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Title: Post Covid-19 and Business Analytics

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Abstract: This paper highlights the way companies can apply artificial intelligence (AI) in the post Covid-19 period. We show that how the AI can be advantageous to develop an inclusive model and apply to the businesses of various sizes. The recommendation can be beneficial for academic researchers to identify several ways to overcome the obstacles that companies may face in post Covid-19 period. The paper also addresses few major global issues, which can assist the policy makers to consider developing a business model to bounce back the world economy after this crisis is over. Overall, this paper enhances the understanding of stakeholders of business about the importance of application of the AI in businesses in a volatile market in post Covid-19 period.

Keywords: Artificial Intelligence, Crisis, Covid-19, Artificial Neural Network, Coronavirus, Economic development

1. Introduction

The current Covid-19 outbreak, started in December 2019 in Wuhan city of China, brings an extraordinary crippling impact on the world economy. During this unprecedented socio-economic crisis for business, it is too early to recommend a business model for companies that can be useful when the world is out of the Covid-19 pandemic. Based on the existing literature on financial crisis or similar exogenous shocks, researchers have started predicting the effect of Covid-19 on world financial markets and direct or indirect impact on economic development (e.g. Bin et al. 2020; Goodwell, 2020). After the failure of the Lehman Brothers in 2008, a strand of literature has evolved and started discussing about the ‘Space Economy’ that focuses on the application of advanced technologies such as the artificial intelligence (AI). Extant studies on the AI show the applicability and effectiveness of the AI in restructuring and reorganisation of economies and financial markets across the world (see Lewis, 2001; Madhav et al., 2017). To initiate the economic development and reduction of inequality in allocation of resources for development of stakeholders, application of this technology receives an immense importance in academia and practice. Based on the above discussion, the objective of this paper is to identify the scope of application of the AI by companies in the post Covid-19 crisis period as there is a lack of detailed studies on the impact of the use of the AI to overcome a pandemic shock similar to the one we are experiencing at the beginning of year 2020. To the best of our knowledge, this original research is the first study to highlight the possibility of application of the AI by companies in the Covid-19 recovery phase.

2. Advantages of using the AI after the end of Covid-19 crisis

Companies can maximise the value of their concerns by minimising the operating cost. Porter (1985) argues that companies apply their sustainable models to take competitive advantages over their peers. One of the main challenges faced by

companies during the last decade is to deal with big data created by high information flow through the internet. To address this challenge, companies start utilising the AI to improve the world economy (Manyika, Chui, Bughin, Dobbs, Bisson, & Marrs 2013). Similar to big companies, small and medium-size enterprises with the government interventions allow themselves to think in a creative manner. In addition, these companies introduce several disruptive changes in their businesses by applying the AI. The development of such infrastructure by big, medium and small companies positively impact the rate of unemployment, GDP and inflation, to name a few, of many countries (Öztürk, Mrkaic & IMF 2014). Moreover, an application of the super-intelligent system creates new scopes for business of various sizes and allows the transmission of required information within a few nanoseconds. As a result, the development of the economy becomes visible because companies, mostly in advanced countries, of all sizes can apply this sophisticated and efficient business model based on advance technology such as the AI. In fact, the analysis of big data allows the companies to reduce the percentage of error in their business model. Furthermore, the global coordination and participation has increased because of the application of these advanced technologies as knowledge and research and development (R&D) begin to transmit widely from one country to another.

Competition among peers in the same industry or between big and small businesses influences innovation to find a sustainable business model. The AI-based models allow companies to reach rural or underdeveloped areas by introducing user-friendly technologies in day-to-day life. For example, a digital-biological converter can make a number of copies of flu vaccines remotely in the absence of human to support the local health system (Boles et al. 2017). Thus, various sectors such as health, transport, manufacturing, agriculture, etc. contribute to the development of the country-level economy, which in turn affects the world economy. During the financial crisis in 2008, the application of the AI by companies remain largely limited. However, recently, due to rapid advancement of technologies, companies are trying to apply a composite Monte Carlo decision-making process in the highly uncertain post coronavirus period (Fong et al 2020). In contrast, before applying the AI-based models to recover the economy from the current crisis, companies need to consider the unprecedented damage caused by the novel coronavirus which is not comparable with the previous financial crises, e.g. collapse of the Lehman Brothers.

3. Application of AI for global development in post Covid 19

One of the major global challenges for the past decades is to keep the global warming stay below 2°C to reduce the risk of biodiversity. The rapid climate change is posing a high risk to the livelihoods of human being and to animal kingdom. A huge number of studies indicates that failure to conserve wildlife can create a threat to human being (<https://www.eauc.org.uk/6998>). In addition, the modern business activities are causing damage to environment and this in turn can allow the harmful virus to find shelter in human being. Thus, the wildlife conservation needs to take care of a large database associated to business, which is difficult to obtain manually. In other words, companies need to identify the habitats to protect, and then create wildlife corridors as these corridors have immense biological significance. Let us take the case of Montana and Idaho in the USA. The conservation scientists of wild animal are using the AI-assisted system to track and record the movements of wild animals. As a result, to reduce the risks associated with biodiversity, company can use the AI-embedded

technologies and can continue to work on maintaining the climate change in the post-Covid-19 pandemic period.

The immense use of the AI can be observed in the healthcare sector, which is a big challenge for all countries around the world. During the recent pandemic, we observe the use of AI-driven tools and importance of active learning and cross-population test models (Santosh et al, 2020). For instance, robots can disinfect hospitals to support the health workers, 3D printers can manufacture the personal protective equipment (PPE) for health workers in hospitals and care homes, smart phone enabled-tracking system can identify the close contact of a person with another infected person etc. are few to mention. Similar to the Covid-19 pandemic, we can also observe an application of the AI by healthcare business in the past decades. For example, the AI system of IBM Watson Health, in partnership with Barrow Neurological Institute, has been used to manage in analysis of many studies to conclude about the genes related to Amyotrophic Lateral Sclerosis (ALS) disease. In addition, remote treatment without risking the life of health carer is only possible by the application of advanced technology. Consequently, once we come out of the crisis, it is important for the companies to analyse a huge amount of information available from every affected country through their AI-based forecasting model. This can mitigate the risk of encountering the similar pandemic in the future.

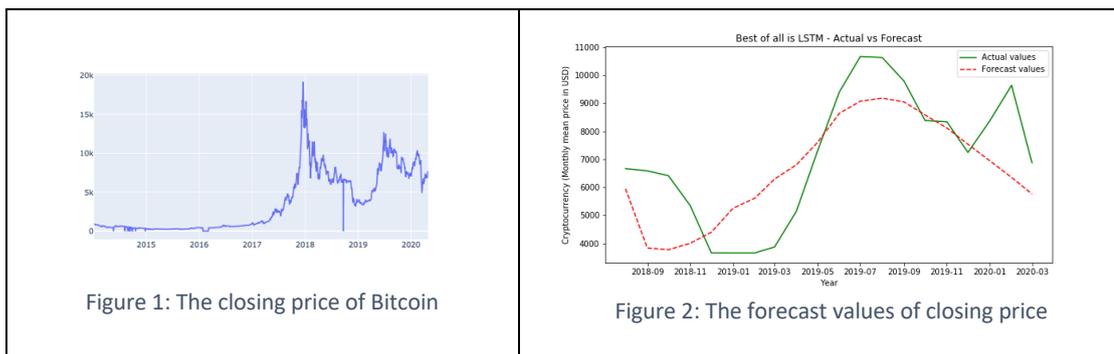
In the recent days, we observe a huge investment in developed and developing countries by the public and private businesses for clean energy (Bloomberg NEF). In the post Covid-19 era, the business can start utilizing the invested resources and generate more units of clean energy (or green energy) with the help of AI-based technology. For example, quantum computing can create plasma reaction in a nuclear fusion reactor which can reduce fuel-based energy and produce clean energy. Companies can also focus on assisting large businesses to find a technology-enhanced way of controlling the cost associated with the cooling system in the big data centre. Deep mind is one of the examples of cost saving smarter energy used by big business, like Google.

The non-self-improving AI can create philosophical zombies (p-zombies), where we can observe a dead subjectivity. By combining the AI with the existing technologies, companies can address complicated problems through biological or artificial neural networks (Christiano, 2016) or they can use the AI that do not self-improve even after interacting with the government structures. Industry can focus more on a short period for accurate early forecasting model using small dataset to check the suitability of an application of the AI (Fong et al, 2020). If businesses can get knowledge about how to reduce the cost of application of AI, how to merge the AI to time (Bostrom 2003) and how to control various parameters of global issues by application of the AI (Yudkowsky, 2008). As a result, the global control system can introduce a limited super-intelligence for the benefit of the society (Goertzel, 2012).

4. An experiment on application of the AI on forecasting cryptocurrency

Let us take a practical application of the AI on a real-time data. In this section, we show the use of artificial intelligence, especially an application of artificial neural network (ANN) in time-series forecasting. Similar to the function of human brains, the ANN is composed of a large number of highly interconnected processing

elements. Currently, the application of neural network is considered as one of the most sophisticated methods for natural language processing and computer data visioning. For instance, in a study on bankruptcy prediction of banks and firms, Kumar and Ravi (2007) find that ANN algorithm can outperform many single or hybrid classical forecasting techniques such as ARIMA and GARCH. In this brief experiment, we use a combination of well-known neural network algorithms such as long short-term memory (LSTM), time-lagged neural network (TLNN), feed-forward neural network (FNN) and seasonal artificial neural network (SANN) to forecast a sample (time-series) of cryptocurrency closing price¹ for the year 2014-2020 (till April 28, 2020). Figure 1 shows the time-series graph of a daily closing price data for bitcoin retrieved from Kraken.



To keep our analysis simple, we calculate the monthly average closing price in each year from the daily 2298 observations. We use 25 percent of this information as the test data and 75 percent data as the training data. In this training method, all the above-mentioned four models try to recognise the regularities and patterns in the input data, learn from historical data and then provide us generalised forecast values, based on the known previous information. Thus, the method is self-adaptive and non-linear in nature. So, it overcomes a priori assumptions of statistical distribution of the data. Based on the optimal parameters – such as root mean square errors (RMSE), our experiment suggests that LSTM model is a better method to forecast the bitcoin price movement. Our finding is reported in Figure 2² and it indicates a downward trend of price of cryptocurrency since January of 2020. However, the model can be a complex one in practice if we consider transaction costs and other financial or environmental exogenous shocks such as economic lockdown due to Covid-19. Note that, our above-mentioned experiment is to show the applicability of ANN rather than drawing conclusion from the results for policy makers.

5. Challenges of using the AI after the end of Covid-19 crisis

The AI opens up a new chapter in the world economy. But, many studies, e.g. Roubini (2014) and Stiglitz (2014) raise serious negative implications of the application of AI in the World Economic Forum 2015 (WEF, 2015). They mention that there is a need of huge investment of money and R&D to invest in the AI-embedded robots that can only be borne by large companies only. Thus, there is a limited opportunity to include

¹ The data is obtained from www.cryptodatadownload.com

² The other figures are reported in the Appendix.

both small and large businesses in the same model which may not be sustainable in the growing economy. Extant studies argue that a huge job loss can slow down the progress of the economy (Lalive, 2007). Popper (2015) reports that the volatility can be higher in the economy when companies are able to use alternative digital money such as cryptocurrency. So, the lack of opportunities to small businesses can increase a higher gap in performance between public and private sectors or small and large companies. This may reduce the efficiency and accuracy in big data analysis and development of a business model applicable to all companies. The privilege of a group of companies with application of the AI may limit the development of the world economy. In addition, there can be a certain catastrophic AI risk. The challenges around the AI-safety or its alignment (see Russell, 2017) can be a huge concern for the companies, especially in the post-coronavirus crisis as there may be a lack of job force in practice.

As it is hard to be definite about the future uncertainties, companies can depend on forward looking taxonomy. One of the popular taxonomies, stated by Sotala and Yampolskiy (2014), defines the dangerous impact of friendly AI (Yudkowsky 2003). For example, a bio-hacking of business can use AI to understand the published genomes, which might create a multi-pandemic (Turchin et al. 2017) and such business model can create neural interfaces to affect the human brains adversely (Hines 2016). Thus, it still remains a puzzle as to what extent companies can apply the AI safely and effectively once the world economy gradually comes out of the Covid-19 pandemic.

6. Conclusion

In this forward-looking, constructive paper, we identify few challenges and yet major advantages that any business can take advantage in using the AI in the post Covid-19 period. However, we acknowledge that immense challenges are waiting for us and the policy makers, around the world, should come together to solve these issues. One major challenge to the policy makers is to identify how to implement ethical practices in business to transmit data securely to get it analysed by AI-based technology for the benefit of the society. The local and international decision makers need to take responsibility to share their expertise to educate the mass about technology, which can reduce the risk of job loss. Moreover, by creating “Artificial Intelligence Marketing” (Murray and Keevil, 2014), the restructuring of the world economic development is possible when the regulators allow the business to use the AI to enhance production-led profitability and to reduce the associated risk through innovative methods. Following the predictions of other studies, we expect that AI-led business can outperform all tasks of human as early as 2023 after the world economy manages to come out of Covid-19 pandemic (see Grace et al. 2017; Shakirov, 2016). In a nutshell, the applications of the AI in the post Covid-19 era can allow the individual and business communities to work together for the world development at a rapid rate by outweighing the negative aspect of using technology in society.

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Appendix

Actual and predicted values from ANN models

