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Robots in daily life: A post-covid-19 perspective

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Abstract

This impact paper offers an overview of how robots equipped with AI may influence various sectors after the Covid-19 pandemic. Specifically, the paper focuses on the education, retail and hospitality, and healthcare sectors. The paper argues that as robots´ intuitive and empathetic intelligence capabilities improve, there will likely be an increase in robot applications in the aforementioned sectors. The paper also presents implications for policy makers, firms and educational institutions.

Keywords: Robots, Artificial intelligence, Covid-19, Society

Robots in daily life: A post COVID-19 perspective

With the rise of the robotics and artificial intelligence (AI) industries, there is growing concern about their dangers. Currently, there is ample debate about whether the increased usage of robots and AI can lead to an economic crisis due to job losses (Coelli & Borland, 2019; Gonzalez-Jimenez, 2017). A recent article argued that robots will have an impact on society and in particular on the educational, retail and hospitality, and healthcare sectors (Gonzalez-Jimenez, 2018). However, robots equipped with AI (herein robots) can also improve our lives and even help us in times of need. The current Covid-19 crisis exemplifies a practical application of how robots can become our allies in fighting the virus. Further, these applications may serve as a catalyst in terms of how these robots are perceived and used in the aforementioned sectors. To illustrate the potential development of robots in various sectors once the pandemic has been controlled, the remainder of the article is structured as follows.

First, this paper provides an overview of how robots are already influencing the educational, retail and hospitality, and healthcare sectors. In particular, the discussion on the healthcare sector will be enriched with current insights from the Covid-19 pandemic. Second, the paper offers a perspective on how robots may further impact these sectors in post Covid-19 times. The paper uses the four intelligences framework advanced by Huang and Rust (2018) to build these arguments. This framework is grounded on robots' and AI´s capabilities of accomplishing tasks that require different types of intelligence. Lastly, the paper will offer a conclusion statement with some key implications for policy makers, firms and educational institutions.

THE “NOW”

The Educational Sector

The new Global Education Monitoring Report estimates annual education spending by households, governments and donors globally at US$4.7 trillion (UNESCO; 2019). Education is an integral part of society and robots are already starting to play a role in this sector. Although still in its infancy, there are already examples of robots being used as educational assistants or even as teachers in classrooms (Bicchi & Tamburrini, 2015; Li, Kizilcec, Bailenson, & Ju, 2016). These robots are able to interact with students, monitor their learning state, and teach them specific skills (Chang, Lee, Chao, Wang, & Chen, 2010). Interestingly, studies are offering support for this trend, showing positive effects of robot usage on children’s math and language capabilities (Brown, Kerwin, & Howard, 2013).

The Retail and Hospitality Sectors

Robots are being integrated into the retail and hospitality sectors. Large global retailers such as Amazon and Alibaba are using robots in their distribution centers (Grewal, Roggeveen, & Nordfält, 2017; Wen, He & Zhu, 2018). However, there are also applications in retail spaces and hotels where customers interact directly with service robots. Robots in these settings perform tasks such as providing information, advertising products, or greeting visitors (Kumar, Anand, & Song, 2017). For example, robots in the “Henn na Hotel” in Japan take the roles of concierge, receptionist and waiter (Park, 2020). At this point, hotels cannot fully function with robots alone and human support is still needed for some tasks.

Nevertheless, according to the hotel manager, using these robots is lowering costs, which makes the hotel more affordable while also offering customers a unique service experience (theguardian, 2015). Moreover, there may also be a novelty effect that allows robot hotels to catch the attention of the press and potential customers.

The Healthcare Sector

Many industrialized nations, including in Europe, are experiencing an aging society. Aging societies generally also entail increases in health care needs, specifically elderly care. Various sources suggest that countries are facing labor shortages in the healthcare sector (Köhler & Goldmann, 2010; Liu, Goryakin, Maeda, Bruckner, & Scheffler, 2016). For example, the WHO (2016) states that there are an estimated 7.3 million nurses and midwives in the European Region, but also highlights that this number is insufficient to meet current and projected future needs. This need has served as a catalyst for companies to develop robots that can support activities in the health- and elderly care sector. For instance, the Care-O-bot, is able to speak, learn and remind patients of their daily routine (e.g. when to take their medicine). Such robots serve as a support system for health professionals as they free up their time for other patient centered activities. Furthermore, research is already offering evidence of the positive effects of these robots on patients as they are reducing patients' loneliness, as well as helping in dementia care and stroke rehabilitation (e.g., Robinson, MacDonald, Kerse, & Broadbent, 2013). Interestingly, there are also timely examples showing the use of robots during the coronavirus pandemic.

As outlined in a recent article (Gonzalez-Jimenez, 2020), robots are serving as allies to humans in the fight against the coronavirus. Various sources offer accounts of how robots are being used in Wuhan, China and Thailand to deliver medicine to patients or measure their vitals (BBC, 2020; Channelnewsasia, 2020). These measures can reduce fatigue in healthcare staff while providing timely patient support. Moreover, they reduce contact between humans, thus reducing the likelihood of additional infections. Further innovations in Chinese hospitals entail the use of robots equipped with UV lights to disinfect rooms (Ackerman, 2020). Coronavirus-related solutions also go beyond the hospital settings as many citizens are quarantined in their homes. In order to serve these citizens, the Chinese government has employed logistics robots (autonomous vehicles) to deliver food and medical supplies (Arthur & Shuhui, 2020). These recent applications set the stage for what may be ahead after the corona pandemic.

THE "FUTURE"

The Four intelligences and the future

Service can be provided by humans and/or machines and depending on the nature of service (i.e. task), different intelligences are required. Huang and Rust (2018) describe these four intelligences as follows:

Mechanical intelligence is the ability to perform routine, repeated tasks automatically. Mechanical AI has a relative advantage over humans as this AI can be extremely consistent (e.g. no human fatigue and offering consistent results). *Analytical intelligence* is the ability to process information to solve problems and to also learn from this experience. This

includes AI that is able to process and synthesize large amounts of data and learn from them (e.g. the use of Big Data). *Intuitive intelligence* is the ability to think creatively and adjust effectively to novel situations and challenges. Tasks that are complex, creative, experiential or holistic and context dependent require intuitive intelligence. The complex nature of the tasks renders them reliant on intuition for successful service provision (e.g. complex and personalized service arrangements). *Empathetic intelligence* is the ability to recognize and understand other peoples' emotions, respond in an appropriate manner, while also influencing others' emotions. Empathetic tasks require high social and emotional knowledge and presence to satisfy the requirements of a job.

It should be noted that some of these AI applications can also be virtual (e.g. using a computer with a screen) and do not require a robot "body". However, the discussion in this section is rather focused on robots equipped with AI (i.e. embodied AI), as some tasks require a physical presence. Looking toward the future, a key question is how the above-mentioned sectors can benefit from the integration of robots in their activities.

Currently, robots are already fairly proficient at performing mechanical and analytical tasks. Covering these tasks will free up time for human staff to dedicate themselves to tasks that require intuitive and empathetic intelligence. This task-based distinction is important, because although progress is being made, robots are still not in a position to cover tasks associated with intuitive and empathetic intelligence at the level of humans. Consequently, for optimal performance, stakeholders should seek collaboration between humans and machines in order to leverage the advantages of both entities. In doing so, stakeholders are able to generate synergies, which can lead to optimization of resources that will also benefit the service recipient (e.g. customer, patient, student).

In the educational sector, robots can already process analytical information and respond and offer quantitative feedback to students (e.g. test scores, failure rate). Nevertheless, these abilities may not be sufficient to offer a complete learning experience for various reasons. First, student behavior, especially in children, is not always predictable and linear. Second, students also display different abilities and personalities that may require the teacher to offer emotional support. Third, problem solving is not exclusive to analytical thinking and creativity is also valued. Hence, for robots to become more independent teachers, it will be essential that these educational robots improve their intuitive and empathetic intelligence. As outlined by Huang and Rust (2018), strides are being made in particular in the realm of intuitive intelligence. However, there is still arguably a significant gap in terms of robots reaching human-level empathetic intelligence, thus suggesting that humans will need to lead educational tasks requiring a strong emotional component in the near-to-mid-term future.

As outlined above, in retail and hospitality, robots are able to draw historical data from shoppers or visitors to make specific recommendations. These functions rely mainly on analytical intelligence. Looking toward the future, robots will be in a position to offer more customized and creative service provisions by tapping into intuitive intelligence. For instance, robots will be able to use their visual and auditory sensors to evaluate shoppers' physical attributes and mood to make recommendations (Bertacchini, Bilotta, & Pantano, 2017). Furthermore, research suggests that humans seek empathetic and friendly service interactions when dealing with robots (Barnett, Foos, Gruber, Keeling, Keeling, & Nasr, 2014; Bertacchini et al., 2017). Therefore, it is likely that we will see an increase in robot usage in retail and hospitality settings as the development of empathetic intelligence progresses.

The healthcare sector is already experiencing applications of robots and AI, especially during the current coronavirus pandemic. Once again, current applications are largely drawing on mechanical (e.g. transport of medicine) and analytical intelligence (providing treatment feedback and patient reminders). However, especially in moments of severe stress and anxiety such as a health crisis, it is essential to protect the mental well-being of victims (Harbers, de Greeff, Kruijff-Korbayová, Neerincx, & Hindriks, 2017). In such situations, humans may still be superior to robots as critical situations can require a large degree of improvisation and emotional affinity. Thus, collaborations between humans and robots in patient care are likely the most fruitful avenue for the future. This will allow an optimization of resources that accounts for human and robots strengths and weaknesses. It should be noted that similar to the other sectors, as robots improve in their intuitive and empathetic capabilities, responsibilities in patient care may shift progressively from humans to robots.

Conclusions

Overall, current applications of robots during the coronavirus pandemic may serve as a foundation to potentially improve social acceptance and the integration of robots in the marketplace. Irrespective of the current pandemic, based on projections by the Boston Consulting Group (2017), there will be an increase in robot usage beyond health-related applications, touching many areas of daily life. In this respect is important that policy makers, firms and educational institutions introduce mechanism to deal with these upcoming changes. As outlined in prior work (Gonzalez-Jimenez, 2018), it is recommended to create governing bodies that establish international regulations and guidelines to manage the integration of robots and AI in various sectors. These governing bodies should take an interdisciplinary approach and include experts from various areas, such as computer scientists, engineers, psychologists, sociologists, law professionals, philosophers, policy and ethics experts and management scholars. Such variety is crucial to design regulations that capture the complexity and impact of these technologies in a variety of domains (e.g. psychological well-being, employment). Firms would also benefit including professionals that can liaise directly with these governing bodies. The benefits would be twofold. First, to ensure that robot and AI related applications in their business adhere to the established and ever-evolving standards. Second, to collaborate with the governing bodies by providing direct market feedback. Like governing bodies, firms should also integrate expert advisors from a variety of domains as part of their advisory board. At a local level, educational programs should be offered at public centers and schools. These programs could provide citizens with knowledge about (a) how to deal with these new technologies and (b) illustrate also the benefits robots and AI may entail for their lives. Finally, society needs to be prepared for the integration of robots and AI. The corona virus pandemic is showing us that, if applied correctly, robots can be our allies in many areas of daily life, thus shaping an optimistic outlook toward what is to come.

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