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SOME CONSIDERATIONS ABOUT ARTIFICIAL INTELLIGENCE AND ITS IMPLICATIONS

Dorin Lixăndroiu

Transilvania University of Brasov (Romania)

lixi.d@unitbv.ro

Abstract: *The article showcases a few considerations with regard to the implications generated by artificial intelligence in universities and on the labour market, by leading to the appearance of new professions which entail new abilities. One possible paradigm change at university level is given by the Open Loop University Stanford model. The article also presents Romania's status within the context generated by the development of artificial intelligence.*

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Key words: artificial intelligence (AI), open loop university, STEM skills

1. INTRODUCTION

The overall evolution of economic systems has entailed the processing of large volumes of data. Alan Turing, in the article *Computing machines and intelligence*, published in 1940 in the *Mind* journal, by stating the phrase: *I propose to consider the question "Can machines think?"*, was the first one to anticipate the possibility of automatic thinking[1]. Alan Turing defines an investigation method in order to determine if a computer is capable or not of thinking like a human being, known as the *Imitation Game*[2].

Artificial intelligence, considered a field of computer science, was defined as a scientific research field after the disappearance of Alan Turing in 1954. The first researchers who

[1] L'intelligence artificielle dans la banque : Emploi et competences (source Athling), available at: http://www.observatoire-metiers-banque.fr/mediaServe/Etude_IA_emploi_competences.pdf?ixh=3741881147685077070

[2] Delahaye J.P., L'intelligence artificielle et le test de Turing, available at: https://culture.univ-lille1.fr/fileadmin/lna/lna66/lna66p04.pdf

became known in this area are: John McCarthy (Dartmouth College), Claude Shannon (Princeton University), Marvin Minsky (Princeton University), Nathaniel Rochester (IBM). The term *artificial intelligence* appears for the first time in the invitation to a research seminar which took place in the year 1956 at Dartmouth College in the USA. It was the moment that marked the beginning of several important research programs in the field of artificial intelligence within the American universities, some of which were carried out in collaboration with large companies (IBM, AT&T-Bell, ...) or with government agencies, such as the Defence Advanced Research Projects Agency (DARPA).

The first expert medical diagnosis system, MYCIN, was developed at Stanford University in 1972. Between 1980 and 1990, AT&T-Bell improves the software for optical recognition of handwriting, required by the postal services.

After the year 1990, remarkable progress is made in terms of applications of artificial intelligence in the field of gamming. Thus, in 1997, the IBM Deep Blue computer beats Gary Kasparov at chess, in 2016, in Seoul (South Korea), the AlphaGo program, developed by Google DeepMind, wins a game with Go champion, Lee Sedol, and in 2017, the Libratus poker program (running on a supercomputer at the Pittsburgh Supercomputing Center) wins a game with the world's best top four poker players.

The concept of *artificial intelligence* is difficult to define. There are several definitions, among which two are worth mentioning. Yann LeCun, professor at the New York University and FAIR-Facebook AI Research director, defines the concept as follows: *Artificial intelligence is an ensemble of techniques which allow machines to perform tasks and solve problems which are normally reserved to people and certain animals*[3].

Andrew Ng, professor and director of the AI Laboratory at Stanford University, states, referring to AI, that: *If a typical person can do a mental task with less than one second of thought, we can probably automate it using AI either now or in the near future*[4].

The concept of *artificial intelligence* is further clarified by means of the fields of application and the techniques used. The main fields of application are: Robotics, Neural Networks,

[3] Qu'est-ce que l'intelligence artificielle?, available at: https://www.college-de-france.fr/site/yann-lecun/Recherches-sur-l-intelligence-artificielle.htm
[4] Andrew Ng, What Artificial Intelligence Can and Can't Do Right Now, Harvard Business Review, 2016, available at: https://hbr.org/2016/11/what-artificial-intelligence-can-and-cant-do-right-now

Fuzzy Systems and Fuzzy Logic, Complex Adaptive Systems, Intelligent Agents, Machine Learning (Deep Learning), Pattern Recognition, Knowledge Representation.

2. THE IMPACT OF THE AI ON THE LABOUR MARKET

The digitalization process we are currently witnessing throughout the entire global economy will allow for an increase in productivity, which will lead to a decrease in prices, to obtaining genuine increased incomes using fewer resources. For example, companies that have understood the importance of information systems assisting in decision-making processes manage to obtain a higher level of productivity. An interesting analysis of the strategic importance of IT is performed by Frank Bannister and Dan Remenyi in the article *Why IT Continues to Matter: Reflections on the Strategic Value of IT*[5] which is meant to be a response to the famous article in the Harvard Business Review, belonging to Carr, *IT Doesn't Matter*[6]. The most recent estimations indicate an increase by 1.3 million new jobs in IT by 2020[7]. Digitalization creates a significant amount of well paid jobs for specialists in the IT field, but also for other areas of economy as well.

McKinsey declared in 2011 that the United States was suffering from a deficit of between 140,000 and 190,000 individuals with analytic abilities, as well as of 1.5 million analytical managers capable of analysing data and making decisions using on-line transaction processing (OLTP), on-line analytical processing (OLAP) or advance search techniques (Data Mining) of information hidden within the data in a Data Warehouse[8].

By integrating AI within companies, in the operating processes and in the systems assisting the decision-making process, an increasing transfer of tactical decisions which imply the analysis of large volumes of data (Big Data) will be made towards AI.

The development of artificial intelligence will lead to the gradual disappearance of several professions considered to be traditional. Intelligent learning systems, based on deep learning

[5] Bannister, F and Remenyi, D (2005), Why IT Continues to Matter: Reflections on the Strategic Value of IT *The Electronic Journal Information Systems Evaluation* Volume 8 Issue 3, pp 159-168, available online at www.ejise.com

[6] Carr, N. (2003), IT Doesn't Matter, *Harvard Business Review*, May, pp 41-49.

[7] European Commission, Communications Networks, Content &Technology (CONNECT), May 2017. A concept paper on digitisation, employability and inclusiveness - the role of Europe. available at: https://ec.europa.eu/newsroom/document.cfm?doc_id=44515

[8] https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Big%20data%20The%20next%20frontier%20for%20innovation/MGI_big_data_exec_summary.ashx

and neural network, allow for a series of complex activities to become accessible and programmable. Deloitte, in a study carried out in 2018, estimates that 42% of the activities in the financial fields, in audit and insurance will be processed by intelligent systems[9].

For example, in the financial sector, AI applications are capable of processing large volumes of data, financial statements, press releases and other information, exceeding the capacity of the human factor. This renders obsolete the workforce engaged at present in such activities.

The progress of new information technologies, based on artificial intelligence, generates a simplification of tasks, therefore entailing the possibility that a number of professions might not any longer require the same abilities as before.

AI must not be considered as being a simple instrument for substituting the human workforce, by means of robotization and automation. The development of this field is much more complex by means of the innovation it implies and it creates a large number of highly skilled professions required in AI applications and an increase in highly skilled jobs required in assisting the new technologies. In response to AI and the inherent risk of job automation, we are currently witnessing a shift of the workforce towards professions which emphasize abilities that intelligent algorithms are not yet capable of acquiring. At present, research is being carried out with regard to this matter, but the evidence is inconclusive.

In a September 2018 study, *The Impact of Artificial Intelligence on Work*[10], prepared for the Royal Society and the British Academy by Frontier Economics, a deep analysis is made, with forecasts with regard to the development of AI.

There are concerns related to the fact that digital technology will allow large companies to consolidate their position on the global market to the detriment of smaller companies that will not be able to make the same investments in AI.

[9] Deloitte: Talent for survival. Essential skills for humans working in the machine age, available at: https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/Growth/deloitte-uk-talent-for-survival-report.pdf

[10] Frontier Economics: The Impact of Artificial Intelligence on Work (An evidence review prepared for the Royal Society and the British Academy) , available at: https://royalsociety.org/~/media/policy/projects/ai-and-work/frontier-review-the-impact-of-AI-on-work.pdf

3. ARTIFICIAL INTELLIGENCE AND THE UNIVERSITY SYSTEM

The development of software packages as applications of artificial intelligence represents a threat to a significant number of qualified jobs but also to the system providing training for the new professions facing profound reforms.

Susskind, R. & Susskind, D., in the paper *The Future of the Professions: How Technology Will Transform the Work of Human Experts*[11], argue that in a society based on Internet technology professions are affected by:

- the efficiency of the automation process which leads to a decrease in the number of individuals required for a variety of traditional tasks;
- the innovation aspect which creates new means of sharing practical expertise.

Susskind's state that: *'in the post-professional society, we predict that practical expertise will be available online'* [12], based on the possibility of digitalizing knowledge belonging to experts and that of democratizing the information provided on the Internet.

Greenleaf G., in *Review Essay: Technology and the Professions: Utopian and Dystopian Futures*[13], makes a critical analysis of Susskind & Susskind's vision on the models proposed for generating and sharing expertise.

The development of AI implies new requirements in terms of specialty, such as *data scientists* or *knowledge engineers,* but it also implies the creation of new qualified professions[14]. The new abilities imposed by AI and the transformation of existing professions[15] entail a work environment with a higher degree of performance and a better balance between the professional and private life of an individual. In a study performed by Deloitte (2014)[16], it is

[11] Susskind, R. & Susskind, D. (2015), The Future of the Professions: How Technology Will Transform the Work of Human Experts, Oxford University Press.
[12] Ibidem
[13] Greenleaf G., Review Essay: Technology and the Professions: Utopian and Dystopian Futures, UNSW Law Journal Volume 40(1), available at: http://www.unswlawjournal.unsw.edu.au/wp-content/uploads/2017/09/40-1-5.pdf
[14] France Intelligence Artificielle, Une stratégie pour la France en matière d'intelligence artificielle, available at: https://www.economie.gouv.fr/files/files/PDF/2017/Dossier_presse_France_IA.pdf
[15] HTS Consulting: Nouvelles compétences, transformation des métiers à horizon 2025 : réussir l'accompagnement au changement, available at: http://www.observatoire-metiers-banque.fr/mediaServe/Etude_competences_metiers _2025 _web.pdf?ixh=4036006186068213780
[16] The Millennial Survey, Deloitte (2014), available at: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/gx-dttl-2014-millennial-survey-report.pdf

estimated that employees belonging to the *Y* generation (also known as *Millenials* or *Digital Natives*, comprising individuals born between 1978 and 1994), wish a more qualitative assessment of their work and reject almost unanimously (92%) profit as the only measure of their performance.

The magnitude of AI on the workforce market raises the issue of training. A rather significant discrepancy can be noticed between the needs of the employers and the current university system. At present, the workforce market favours a pluridisciplinary qualification focused around specific hard skills, knows as STEM (Science, Technology, Engineering and Mathematics), and on digital skills. The continuous evolution of AI and the rapid rate of degradation of knowledge prompt a reconsideration of the training period. This period should not be considered as a stage in an individual's life, but rather a continuous process of *lifelong learning*.

Such a model is proposed by the Stanford University, under the designation *Open Loop University*[17]. The model is imposed by the frequency with which graduates have changed professional careers. These changes require advanced learning at variable intervals during an individual's lifetime. The idea behind this model is clearly shown in figure 1.

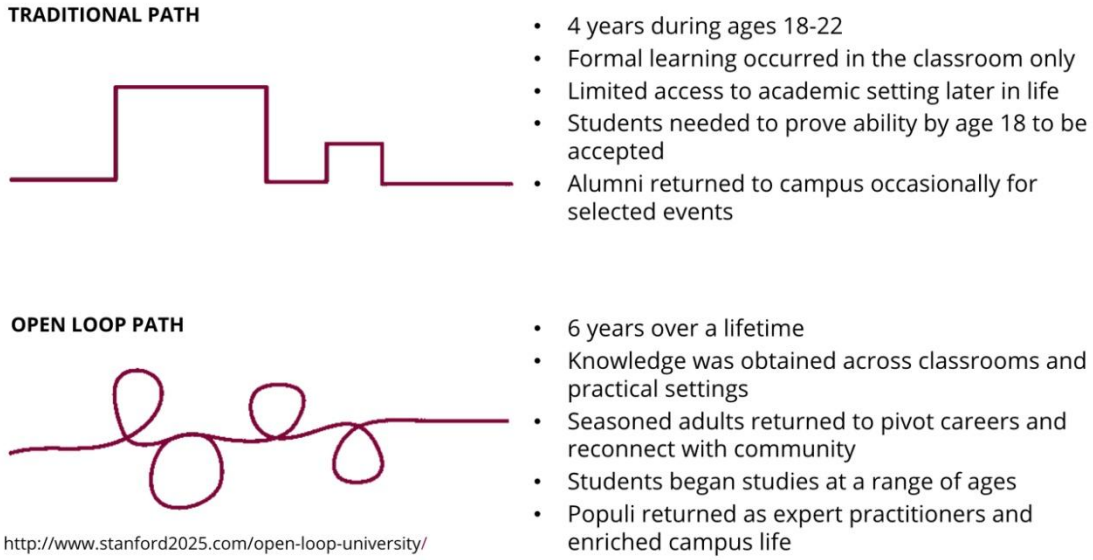

Figure 1. The *Open Loop University Model*

Source: http://www.stanford2025.com/open-loop-university/

[17] Open Loop University Stanford 2025, available at: http://www.stanford2025.com/open-loop-university/

We consider that such an approach requires a profound understanding of the idea of focus on abilities rather than on knowledge. This idea is probably the closest one to becoming a reality. Practical implementation implies a reorganization of academic courses based on a broader scope of abilities: scientific analysis, quantitative reasoning, efficient communication etc.

Within the *lifelong learning* model, another issue appears in relation to the training of adults, issue which must be approached in another manner, different than that used in the case of children and adolescents. If *pedagogy* is the art and science of educating children and it is based on the conviction that the teacher should adhere to a standardized curriculum, *andragogy* (the science of teaching adults) must take into consideration that:

- adults have a high degree of epistemological curiosity;
- they are more motivated to learn and are more perseverant;
- they know exactly what they want to learn;
- they are more receptive to practical applications of theoretical knowledge.

4. ARTIFICIAL INTELLIGENCE AND THE EU STRATEGY

In April 2018, the European administration presented a plan for AI in the European Union. The European Commission positions itself as a coordinator for the development of national policies in this sector, in its desire to catch up with USA and China. (China announced in 2017 a public investment plan of 18 billion Euros until the year 2020[18]).

In this regard, 24 EU countries, joined by Norway, signed a declaration of commitment to modernizing national policies in view of developing research in the field of AI. The only states that did not sign this declaration are: Cyprus, Romania, Croatia and Greece[19].

EU is expecting an investment in AI of 20 billion Euros from the signatory states and the private sector until the year 2020. The European Commission contributes with an investment of 1.5 billion Euros for the timeframe 2018-2020 within the programme *Horizon 2020*[20],[21] .

[18] La Commission européenne veut promouvoir l'intelligence artificielle dans l'UE, available at: https://www.touteleurope.eu/revue-de-presse/la-commission-europeenne-veut-promouvoir-l-intelligence-artificielle-dans-l-ue.html

[19] 24 pays européens signent un pacte pour développer l'intelligence artificielle, available at: https://www.euractiv.fr/section/economie/news/twenty-four-eu-countries-sign-artificial-intelligence-pact-in-bid-to-compete-with-us-china/

[20] La Commission européenne veut promouvoir l'intelligence artificielle dans l'UE, available at: https://www.touteleurope.eu/revue-de-presse/la-commission-europeenne-veut-promouvoir-l-intelligence-artificielle-dans-l-ue.html

The coordinated plan at the level of the European Union in the field of AI has the purpose of guaranteeing the complementary aspect and the synergies between the measures taken at national and EU level, in order to maximize the impact and disperse the positive effects of AI across Europe. EU countries are encouraged to develop their own national strategy in terms of AI until the mid of the year 2019. Until now (December 2018), the following countries have adopted national strategies with corresponding budgets: France, Finland, Sweden, the United Kingdom and Germany[22]. Other countries, such as Denmark, Luxembourg, Netherlands and Ireland are integrating the measures relating to AI in a broader strategy for digital transformation.

"The member states have a level of excellence in certain sectors, but they cannot achieve much on the international scene. Nevertheless, the EU can be a driving force", stated Mariya Gabriel, European commissioner for digital economy and digital society, at a press conference in Bruxelles on the topic of investments in technology and artificial intelligence[23].

We consider that, by positioning itself outside the common strategy of the EU countries, Romania will only increase the existing gap in digital competition, given the evolution of the main indicators in this regard[24]: *Digital Economy and Society Index (EU28 DESI)* defined for the countries in the European Union, *International Digital Economy and Society Index (I-DESI),* an extension of the *UE28 DESI* index, *E-Government Development Index (EGDI), Human Capital Index (HCI)* and *IMD World Competitiveness Yearbook.*

At present, in Romania, scientific research backed by the government in the field of computer science is carried out through isolated projects, lacking magnitude. The absence of a database for scientific research leads to the possibility that several universities and research institutes are carrying out parallel work on the same topic, without performing a synergic activity. In

[21] HORIZON 2020, available at: https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/H2020_RO_KI0213413RON.pdf
[22] Questions et réponses: Plan coordonné dans le domaine de l'intelligence artificielle «fabriquée en Europe», available at: http://europa.eu/rapid/press-release_MEMO-18-6690_fr.pdf.
[23] 24 pays européens signent un pacte pour développer l'intelligence artificielle, available at: https://www.euractiv.fr/section/economie/news/twenty-four-eu-countries-sign-artificial-intelligence-pact-in-bid-to-compete-with-us-china/
[24] Lixăndroiu D., Digital Competitiveness Indicators and the E-Government Process in Romania, JSEG - *Journal of Smart Economic Growth*, Volume 3, Number 2, Year 2018, available at: https://jseg.ro/ojs/index.php/jseg/article/view/98/68

the *National Strategy regarding the Digital Agenda for Romania 2020*[25], the phrase *artificial intelligence* appears only once, in the SWOT analysis for innovation in IT&C in economics, as an opportunity: "*The increasing demand for autonomous systems incorporating elements of artificial intelligence".*

Nevertheless, in Romania, there are Romanian companies that carry out activities in the field of artificial intelligence, creating important applications in the area of cyber-security (antivirus software), in the field of education etc.

We consider that Romania's adherence to the great European research concert in the field of AI could have represented a good opportunity to carry out major research with multiple applications in various areas of interest.

5. CONCLUSIONS

Artificial Intelligence has an interdisciplinary nature: mathematics, computer science, statistics. By combining various approaches from these disciplines, an attempt is carried out to imitate the cognitive processes of the human brain (memory, recognition, language, reasoning).

In terms of the evolution of AI and the possibility of imitating emotional processes, we believe that the horizon 2030, set by some researchers, is too optimistic.

The changes brought on by AI creates unease: workers are afraid of losing their jobs due to automation, a large number of individuals are asking who will be responsible if a wrong decision is made by an AI governed system, the business environment is concerned by the international competitiveness in the field of AI, taking into account the massive investments made in various parts of the world which will influence productivity and costs.

Gilles Babinet raised the issue of the *End of nation states,* given the loss of sovereignty induced by technological development and the process of globalization[26].

[25] Strategia națională privind Agenda Digitală pentru Romania 2020 https://www.juridice.ro/wp-content/uploads/2014/12/Strategia-Nationala-AD.pdf

[26] Babinet G., Institut Montaigne, La fin de l'Etat-nation? Partie 1, les glissements de souveraineté induits par la technologie, available at: https://www.institutmontaigne.org/blog/la-fin-de-letat-nation-partie-1-les-glissements-de-souverainete-induits-par-la-technologie

It is difficult to provide a certain answer to all these issues, given the phenomena with which human kind is currently confronted al a global level, but AI evolution will certainly clarify these matters over the course of the following years.

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available at: https://www.touteleurope.eu/revue-de-presse/la-commission-europeenne-veut-promouvoir-l-intelligence-artificielle-dans-l-ue.html

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