Introduction

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You are looking at the first issue of *Enjeux numériques / Digital Issues*. This new quarterly in the series *Annales des Mines* intends to focus on the challenges raised by digital technology by soliciting viewpoints on the technology itself, the economy and society. This first issue is devoted to artificial intelligence, a topic that has attracted attention from these different viewpoints and crystallized reflections.[1] The thoughts herein reflect an awareness of the scope of artificial intelligence (AI) even as we observe it developing around us.

As indicated by the frequency of searches on Google for artificial intelligence (including phrases such as machine learning or neural networks), the renewal of the attention being paid to this topic comes from the mounting interest in "big data". The progress made using algorithms, the new computational capacities of devices (ranging from graphic cards to the cloud), and the availability of huge quantities of data combine to explain the advances under way. Artificial intelligence comes down to its algorithms, themselves inseparable from both the data to which they will be applied and the data-processing platform.
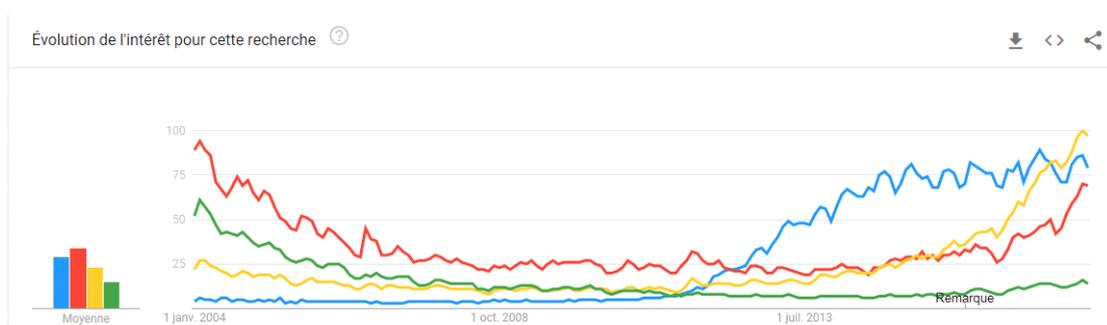
Figure 1: Google trends worldwide, from January 2004 to December 2017

In his inaugural lecture at the Collège de France in February 2016 on deep learning as a revolution in artificial intelligence, Yann Le Cun,[2] director of Facebook AI Research, showed how deep learning (undoubtedly the first reason for the renewed interest in this topic) has opened the door toward significant advances. According to him, learning processes underlie the systems of all big Internet firms, and are used to filter undesirable contents, organize search findings, make recommendations, and select information specifically for individual users. AI has been present for several years now, and is now omnipresent on the Internet, ranging from search engines to the social media. Since Web services are still the principal field of AI applications, the big digital platforms are striving to take leadership in this domain.

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[1] This article has been translated from French by Noal Mellott (Omaha Beach, France).
[2] http://www.college-de-france.fr/site/yann-lecun/inaugural-lecture-2016-02-04-18h00.htm.

But artificial intelligence is not just a matter of algorithms operating in the background on digital platforms. It increasingly enters into a chain of interactions with the physical world: cameras that recognize images, devices that understand spoken languages, robots that are becoming autonomous… German experts talk about "cyberphysical systems" in the industry of the future. For this reason, it is important to understand the issues currently raised by artificial intelligence. I would like to share with you the idea that served as the guideline for our work on this special issue, namely: AI is now migrating into all business processes.

We have chosen to turn to the stakeholders, in particular French, who are implementing AI or who have devoted thought to this implementation and to AI's place in our society. For want of space, this first issue has left aside the fields of health, transportation and education, even though they deserve attention. Instead, the examples reported herein come from finance, insurance, employment, commerce and manufacturing. These articles are based on analyses of the relations that people and our society have with AI. Two international viewpoints, Japan and China, broaden our view and thoughts on this topic. However we have omitted futurological musings about the passage from the now familiar "weak" AI to a "strong" AI that might surpass humanity. Instead, we have chosen to concentrate on the socioeconomic issues that have already cropped up.

This issue also purposes to contribute to discussions about developing AI in France. Following the 2017 release of a report[3] that proposes an AI strategy for France, the MP (and mathematician) Cédric Villani was asked to draw up an AI roadmap for the government to use in the coming years. The French Academy of Technologies has also released reports on artificial intelligence and machine learning, sources for Yves Caseau's article on benefitting from this new technology.

The uses of AI are grounded on an infrastructure. A report on the regulation of algorithms for processing contents[4] discusses three models of development each corresponding to a different rationale:

● PROFUSION. Hundreds of firms are offering new data-processing services using software (including the algorithms of machine learning), many of them from open sources. This is the very field where France, its researchers and start-ups, are present.

● "MASTER-OF-THE-WORLD" ALGORITHMS: They have been developed by the leaders in artificial intelligence. Watson by IBM became famous as a champion of the game Jeopardy, and AlphaGo by DeepMind/Google beat human champions at Go. These hard-core AI platforms are now trying to branch out into the field of health. IBM and Google have listings of firms that are using their AI, via an interface, to invent new services. An ecosystem is thus being formed around their platforms.

● "DATA LAKES": Some firms are proposing a service with an infrastructure for storing and processing the data that they have culled for their own needs. In Europe, the firms pursuing this strategy are trying to organize partnerships with the goal of reaching a critical size in terms of both the mass of data and the skills for processing them.

These three models coexist, and are functioning in parallel. Despite differences, they raise questions common to several fields.

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[3] FRANCE STRATÉGIE (March 2017) "Anticiper les impacts économiques et sociaux de l'intelligence artificielle", report of Work Group 3.2, 48p. Available via
http://www.strategie.gouv.fr/publications/anticiper-impacts-economiques-sociaux-de-lintelligence-artificielle
[4] PAVEL I. & SERRIS I., "Modalités de régulation des algorithmes de traitement des contenus", 63p. (Paris: Conseil Général de l'Économie), 13 May 2016. Available at:
https://www.economie.gouv.fr/files/files/directions_services/cge/Rapports/2016_05_13_Rapport_Algorithmes(1).pdf.

The top-ranking question is about the ability to control AI operations and to communicate about this control. There is always a human team, with developers in charge; and it ought to be held accountable. This issue also crops up in AI research itself: how to develop an AI that can explain what it is doing? The need for internal controls, by all parties who offer AI services, goes in hand with the need for external controls by public authorities for seeing to it that AI operations abide by the law. A starting point is the requirement that such operations not be discriminatory.

In these various economic sectors and businesses, we need to make headway in discussions on fair practices and standards of conduct so that proposals can be made for a formal framework for regulating new AI-related services.

Our approach seeks to stand back from talk that only stirs up feelings of anxiety by focusing on this technology and the dangers related to it: on the peril for our freedoms, the risk of personal data being captured, the dangers of competition ("winner takes all") and the jeopardization of sovereignty (What if the big digital platforms are mightier than nation-states?). We have tried to maintain a positive view on AI and the technology used to design or operate algorithms. This is essential to attract young people into the demanding courses of study (mathematics, engineering, data science) in which France is currently well placed.