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Artificial Intelligence and Blockchain in Online Education

Innovative impact

Artificial Intelligence, in general, and more specifically Machine Learning are the hottest jobs in the IT industry right now, and it is expected AI to grow exponentially in the next five years. In education it will include looking at new models of teaching. Online courses have raised the possibility of changing the business of learning, while AI may be able to change the nature of teaching, providing more personalised platforms and free teachers to spend their time more effectively.

The learning environment isn't fixed and technology is far from static, so instead of developing new digital learning spaces, perhaps universities may be better off embedding digital technologies across the spaces they already have. This means that spaces and application interfaces won't be as important as "smart" solutions - such as AI and blockchain - that can respond in real-time based on the analysis of data and the patterns of personalized use.

Introduction

The stakeholders who make decisions concerning the introduction of online learning in universities are deeply aware of the social impacts of emerging technologies and of the role of real people in shaping those technologies. However, people are no longer the only ones using computers, phones, tablets, and devices to connect online. Increasingly, our cars, thermostats, refrigerators, and a host of other objects form a networked, physical world. Furthermore, Artificial Intelligence (AI) today brings the ability of algorithms to process massive amounts of data and make inferences about the interactions between underlying factors. As we read, study, search and navigate the world, inferential machine learning is getting smarter by finding, observing, and recording hidden models that explain our behavioural patterns. More, this data can be used to change parameters in cyber-physical systems that live around us and positively influence Education.

Learning from vast amounts of data

Intelligent systems may be able to respond directly to students and teachers based on the huge amount of data gathered through e-learning platforms and management systems. So, without losing ourselves in controversies and open questions, we can say that AI's future will surely have an impact on organizations, which means the replacement of our current analytical tools with intelligent agents, state-space problem representations, uninformed and heuristic search, game playing, logical agents, and constraint satisfaction problems. This is not new and AI techniques can also be used to create new ideas in three ways: by producing novel combinations of familiar ideas; by exploring the potential of conceptual spaces; and by making transformations that enable the generation of previously impossible ideas (Boden, 1998). However, the potential of AI has taken a long time to be exploited and is today more common in search tools (Google) and commercial applications (Amazon), for example. Recent advances, such as machine learning provided by Microsoft, Google or IBM (e.g. Watson), have not reached (yet) a widespread use nor they represent recognizable trends in society, and certainly not in educational applications. However, there is an initiative by EADTU to organise action lines on Artificial Intelligence in teaching and learning with the participation of other European universities.

The emergence of blockchain

Blockchain has been proposed initially in a paper from Nakamoto

References

- Ateniese, G., Faonio, A., Magri, B., & De Medeiros, B. (2104). Certified bitcoins. In: *International Conference on Applied Cryptography and Network Security*. pp. 80–96. Springer.
- Boden, M. (1998). Creativity and artificial intelligence. In *Artificial Intelligence*. 103 (1-2), p. 347-356. Elsevier. DOI: [https://doi.org/10.1016/S0004-3702\(98\)00055-1](https://doi.org/10.1016/S0004-3702(98)00055-1)
- Brandão, A., São Mamede, H., & Gonçalves, R. (2018). Systematic review of the literature, research on Blockchain technology as support to the trust model proposed applied to smart places. In *World Conference on Information Systems and Technologies* (pp. 1163-1174). Springer, Cham.
- Burbules, N. C. (2014). Meanings of “ubiquitous learning”. *Education Policy Analysis Archives*, 22, 104. doi:10.14507/epaa.v22.1880
- Chakrabarti, A., & Chaudhuri, A. K. (2017). Blockchain and its Scope in Retail. *International Research Journal of Engineering and Technology*. 4(7), July.
- Cope, B., & Kalantzis, M. (Eds.). (2010). *Ubiquitous learning*. Chicago: University of Illinois Press. Retrieved from <http://manchesterileap.pbworks.com/f/Ubiquitous+Learning+Book+Review.docx>
- Decker, C., & Wattenhofer, R. (2104). Bitcoin transaction malleability and MtGox. In *European Symposium on Research in Computer Security*. pp. 313–326. Springer.
- Grech, A., & Camilleri, A. F. (2017). *Blockchain in education*.

(2008), as a solution for cryptocurrencies. It is a decentralized technology that allows to perform transactions through shared network participants, supported by new forms of distributed software architectures. This technology improves the transparency of products, the management of the supply chain and more efficient data chain, better loyalty management system, improving customer profiles and preventing counterfeiting (Chakrabarti & Chaudhuri, 2017).

The blockchain technology presents itself as valuable solution in a decentralized exchange environment where all transactions are recorded visibly open to everyone. The goal of blockchain is to provide confidence in data, although these attributes also configure many technical challenges and limitations that need to be addressed (Brandão et. al., 2018).

The blockchain proposed by Satoshi Nakamoto (Nakamoto, 2008) for the bitcoin cryptocurrency, intended to present it as a ledger, where transactions of bitcoin users were stored, so that different transactions using the same monetary value could not occur without a centralizing entity to validate them. In Nakamoto proposal, the transactions are visible to the members of the network through a node value transfer to another node on the network, identified in advance. The solution to achieve defense against modifications, tampering or other fraud attempts in the ledger involves the simple detection by the network users. To get this control over changes in the elements of the ledger, the blocks are interconnected, forming a chain.

In a simplified way, the blockchain has in its foundation: a distributed peer-to-peer network (Decker & Wattenhofer, 2014); the time of creation or modification (timestamp) (Ateniese et. al., 2014); the one-way function with the application of applying hash functions; the digital record of the author of the amendment; and the generation of a new mechanism blockchain block.

The supported confidence in Blockchain technology is evaluated by McKnight et. al. (2017) and suggests an opportunity for regulators and policymakers to shape the development and commercialization of disruptive innovation. Privacy and security are two of the issues that can justify the more widespread use of Blockchain technology.

The application of blockchain

Why does it seem so important and why everybody is talking about it? The main reasons that could explain this success are: a single entity does not own the data stored inside the blockchain; the data is cryptographically stored inside the blockchain; the blockchain is immutable, so no one can tamper with the data that is inside the blockchain; the blockchain is transparent so one can track the data if needed.

It seems, according to several authors, that the use of blockchain technology will have no limits of application. Of course, this includes the more particular area of Education. Several use cases are already in place and were studied by Grech & Camilleri (2017). In Education there are several potential applications for this technology, namely, for the purpose of increasing efficiency and transparency, and maintaining

Publications Office of the European Union 2017, 132 S. - (JRC Science for Policy Report). Luxembourg.

Hwang, G. J., & Tsai, C. C. (2011). Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, 42(4), E65-E70. doi:10.1111/j.1467-8535.2011.01183.x

McKnight, L. W., Etwaru, R., & Yu, Y. (2017). *Commodifying Trust: Trusted Commerce Policy Intersecting Blockchain and Internet of Things*.

Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Retrieved from the web on 21/Feb/2019 in <http://bitcoin.org/bitcoin.pdf>

a high level of security. A few examples of applications:

- Certification of student degrees between institutions: this will allow for a better mobility of students across the European Union and, eventually, between universities and schools that adhere to the system;
- Creation (and maintenance) of a student academic CV: a digital document that can be shared with employers, safeguarding all GDPR aspects, with some restricted nodes, such as universities, to be able to access the fields to update;
- Student identity: which can be unique across all institutions, sharing the same base platform;
- Professor identity: in the same way as the student's.
- Records management: reducing or eliminating paper-based processes across a campus or between universities.
- Smart Contracts and verifiable transactions: to support agreements, and being able to validate attendance and assignment completion. Also, for Distance Learning, blockchain applications could be used to minimize fraud attempts;
- Authorship: validation of educational resources authorship using blockchain.

Conclusion

The last years brought new advances and general access to Artificial Intelligence through availability of algorithms provided via cloud models, allowing high volumes of computer and data processing. Also, the inclusion of those built-in algorithms into applications is now of great simplicity. This opened up new ways to develop disruptive solutions for Education in general, and for distance learning in particular.

On the other hand, blockchain is also a technology with enormous disruptive power that, after a few years of intensive implementation as a cryptocurrency base, is now proving to be an open resource with multiple possibilities in different fields. The key interest in this technology lies in its ability to move from a centralized data logging system to a distributed system that ensures no change in information and keeps the privacy of data.

There is a growing interest in AI and blockchain technologies today. So, for this interest to become a real contribution to the development of Education it will be necessary to open our minds. Online education may benefit from many of these new tech developments, and there is a need to clarify what these are to make sure investments are directed to the right solutions.