

Artificial intelligence and data analytics in digital business transformation before, during and post COVID-19

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A New World Post COVID-19

Lessons for Business, the Finance Industry and Policy Makers

edited by Monica Billio and Simone Varotto

Artificial Intelligence and Data Analytics in Digital Business Transformation Before, During and Post COVID-19

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Abstract Business activities have become highly dependent on the functions that digital technologies offer. The role and critical value of digital technologies such as artificial intelligence and data analytics are clearly witnessed during the COVID-19 pandemic. It is hard to just imagine what the world would become if there were no Internet and digital technologies during these times. The trend and potential value of artificial intelligence and data analytics to leverage and transform organisations are explored, with challenges identified and directions offered to make businesses ready to embrace future unknowns.

Keywords Artificial intelligence. Data analytics. Digital transformation. Technology impact. Technology in pandemic.

Summary 1 Artificial Intelligence and Big Data Before and During COVID-19 Pandemic. – 2 The Trend of AI & Big Data Development in Post-Pandemic. – 3 The Challenges in Using Data Effectively for Social and Economic Analyses.



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325

1 Artificial Intelligence and Big Data Before and During COVID-19 Pandemic

Data has become one of the most valuable assets to determine the success of businesses and public sector institutions globally. Artificial intelligence (AI) and data analytics are the key factors to unlock the value of data assets. Data has played a vital role in the battle against COVID-19. From predicting epidemic progression, detecting infections and diagnosis, accelerating clinical discovery, optimising resource allocation, and supporting public policymaking, in almost every aspect of the epidemic response, AI and big data have made a positive contribution to strategic decision-making and operational measures.

From the perspective of different beneficiaries, with the help of AI and big data applications, data-driven pandemic responses have taken many forms:

- The public can access the latest statistics to understand the dynamic of the pandemic (WHO 2020b); get information on prevention (WHO 2020a; NHS 2020); receive notifications on the potential risk of infection - contact tracing (Google 2020); and get diagnostics or treatment advice from doctors (GSMA 2020; Ghosh, Gupta, Misra 2020). Transparent and sufficient information exchange avoids unnecessary panic among the public and helps cooperation.
- AI and big data modelling help governments to improve virus surveillance and responses via outbreak predictions (Ardabili et al. 2020; Strzelecki 2020), spread tracking (Zhou et al. 2020), resource allocation (Morariu et al. 2020; Ibrain, Salluh 2020), and policy decisions support (Gao et al. 2020; Gatto et al. 2020).
- AI empowered health institutions and agencies with quick computed tomography (CT) scan image recognition systems (Huang et al. 2020; Mei et al. 2020). In China, more than 100 hospitals employed AI image recognition in lung CT identification which helps with large-scale infection testing (Cheng 2020). Biomedical research might be the one that benefits the most from AI and big data technology (Mamoshina et al. 2016). The vast amount of biomedical data forms the foundation of genomic sequence analysis, drug discovery and vaccine development (Stebbing et al. 2020; Beck et al. 2020). The global race for coronavirus vaccine is essentially a competition to leverage the advantage of AI and big data in bioscience (Magar, Yadav, Farimani 2020).

2 The Trend of AI & Big Data Development in Post-Pandemic

With regard to the accelerated adoption of AI and big data, we recognise three trends that are likely to influence the post-pandemic period.

The first trend is an accelerated digital transformation in various industries with the purpose to compete or even survive through digitisation of the production and delivery of products and services by deployment of technologies such as AI and data analytics. During the lockdown period, the digitisation in enterprise activities and virtual business grew fast, partly driven by the restrictions on the traditional way of conducting business. The increased mode of digital business processes may become the new normal for enterprises, public sectors and individuals. Therefore, traditional enterprises face an urgent necessity for digital transformation to servitise their offerings (Tien 2015) and use technical platforms to conduct business in digital business ecosystems (Liu, Guo, forthcoming). To a large extent, as commented by Atkins (2020), “COVID has been the catalyst for digital transformation at scale”. However, enterprises should maintain a balance between their long-term strategic targets and the immediate company benefits that come from technological solutions, which may pose organisational challenges. In a recent survey (NewVantage Partners 2019) administered to 65 Fortune 1000 leading firms, about one third reckoned that they are not data-driven companies yet even though they have already adopted big data and AI and would still increase their investment in those areas. It follows that the journey of digital transformation for organisations is a long-term commitment that will require a radical shift of the mindset of the leadership and changes in business operations and culture across the firm (Liu, Li 2015).

The second trend is an increased exploitation of big data which bears broad implications for all sectors. Data harnessing involves a wide scope of activities starting from the ownership of data or digital sovereignty, to data collection, storage, management and utilisation. This raises a number of challenges. For instance, digital sovereignty is a highly debated issue that is still under the spotlight (Pinto 2019). When organisations grapple with increasingly larger data sets, they gradually improve their ability to change the landscape of business competition. Therefore, enhancing the ability of harnessing big data is critical to a company’s long-term development.

The third trend is an easing of the bottleneck due to algorithm maturity. In a review conducted by Bullock et al. (2020), a broad range of AI-driven applications which are used against COVID-19 have been examined. The disappointing finding is that few of the current AI systems are mature enough to make a substantial operational impact in the fields of epidemiology, diagnosis and therapy. A conclusion derived from the study is that “AI systems are still at a preliminary stage, and it will take time before the results of such AI measures

are visible” (Petroopoulos 2020). The constraints mainly come from the lack of solid historical training data and the lack of quality data without noise and outliers (Naudé 2020).

These three trends are interrelated as progress in one area accelerates the advancement of others. The development of technological capabilities and the penetration of technologies to business practices and people’s lives will bring profound changes in the years to come.

3 The Challenges in Using Data Effectively for Social and Economic Analyses

The need for and benefit from collaborative work in science and technology across disciplines and geographic boundaries have been recognised and even amplified during the COVID-19 pandemic. For example, since the National Oceanic and Atmospheric Administration (NOAA) has made their dataset open access, 68,000 other datasets have become publicly available (NOAA 2018). Those datasets have promoted innovations in weather applications and promoted scientific research in related fields. Other examples are the MIMIC open dataset, which was developed by the MIT Lab for Computational Physiology (Moody, Mark 1996) and the datasets of the Beth Israel Deaconess Medical Center (BIDMC) (Johnson et al. 2016). After more than 20 years of continuous maintenance and updating, BIDMC continues to make the datasets open to researchers as a comprehensive clinical and physiologic data source, which has led to significant contributions to research in the medical field.

Although great advantages are reaped in technological innovations from data openness, potential concerns relate to data misuse and the consequences of breaching data security. As new privacy and data protection laws are gradually put in place in many jurisdictions, the possible conflicts of interests between data openness and privacy become a significant factor in preventing the adoption of big data technology and AI. In order to solve privacy and security issues, researchers have attempted to train AI algorithms without using sensitive data. Federated learning (Konečný et al. 2016a, 2016b; McMahan et al. 2016) is one of the promising solutions which adopts decentralised collaborative machine learning and have been applied in retail, healthcare, and fintech (Yang et al. 2019). Due to differences in cultural backgrounds and strategies in the development and application of new technologies, different geographical regions have put different emphasis on data privacy. This represents a challenge for data re-use and sharing across industries and countries.

AI ethics is a topic that is much debated in academic and industry circles. Due consideration on AI ethics is needed during the process of system development. Dignum (2018) classifies AI ethics into

three levels: ethics by design, ethics in design and ethics for design. These focus, respectively, on 1) AI's capabilities in ethical reasoning, 2) the methods of analysis and evaluation of AI's ethical implications, and 3) the code that should be adopted to ensure the ethical integrity of developers and users. AI ethics is not just a technical issue. Rather, it is a social concern with broad implications. The European Union published the first draft of ethics guidelines for trustworthy AI (HLEG) in December 2018 with the purpose of leading the discussion. Although there is still a long way to go before key regulations are in place, we believe that researchers in the relevant fields have a critical role to play for the safe and ethical deployment of AI in business, government sectors and society at large.

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