modeling is also used. The approach of the latter tool makes it possible to recognize the various essential steps in hospitals through graphic symbols.

Process Mining organization and Business Process Modeling technologies are essential in the healthcare sector:

1. To help manage hospital employees (Figure 1).
2. To help warn patients in the event of a fall.
3. To help telemedicine change the way hospitals operate.

Figure 1 : BPNO-PMO dans le secteur des ressources humaines



This diagram shows process mining and business process modeling in the human resources industry. The interventions are short- and medium-term and are evaluated according to the risks estimated by artificial intelligence. Urgent actions represent box B while non-emergency actions represent box A. They are also classified by colors, for example, red signifies the risks assessed by AI, and orange represents the skills of human resources.

Source: Angelo Rosa, Alessandro Massaro, MDPI, 22 November 2023.

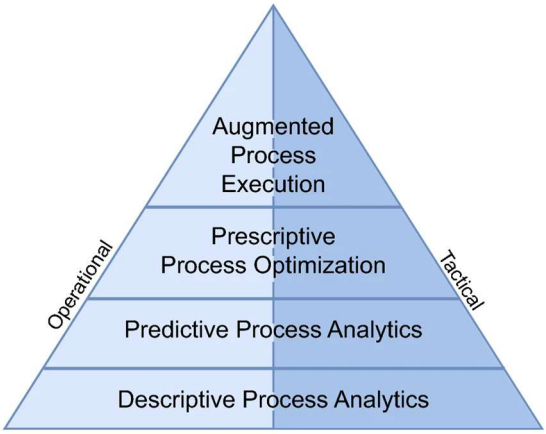
FROM PROCESS MINING TO AUGMENTED PROCESS EXECUTION

The Process Mining Organization, also known as PMO, is a tool that allows you to increase the management of processes within a company. It's a time-saving tool. Artificial intelligence algorithms are also essential to an organization. They automate the execution of processes and make decisions quickly in the event of a problem. These two tools, which have become essential today, make it possible to both automate processes and improve the performance of an organization. These two tools are complemented by the emergence of Business Process Management, also known as BPM. It develops in depth the business performance of a company.

The Business Process Management has a multi-level pyramid (Figure 1):

1. The first level describes the current processes (e.g., processes for the year 2024).
2. The second level predicts the future (e.g., where the company will be in 2030, 2035, etc.).
3. The third level takes the predictions and turns them into concrete actions to improve the company's performance.
4. The fourth level allows the processes to run autonomously, thanks to the supervision of the people.

Figure 1: Business Process Management Pyramid



The pyramid represents the model of Business Process Management. This model shows the steps from an operational and tactical point of view that need to be taken to maximize an organization's performance and automate its processes. It has four main stages: descriptive process analytics, predictive process analytics, prescribed process optimization and augmented process execution. Communication with managers is done at every step of the pyramid using simplified language systems made by artificial intelligence.

Source: David Chapela-Campa, Marlon Dumas, SPRINGER LINK, 4 November 2023.

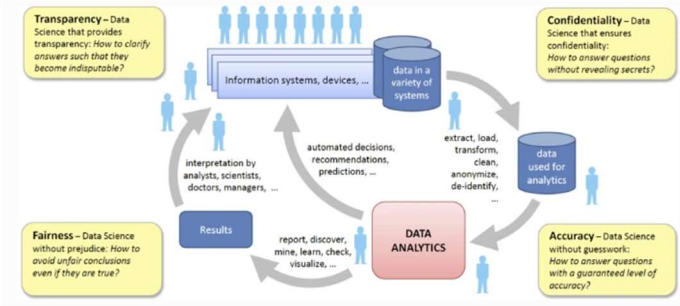
TRUSTWORTHY ARTIFICIAL INTELLIGENCE AND PROCESS MINING: CHALLENGES AND OPPORTUNITIES

In recent years, artificial intelligence has become ubiquitous in the daily life of companies because it saves time and provides significant help in terms of productivity and performance. However, some companies are unaware of the rules that govern artificial intelligence, exposing them to significant risks (bad reputations, legal sanctions, unfair bias, lack of transparency, lack of consumer trust, ethical risks, etc.).

Process mining is a tool to help users of artificial intelligence in companies understand the rules and avoid any possible risks. It then sets a framework with rules that make it easier to follow the steps without incurring any possible problems.

The impact of artificial intelligence has become global, affecting all spheres of our society. The European Union is taking a serious look at the subject of artificial intelligence and is proposing to put in place strict rules that reduce possible risks for both consumers and businesses. Today, these rules are simply discussed but will in the coming years be common and applied to all users. The European Union encourages all countries to take the lead in creating laws governing the impact of artificial intelligence at the national level. Indeed, it is a theme that has become major and consequential for companies.

Figure 1 : The Importance of Responsible Data Science (RDS)



This diagram shows the importance of Responsible Data Science, also known as RDS, in regulating the use of artificial intelligence. These regulations have become a key concern from a national, European, and international point of view. The RDS sets out four essential principles for the use of artificial intelligence: fairness, accuracy, confidentiality, and transparency. These principles significantly diminish the negative consequences of artificial intelligence for businesses and consumers if applied strictly.

Source: Andrew Pery, Majid Rafiei, Michael Simon, Will M. P. van der Aalst, SPRINGER LINK, published 24 March 2022.