Artificial intelligence and work: The organizational challenge

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Abstract:
How can artificial intelligence (AI), given its potential and limits, transform the world of work? Examples in several sectors are cited to show that the tasks that constitute jobs cannot always be automated thanks to AI and that, in many cases, AI-based procedures are used to supplement human interventions. To minimize the risks of machines replacing humans in the world of work, it is essential to boost on a wide scale learning-to-learn organizations, which will be better adapted to foster a complementarity between machines and people.

Artificial intelligence (AI) is a favorite topic for debates about its socioeconomic consequences and the future of work (CÉCILE *et al*. 2020, BENHAMOU 2018, BENHAMOU & JANIN 2018). For a dozen years now, this technology has been making strides thanks to the massive collection of ("big") data, increased computing power and algorithms (CHOLLET 2018). These advances have led to applications in several fields and affected many economic sectors, public and private: transportation, health, the banking and insurance industry, supply chains, defense and national security, to mention but a few (VILLANI 2018). In the near future, AI will probably be able to execute more complicated tasks, including tasks that involve reasoning and decision-making, and to rival, even more, human cognition. The computer's win in the game of Go, the first driverless vehicles and the performance of software for computer-aided diagnoses are symbols of the progress accomplished.[1]

Some observers see AI as an economic opportunity for optimizing production processes and lowering costs thanks to automation. Others, on the contrary, see it as a serious threat to jobs, as swaths of the economy, along with the jobs therein (unskilled but also highly skilled: attorneys, auditors, doctors, etc.), are upended. No consensus has taken shape around a scenario in between these two extremes. Some studies have hypothesized that electronic technology, including AI, will massively automate tasks and destroy nearly half of all jobs over the next two decades in the United States and other industrialized countries (FREY & OSBORNE 2013, BOWLES 2014), while other studies have come up with much lower figures, ranging from 10% to 15% (ARNTZ *et al*. 2016). No consensus seems to have formed because of the limited methodology used in these studies and the absence of large-scale statistical surveys on AI, in particular machine learning (CÉCILE *et al*. 2020).

Despite the difficulty of knowing how many jobs AI will destroy or create, we can assume that it, like any other technology, will deeply alter our ways of working and even the contents of jobs, but that the impact will differ depending by sector (BENHAMOU & JANIN 2018, BENHAMOU 2020). Major effects can be expected on: skills, individual and collective learning, organizations, and labor market mobility. To identify the principal issues stemming from the massive deployment of AI in the world of work, this article will draw examples from various sectors while reckoning with both the potential and limits of AI.

[1] This article, including any quotations from French sources, has been translated from French by Noal Mellott (Omaha Beach, France). The translation into English has, with the editor's approval, completed a few bibliographical references. Websites were consulted in April 2021.

AI's limits

The progress of AI mainly concerns logic, representations of knowledge, and the perception and processing of natural languages. In no case is thinking as such concerned. While sparing details about this technology, let me point out that it reproduces existing classifications and has well-defined objectives, such as winning a game, identifying a pathology (*e.g.*, a cancerous tumor) or even steering an autonomous vehicle in specific traffic conditions (*e.g.*, during the daytime on a superhighway).

AI has trouble handling complexity.

Although AI is capable of performing simple and, too, complicated tasks as efficiently as human beings, or even better, the execution of these tasks always relies on predetermined rules and stems from highly standardized procedures that use masses of codifiable data. AI's main limitation is that it cannot "deviate" from these rules and standards, and think for itself (BENHAMOU 2020). This technology is, therefore, deterministic and controlled, since programmers choose the software to use (type of neural networks, number of layers, etc.), learning methods (the algorithms for initializing and updating the weights assigned to neurons) and the sets of learning data.

This is a far cry from an invention that, endowed with self-consciousness and broad autonomy, escapes from the control of the engineers who designed it. As pointed out with sectoral examples (BENHAMOU 2020), this limitation makes it hard for AI to solve complex problems such as managing unforeseeable human behavioral patterns, simultaneously executing several complicated tasks, determining and analyzing causal chains involving multiple factors, or being empathic and attentive to people while taking account of their complexity (economic, social, human, psychological, etc.). It is no accident that AI has scored its major successes by using digital images and data that have highly standardized contents and are well known.

Finally, even though AI's efficiency results from the input of a large number of events (often several thousands) and on intense computing power for learning, we cannot easily generalize the results from one situation to another. This is another major limitation. The volume of data does not mechanically guarantee a high quality of analytics, nor optimal decision-making, in each and every situation or for unpredictable events. Nearly all tasks of understanding and decision-making done by people still lie out of reach of current forms of AI. No "smart" expert system used in health care can fully take in charge patients for diagnosis, therapy or the prevention of risky behaviors. Nor are autonomous vehicles yet capable of coping with an "unlearned" situation while driving.

AI cannot think on its own.

So, reality is still very far from measuring up to the expectation that the general public might have of AI as a computer as intelligent as human beings, a self-conscious machine that carries out fully autonomous actions. Although AI is present in our smartphones, where it manages the voice-user interface and optimizes the display of personalized advertisements, its existing forms are still far from being conscious. An expert healthcare system can identify cancerous tumors but cannot take charge of complicated cases of patients suffering from multiple pathologies. Much progress is needed before imagining a "strong" AI that might be likened to human intelligence owing to its capacity for apprehending contexts and appealing to "common sense", and to its ongoing learning processes. Such an achievement still seems out of reach, as the researcher Yann LeCun (2016) has stated: "*As long as the problem of unsupervised learning is not solved, we will not have any truly intelligent machine. The question is fundamentally scientific and mathematic, not technological. Solving this problem will take many years or several decades. In fact, we just don't know.*"

Despite these major limits, the generic nature of the technology under development lets us glimpse its impact on all sectors in the economy. How to distinguish the tasks that can be automated from those that cannot (at least not before several decades)? Which organizational conditions would be conducive to a complementarity between people and computers instead of the replacement of the former with the latter? In fact, the direction toward which the scales will tip will be determined by how AI is rolled out, how the gains in productivity made thanks to it are shared, and which choices are made about organizing tasks and work teams.

AI's potential: Replacement or complementarity?

Not all jobs consist of a single task. Some involve several, some of which cannot be automated. Some tasks are "secondary" with little value added while others constitute an occupation's "core" and create value. Depending on the task, the spread of possible outcomes ranges from its simple elimination to its transformation or even the creation of new tasks within a single occupation. AI will fully take over and eliminate certain tasks when it improves efficiency and economic performance (by, for example, executing given tasks more precisely at a lower cost, of course). But machines will not take over other tasks.

Not all tasks can be automated.

Our report (BENHAMOU & JANIN 2018) cites several cases in various sectors to show that the occupations will be preserved that involve social, human skills or draw on cognitive skills based on creativity and complicated problem-solving. This holds in health care and social services, for doctors, general practitioners and specialists as well as nurses and their aides. In transportation, driving in convoys on superhighways could eventually disappear as autonomous vehicles take the road; but the number of truck drivers will, therefore, probably not decrease. In transportation, the transformation of certain occupations might lead to creating new jobs in the supervision and management of fleets, predictive maintenance and vehicle safety. This trend is not something new. In the automobile industry, where robots have been used for some time now, workers have been shifted toward supervisory tasks. It is important to identify and anticipate the skills that will be needed as the rollout of AI transforms jobs. AI solutions for sorting queries and responding to the most frequent ones or for customizing recommendations will, likewise, reduce the number of employees but increase the complexity of the remaining tasks, which the machine will be unable to perform. In the banking industry, AI might boost the role of account advisers while reorient this occupation toward an individualized followup on customers. Some physical interactions will have to be preserved in the most complicated cases and for the vulnerable.

AI is often complementary to human interventions.

AI-based techniques already provide assistance to people (*e.g.*, assisted decision-making). The human task is not modified conceptually, but the employee relies on a system that improves performance (diagnoses and prescriptions in medical care, client services in banking, etc.). Human interventions are required only for reasons related to AI's limits or acceptability. Human interventions might be necessary due to limits inherent in the technology itself — in, for example, situations where the technology is not yet (and probably not for a good while) mature enough given the complexity of activities (*e.g.*, driving a vehicle under all traffic conditions, including at night or in the dark). Another limitation might be related to the collecting and processing of data from a multidisciplinary approach for handling complex cases (*e.g.*, patients suffering from several

pathologies). Human interventions might also be needed for reasons of social acceptability (*e.g.*, announce a diagnosis to a patient, make a decision with major consequences on an individual, or use procedures that violate legal protections related to confidentiality). Since human contacts are often indispensable in fields requiring social interactions, such jobs cannot be replaced with AI.

In brief, tasks will still be done by people whenever the degree of complexity related to decision-making is too high or when human contacts and social interactions are needed (as in activities involving negotiations or discussions, which will still remain in human hands). In contrast, all the tasks characterized by a regularity based of predefined rules (such as organizing, planning or controlling so as to detect fraud, defects or anomalies, or the management of data collecting and processing) are very likely to be automated or downgraded owing to AI. Support functions are in the cross hairs in many a sector (the retail trade and back-office positions in the banking and insurance industry, marketing and legal services).

Learning organizations for human/AI complementarity,

Though not necessarily a preoccupation in matters of jobs, AI underscores the importance of continually "learning to learn". An organization of tasks based on ongoing learning is well adapted to meeting the challenges of AI. As a recent study has shown (BENHAMOU & LORENZ 2020), "learning organizations" organize work so as to favor the development of skills and qualifications that cut across several fields and bolster ongoing learning by wage-earners. As suggested by examples from the sectors cited in this study, such skills and qualifications — the ability to communicate with others and exercise influence over decisions, to transmit skills and organizational know-how, to move beyond predetermined rules and settings, to manage contingencies — will grow in importance as AI is rolled out. So, the learning organizations that give priority to crosscutting skills and qualifications and ongoing learning processes will be a key to human/AI complementarity. According to this study, a major issue for AI will be to provide support to the plans, both private and public, for organizational and managerial reforms. This support might involve a national program for learning organizations, as exists in northern Europe. Dealing with these organizational challenges has to be consistent with trends in the system of education and training. In several European countries, including France, the system of education is not conducive to a shift of the organizational paradigm inspired by the learning model.

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