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Abstract

Artificial intelligence invades slowly the field of the medical and industrial areas. One of the most relevant technology using artificial intelligence is certainly the exoskeleton which may face extraordinary evolutions. The medical issues are very important, as well as the fear they can present due to the risk to create an augmented human. That is why the reflection about artificial intelligence and its issues are now led by the European Union instances.

The impact of new technologies in the fields of nanotechnologies, biotechnologies, computer sciences and cognitive sciences invites us to question the possibility of upgrading of human beings. What is specific about artificial intelligence is its ability to imitate human intelligence, yet it distinguishes itself when it comes to fastness of analysis. However, even though human intelligence and upgraded intelligence remain dissociated, ethical concerns emerge when both start merging. Moreover, we can wonder if human intelligence can be automatically considered as upgraded. Yet, to fully comprehend the correlation between the two, we must first understand each definition on its own. Generally, intelligence has been defined as the set of mental and cognitive capacities attributed to an individual and which make him able to understand reasonings and to learn new concepts and paradigms. It is the "ability to learn and understand". Artificial intelligence, on the other hand, is not that easy to define.

Scholars have attempted to explain it around key concepts: its purposes, data dealing, investigation methods, and the knowledge that resulted from it. Defining artificial intelligence is also quite difficult because it is based on understanding how human cognition works in order to create a similar artificial cognitive system. Artificial intelligence thus depends on several fields of study such as mathematics, cognitive sciences, and of course, computer sciences. Considering this, artificial intelligence would be the kind of science which consists in building computer programs able to accomplish tasks that would normally require a human form of
intelligence.

Some sectors of industry and research happen to be particularly concerned with such kind of combination: the merging of mechanical skills and human intelligence, especially the industry with the emergence of exoskeletons and cobots which share the same work space as a regular employee, and which can also be beneficial in terms of health and physical endurance (I). Yet, artificial intelligence raises both ethical and legal concerns (II).

I. The Exoskeleton: From Cured Human to Augmented Human

The fields of industry and health are particularly concerned with the new forms of technologies and can more and more easily visualise both mechanical skills and human abilities being merged. Exoskeletons and cobots share the same workspace as regular employees, and might be given artificial intelligence, hence allowing them not only to gain in efficiency but also to secure the work for human workers. Yet, the interfering of new technologies did not come without full comprehension of the implications: the workplace was redesigned in order to divide both authority and power of decision between human and robot workers, while still having humans able to take control over the machines in case of emergency (A). The use of exoskeletons in clinical tests also imply encouraging results (B).

1. Cobotics: Towards a Collaboration between Human and Mechanical Workforce

The first cobots have been designed to complete the assembly line in the transport industry, in order to carry heavy pieces of material which necessitated the greatest attention when being manipulated. Those cobots are often represented as exoskeletons whose role is to assist human work through improved physical performances. Recently, Korean entrepreneur LG revealed its exoskeleton improved with artificial intelligence and connected to service robots: the LG CLOi SuitBot. LG describes it as a « mobile human-like robot ». It is supposed to make the moves of workers in warehouses easier and to help people who need to carry heavy charges. This robot is endowed with artificial intelligence: thanks to the analysis of environmental and biometric data, it is able to assist the bearer and to suggest movement that might make his work easier.

This collaboration between human and robot workforce is called cobotics. Robots have thus proven themselves helpful when it comes to repetitive or tiresome tasks. The collaboration between human and machines no longer belongs to Science-Fiction. It is nowadays possible to design collaborative robots capable to evolve within human workspaces. The cobot hence becomes an essential tool. The human-machine collaboration has thus become the new objectives of the industry of tomorrow. Robots are becoming more and more skilled and able to collaborate with humans. This is how the term of cobotics or corobotics emerged, as a contraction, « robotics » and « collaboration ». Cobots constitute a category of robots capable to link together both artificial and human movements, but also with increased capacities. Hence, it is constituted by a robot-like form based on the cooperation between a human individual and an autonomous artificial system. It allows to improve work performances, whether it be in speed, precision, but also in preserving human workforce’s health and well-being by avoiding difficult moves that might constitute a threat to their safety. This almost-human form of those
tools might seem quite concerning since a robot is endowed with a human-like body shape to easily execute tasks in an environment that fits human workforce (transporting object, to move over a precise area, etc)\(^3\).

2. **Exoskeleton, Artificial Intelligence and Medical Area**

In the medical area, robotics combined to artificial intelligence are really hopeful. It goes beyond chirurgical robotics and future seems promising towards repairing robotics. This one is mainly concerning prosthesis using, exoskeletons which provides new skills\(^4\). Exoskeleton is a kind of articulated and motorized armor which complete owner physical abilities. It provides human to perform more intensive physical effort such as carrying heavier loads crossing longest distances. There are two major categories. Firstly, endogenous exoskeletons are controlled inside the body using skin or nervous sensors. Secondly exogenous exoskeletons are driven through force sensor.

Many activity scopes are concerned by using exoskeletons such as health care and industry. Indeed the exoskeleton helps tetraplegic patients who suffer of spinal cords traumas to improve their life’s qualities. It also helps the worker who needs to support intense loads. So, the exoskeleton reduces the harsh working conditions and increase worker’s productivity. And turning to artificial intelligence system guarantees a kind of trustworthiness in the robots. For the first time in october 2019\(^5\) a tetrapleic patient succeeded in driving an exoskeleton thanks to a cerebral implant. The clinical study intituled «Brain Computer Interface» led by the team of the Professor Alim-Louis Bendabid and Stefan Charbardes from the Clinatec center (Université Grenoble Alpes) made possible for a tetraplegic patient to pilot by himself an exoskeleton\(^6\). The lesions suffered by the spinal cord make impossible nervous control of limbs (legs, arms). Thanks to a neuroprosthesis collecting and handing signals to the brain, the patient is able to drive the exoskeleton. In terms of exoskeletons, we can question their use: what about the exoskeleton only used to extend human physical abilities? Our society has to define the boards of the exoskeleton uses, and the border between repairing and extending. The only goal of the exoskeleton is to enable the patient to get the control of his own body back, and rediscovering autonomy, even if it must involve an hybridization. Those questions are warranted, but they can’t stop the fair progressing of the medical research.

The science-fiction body representation doesn’t match with the human body seen in a medical point of view. The robotics system of the exoskeleton is fantasized, and the augmented human is up for impassioned debate, but these impressive innovations are just mechanic ways to assist the human being. Exoskeleton is a medical device in sense of the french public health

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code defining as any device or tool meant to be used in medical ways. The exoskeleton is consistent with the conditions defined by the Code. Indeed, it corresponds to the definition of « any instrument, device, equipment » used in a medical way, that is to say, enable the tetraplegic patient to walk and fulfil any movement. The medical aim is the major worry and should be study carefully. Even more today because the medical progresses not only affect people who have to be cure but goes to assist and augment human abilities. Can cured human be an augmented human?

Question can be considered under prosthesis subject, with the example of the South-African athlete Oscar Pistorius who has had his leg amputated. His leg prosthesis enabled him to move, and even more he became an olympic athlete. According to the athletic authorities, this prosthesis shouldn’t allow him to compete with the other olympic athletes because this medical device may potentially create an imbalance between them. The problematic is absolutely similar in case of exoskeletons field. Although, nowadays it is used for clinical trial, the owner of an exoskeleton may have his physical abilities increased (because it is the main aim of its use), but this use can be augmented comparing to the human who’s not using this technology? The border between repaired human and augmented human is very thin.

II. Looking for an Ethical and Trustworthy Artificial Intelligence

Artificial intelligence disrupts the public opinion which fears the surpassing of the human by the machine. Indeed, the artificial intelligence system is able to learn many data because it is provided with almost unlimited memory. This thought around ethics, robotics and artificial intelligence is not recent but was firstly mentioned in science-fiction literature. Isaac Asimov, an astrophysicist and science fiction writer, defined the Three Laws of Robotics:

1) A robot cannot harm the human being, nor leave a human in danger;
2) A robot must obey the orders given by a human, unless this law infringes the previous one;
3) A robot must protect its existence unless it does not respect one or the other of the first laws.

We can say today that the ethics of robotics is under construction in European Union. A slow construction but which wants to be stable and effective and which would make it possible to establish an artificial intelligence efficient and worthy of confidence. The European Parliament drafted a report containing recommendations to the European Commission about the rules of civil law on robotics published in 2016. This report contains ethical scope for robotics. On April 8, 2019, the European Commission presented the next steps towards the establishment of trustworthy artificial intelligence. The will of the Member States is to collaborate in order

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7 According to the French Public health (art. L. 5211-1), a medical device is any tool, product, used for medical situations.
to stimulate an artificial intelligence according to the common values within the European Union, and focused on four objectives: to increase investments, to make more data available, to cultivate talents and to guarantee confidence. This last point it is obvious that artificial intelligence raises great ethical questions. It is therefore important to ensure a certain confidence in the machine so that companies use it more and more. This technology must respect fundamental rights, which is why a European group of experts from all scientific circles has worked on the main ethical guidelines for the development of a trustworthy artificial intelligence.

The Commission has therefore presented the first reflections around this major theme, and seven essential elements have been identified by the experts in order to define a reliable artificial intelligence. The first element is about the human factor and human control: artificial intelligence systems must be at the service of human beings and fundamental rights and must not undermine human autonomy. Then, we have to pay attention to the robustness and security: artificial intelligence must be equipped with reliable and robust algorithms able to handle potential errors. The third element is about privacy and data governance: citizens must have full control of their data. They cannot be used for purposes that could harm them. The fourth element is about the transparency; indeed, the traceability of artificial intelligence systems must be ensured. This means that we must have the necessary and sufficient information to know the path of the machine, from its conception to its distribution. The fifth element is the diversity, non-discrimination and equity, it means that an artificial intelligence system can only be used if it takes into account all human capabilities and their needs. The sixth element is about societal and environmental well-being. Societal and environmental well-being encourage the use of artificial intelligence systems to support social evolutions as well as ecological responsibility. The last point is the accountability. The idea is to encourage the establishment of mechanisms to ensure the responsibility of artificial intelligence systems.

At the moment there is no efficient regulation to control the operation of artificial intelligence. No matter the field concerned, health or industry, it is essential to have a reliable EU-wide regulation that would make it possible at the same time to mitigate the fears related to a possible overcoming of the human by the machine, while ensuring the competitiveness of the European Union in a sector more and more promising.

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