YOUNG INTERNATIONAL NETWORK OF CENTESIMUS ANNUS PRO PONTIFICE

Value Adding AI: A Case Study on the Corporal Works of Mercy

YIN of CAPP Contribution to the 2020 CAPP International Conference

Prepared by the 'Human and Artificial Intelligence' working group

Background of the Young International Network
The Young International Network (YIN) brings together the members of the Fondazione Centesimus Annus Pro Pontifice (CAPP) up to and including 35 years. The primary aim of YIN is to bring inspire the growing group of young people with interest for and knowledge of the Catholic Social Doctrine and to contribute to the work of CAPP.

On this discussion paper
This is the fourth discussion paper of YIN and has been prepared for the 2020 International Conference of CAPP. It provides thoughts, remarks and suggestions raised in relation to the themes of this year's International Conference. This contribution aims to report on our discussions and views on the emerging role and perceptions of Artificial Intelligence.

1 Understanding AI

For many of us, discerning the essence of Artificial Intelligence (AI) is not an easy task. From a business perspective, AI is described as a constellation of technologies which allow to sense, comprehend, act and learn.[1] It is distinct from the natural intelligence of humans, but also aims to simulate this type of intelligence and as such draws upon many disciplines outside computer science, mathematics, and statistics, including e.g. psychology and linguistics, but also philosophy. AI – in development as discipline already since the1950's – matters because it is the start of a new form of interactions and relationships between humans and technology that will disrupt productivity and enhanced human ingenuity.

To understand the meaning of AI, it would be necessary to better understand what purposes AI serves and can serve. As Saint John Paul II already wrote in 1987: '*a type of development which did not respect and promote human rights – personal and social, economic and political, including the rights of nations and of peoples – would not be really worthy of man'*.[2] From a technological perspective, it is advocated to promote the development of 'artificial general intelligence' or 'strong AI', which is capable of – more or less similar to humans – demonstrate broad machine intelligence like a human is able of.[3] But does that adequately address its purpose?

2 What We Can Risk with AI

AI is moving from the lab to the workplace, with profound implications for business and society. Pope Francis reminds us *'(…) that even the best mechanisms can break down when there are no worthy goals and values, or a genuine and profound humanism to serve as the basis of a noble and generous society.*'[4] Not surprising, as AI is permeating our economy, debates are intensifying on its increasing scope and impact. It has been strongly embraced by some and strongly criticized by others, just as well largely ignored or distanced from by many others.

Ethical discourses have raised various questions with regard to purpose and role of AI in society. It includes legal questions regarding liability and privacy, it regards both societal questions such as possible job losses and questions of employment transitions and its impact on and contribution to economy and everyone's participation in it.

The downside is, for instance, that the same technology that removes accessibility barriers to make the world more inclusive may highlight the digital disadvantage for a broad segment of the worlds' population. The current health and economic crisis resulting from the great lockdown in 2020 is a reflection of what may come in the future. Especially for those that may easily be marginalized, including people with lower incomes, less education, women and underrepresented minorities worldwide.

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[1] Accenture, 'Artificial Intelligence', available at: www.accenture.com/_acnmedia/PDF-78/Accenture-AI-Insights-summary.pdf.

[2] Encyclical Letter Sollicitudo Rei Socialis of the Holy Father John Paul II, 30 December 1987, at 33, available at: www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_30121987_sollicitudo-rei-socialis.html.

[3] See e.g. R. Kurzweil, The Singularity is Near, Viking Press, 2005, p. 260.

[4] Encyclical Letter Laudato Sí of the Holy Father Francis on Care for our Common Home (Laudato Sí), 24 June 2015, at 181 (originally stated in the context of national and local policy making), available at: http://w2.vatican.va/content/dam/francesco/pdf/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si_en.pdf.

The more prevalent risk of AI seems to be employment productivity as repetitive tasks with low cognitive skills are expected to be replaced by more sophisticated digital jobs and the enablement of AI.[5] However, there are many other considerations including privacy, cybercrime and cyberwar, social media, the moral conundrums of AI, big tech's relationship to inequality and inclusiveness, and the challenges for maintaining democracy.[6]

3 Importance of Ethics

Recognizing these social and ethical challenges on AI, the Pontifical Academy for Life, Microsoft, IBM, Food and Agriculture Organization of the United Nations (FAO), and the Italian Government signed the 'Call for AI Ethics' in February 2020, in Rome. The Call addresses governments, organizations, and institutions involved in the development of AI to ensure it will serve the human genius and creativity instead of its gradual replacement.[7] The Call for AI Ethics is a document comprising six principles – also referred to as 'algor-ethics' - for the ethical use of AI: [8]

1. Transparency: in principle, AI systems must be explainable;
2. Inclusion: the needs of all human beings must be taken into consideration so that everyone can benefit, and all individuals can be offered the best possible conditions to express themselves and develop;
3. Responsibility: those who design and deploy the use of AI must proceed with responsibility and transparency;
4. Impartiality: do not create or act according to bias, thus safeguarding fairness and human dignity;
5. Reliability: AI systems must be able to work reliably;
6. Security and privacy: AI systems must work securely and respect the privacy of users.

The Call presents these principles as fundamental elements of what is to be considered good innovation, because 'in order for AI to act as a tool for the good of humanity and the planet, we must put the topic of protecting human rights in the digital era at the heart of public debate.'[9]

4 AI Catalyzing the Corporal Works of Mercy

We have sought to better understand how 'worthy AI' is taking shape, and how we can consider the extent to which AI is already developing as promoted by the Call. As a first step, we have taking the Corporal Works of Mercy as a starting point and considered how it relates to specific examples of AI. Matthew 25:33-46 puts forward seven Corporal Works of Mercy, which are: (i) to feed the hungry, (ii)

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[5] See, for instance, B. Smith, 'Microsoft launches initiative to help 25 million people worldwide acquire the digital skills needed in a COVID-19 economy', Microsoft Blog, 30 June 2020, available at: https://blogs.microsoft.com/blog/2020/06/30/microsoft-launches-initiative-to-help-25-million-people-worldwide-acquire-the-digital-skills-needed-in-a-covid-19-economy.

[6] See on this topic also the first YIN Paper 'Detecting today's New Things and socio-economic priorities: On the role of free will in AI enhanced societies', 2018, available at: www.centesimusannus.org/wp-content/uploads/2018/05/Contribution-of-YIN-to-the-CAPP-International-Conference-2018-1.pdf.

[7] See also Academy for Life, 'Rome Call for AI Ethics', 28 February 2020, p. 6-7, available at: www.academyforlife.va/content/pav/en/events/intelligenza-artificiale.html.

[8] Rome Call for AI Ethics, 2020, available at: www.academyforlife.va/content/dam/pav/documenti%20pdf/2020/CALL%2028%20febbraio/AI%20Rome%20Call%20x%20firma_DEF_DEF_.pdf.

[9] Idem, p. 6.

to give water to the thirsty, (iii) to clothe the naked (iv) to shelter the homeless, (v) to visit the sick, (vi) to visit the imprisoned, or ransom the captive, and (vii) to bury the dead. These Works invoke each of us to act, with a clear human perspective, to engage in fraternity and in pursuit of justice for the bodily needs of others.

Where AI is reimaging what our relation is with machines, we consider now it is developing our human pursuit with the seven Corporal Works of Mercy. As such, we have taken up the quest to explore the human purpose of AI through these Works, revisiting to what extent – using freely accessible sources – we can already establish examples of how AI is playing a role. The Works are a helpful guidance for Christian perspective, as '(t)he Lord wants us to do these Works of Mercy, because even the strongest faith is of no use without such Works'.[10] We aim – although it is a preliminary analysis – to better understand the role of AI to review if and how AI facilitates us humans to serve a worthy purpose.

1. Feed the hungry

During these days where we discuss 5G and autonomous cars, we still haven't solved a big and fundamental human problem: world hunger. More than 800 million people around the world can't feed themselves enough while 15.000 children die each day due to the circumstances that come with malnutrition. At the same time, there are more than 1.9 Billion overweight people and 600 million of these are obese, that's only 25% less.

It may seem bizarre, but when looking at the Devine Works of Mercy and especially comparing the Corporal Works of Mercy with the Spiritual Works of Mercy, they appear to be the perfect fit: feed the hungry for the corporal while instruct the ignorant on the spiritual site. Instead of keeping our 'more is more' thinking, we need to solve this problem by being more efficient, aware and open minded, that's where AI can guide us, also in light of the call to feed the hungry.

The first and obvious choice is to decrease our waste of food that is already produced. We can maximize our output if we stop wasting 50% of it. With the help of Big Data we can quickly and better analyze food for its state and not only decide after a black or white scheme. As an easy example: A tomato which isn't good enough for a salad can be still more than good enough for the ketchup production. With projects like TOMRA food is not only analyzed but also helps on the logistic and infrastructure standpoint of transferring food wiser while not wasting it.[11] Similar projects like these can not only help in private households but can also have a big impact on corporate logistics and supplies while being cost efficient on itself.

While such a solution is perfect for developed countries to save a lot of food which would be wasted, we need to make sure that less developed countries where the real hunger is the case get a good amount with more food being saved. More than 60% of poor population in developing countries work in agriculture, so it is clear where help is needed, and AI can improve the life of farmers and the lack of food. The real solve will be to create a system where companies will also benefit from feeding these less developed countries.

2. Give water to the thirsty

'Giving water to the thirsty' is first of all a response to a physical need, as is the case with feeding the hungry. As such, it deals with questions of supply and demand side. Exemplary is the availability of water. Water is a substantial part of all that's living, and covers over 70% of the earth's surface. Only

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[10] The Devine Mercy, 'Works of Mercy', available at: www.thedivinemercy.org/message/acts.
[11] See, for instance, www.tomra.com/en/about-us/tomra-innovation/lucai.

some parts of the world have secured availability of clean drinking water and sanitation, leaving many people still thirsty. Pope Francis has pointed out the value of water for our *common home* and directed action to address the *water poverty*.[12] Commodification of water ignores the fact that water is an essential *human value*, and it impedes us in giving drink to thirsty.

In YIN's 2019 paper on 'Blue Gold', we that stated water must not be seen as a core ecological or economic source only, it is too a spiritual source.[13] It is a source that should necessarily be accessible to all humans to respect our human dignity. The state of play shows a different picture. What can AI do to contribute to this 'issue of water'?

AI should and can be used to contribute to solutions that prevent waste of clean drinking water. It can help in better forecasting the need (and availability) of water (peak and off peak). Most importantly, it can contribute to making available clean drinking water also at a lower cost. With AI, it is possible to bring forward better tools to real time monitor water for bacteria and other harmful particles, in order to assure safety of drinking water.[14]

With climate changes involving increasing temperatures and droughts, as a consequence, giving drink to those thirsty will become a bigger human challenge. Examples have been shown where AI assists in assessing water scarcity as input for amending water infrastructures.[15]

3. Clothe the naked
The third Divine work of mercy invites us to 'clothe the naked'. This seems rather straightforward but when searching for the 'naked' we should also look for those who are rejected, alone, and even forgotten. Often, the naked are just stripped of all meaningful human relationships. Technology could help but it requires to be centered around our human relationships.

Artificial Intelligence allows machines to sense, comprehend, act and learn according to a given data or behavioral pattern. This can offer the possibility of removing many accessibility barriers to make the excluded part of meaningful human interactions. For example, computer vision might help people who are blind better sense the visual world, speech recognition and translation technologies might offer real time captioning for people who are hard of hearing, and new robotic systems might augment capabilities of people with limited mobility.[16]

4. Shelter the homeless
Mercy involves compassion between each other, and as such the fourth divine work of mercy sets forth the duty to shelter the homeless. Our current economic system fails in its intention to offer all citizens the possibility to have a home. Well, maybe AI can change this reality, for instance, AI is a tool that manages data in any kind of way, it is high developed technology which has the ability to understand better how to use our resources, and even so, use the resources in a more efficient way. One of the requirements and approaches to use AI to shelter homeless people is for them to have a smartphone. Although not all possess a smartphone, research demonstrates that today already more

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[12] Laudato Sí at 27 et seq.

[13] YIN, Blue Gold in our Common Home: International Perspectives on the Role of Water', 2019, www.centesimusannus.org/wp-content/uploads/2019/06/PAPER-by-YIN.pdf.

[14] See, for instance, Microsoft's Clean Water AI, see: www.microsoft.com/en-us/ai/ai-lab-clean-water; www.youtube.com/watch?v=M3lTPZw5sOc.

[15] See: J. van Deusen, 'Assessing Economic Water Scarcity Needs with GIS and AI', ESRI Blog, 24 September 2020, available at: www.esri.com/about/newsroom/blog/economic-water-resource-scarcity.

[16] M.R. Ringel, 'AI and Accessibility: A Discussion of Ethical Considerations', 2020, available at: www.microsoft.com/en-us/research/publication/ai-and-accessibility-a-discussion-of-ethical-considerations.

than 94% of the homeless have a smartphone.[17] This enables more ways to provide options for enabling interactions involving AI.

There are numerous projects which already involve AI in addressing homelessness . One of the most promising ones is the one developed by Ample labs. They have developed an AI tool that allows the subject who is currently in a disadvantageous situation to find free meals and free shelter in an efficient way. This AI tool has been implemented only in the city of Toronto, but the future implications are huge and impressive, where they aim to find better ways to connect.[18]

The technology used behind the Ample labs' AI tool is basically a chatbot that will guide and advise people that need a shelter. The chatbot has the capacity to offer that kind of help in an efficient way, which means that there will be a bigger and more powerful organization of all the data around shelters and free meals, and more importantly, enabling that more people will be benefited. Such solutions have a high chance of making a big contribution to address the problem of homelessness in the near future in other parts of the world too.

5. **Visit those in prison**

Another divine work of mercy is to visit those in prison. A prison, though, must not always be made out of brick and mortar. Unhealthy socio-economic environments can also exclude, and as such 'imprison' people. The reasons for emotional or financial struggles often lie in people's difficult surroundings. On a macro-level, some already poor areas, for example, suffer big human and economic losses due to natural catastrophes, such as those caused by a changing world climate. At a micro-level, for instance, elderly people living in the countryside of developed countries spend a lot of time home alone as soon as their mobility decreases. At the same time, due to the measures taken after outbreak of the COVID-19 virus, many elderly people cannot leave their homes or receive visitors. In both cases, their home areas become a sort of prison, which keeps them from having the life they deserve, by not being able to take full part in society. AI contributions in this area should invoke development of more inclusiveness, accessible also to the elderly.

AI, today already, helps understanding climatic changes. On the one hand, it helps analyzing data to better understand what leads to climate change. On the other hand, it helps various industries to see and reduce their impact. In the energy sector, for example, the amount of emitted CO_2 today is reduced due to forecasts made with AI able to better predict the amount of energy that is needed. In this case, AI can be crucial for people's lives.[19]

AI also enables cars, busses or trucks to drive without human interaction. Until now, a driver with a driver's license is required. Once further technical advances are made, also elderly gain more possibilities to freely move around. It makes it easier to go to social events or stores, without the need for a valid driver's license, or hiring a driver or having good bus connections. Furthermore, kids from rural areas, would be able to go to schools and meet people without parents having to drive them every day. In this case, AI helps in mobilizing people's lives.[20]

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[17] H. Rohades, S.L. Wenzel, E. Rice, H. Winetrobe and B. Henwood, 'No digital divide? Technology use among homeless adults', Journal of Social Distress and the Homeless, 2017, p. 2, available at: https://socialinnovation.usc.edu/wp-content/uploads/2018/02/Rhoades-et-al-2017-final.pdf.

[18] Ample labs, available at: www.amplelabs.co.

[19] O. Martynova, 'Opportunities and Challenges of Artificial Intelligence in the Energy Sector', 4 February 2020, available at: www.intellias.com/opportunities-and-challenges-of-artificial-intelligence-in-the-energy-sector.

[20] A. Schroer, 'Artificial intelligence in cars Powers an AI revolution in the auto industry', 19 December 2019, available at: https://builtin.com/artificial-intelligence/artificial-intelligence-automotive-industry.

6. **Comfort the sick**

The sixth Divine work of mercy is to comfort the sick. AI has already arrived in the healthcare sector and will play a role in the future that can hardly be overestimated. This applies to all areas of the sector. One often mentioned medical application of AI is diagnostics. AI can be used as an early-stage diagnostics tool to detect e.g. early-stage cancer and create more time for treatment. AI systems are able to surpass human experts in breast cancer prediction and diagnosis much earlier.[21]

Furthermore, decision support systems based on AI will be phased in hospitals and medical practices to reduce the error rate of treatment decisions by calculating the success rate of various treatment options. In general, the increasing use of supportive AI applications gives physicians more time for human interactions with their patients.

However, a not to be underestimated proportion of people in the world is not even able to go to a doctor or hospital quickly because they live too far away. AI applications, such as a smartphone app, can provide first medical advice to people in these remote locations without doctors and can help them determine the closest and right doctor for their medical ailments.

In addition, AI will also play a decisive role in pharmaceutical research in the future. Finding successful new drugs is the most difficult part of drug development. This is due to the enormous size of the so-called chemical space, which is estimated at about 10^{60} molecules. AI is able to predict possible synthetic pathways for drug-like molecules and can help to bring new drugs to market more quickly as automated processes and more precise forecasting models shorten the development phase. In the context of patient selection for clinical trials, AI approaches can be used to identify and predict human disease biomarkers. This allows the recruitment of a specific patient population in advanced stages of clinical trials. Predictive modeling of AI in patient population selection can therefore significantly increase the success rate in clinical trials.[22]

7. **Bury the dead**

The final Divine work of mercy, to bury the dead, is a reminder of the dignity of a proper burial. The practice of this Divine Work of Mercy isn't just about burying a dead person, we must remember praying for the dead, attending funerals and visiting graves. Where these works are primarily a personal and interpersonal activity, where AI may have a limited role to play, the COVID-19 situation has shown problematic cases of burying the dead. Here, AI may assist to better coordinate and connect between the many caretakes and undertakers, to allow that those that have died can be buried.

Furthermore, in burying the dead, we are also asked to spend time with the widows and widowers left behind. As considered above with visiting the imprisoned, there is much we can do and where AI may assist us.

5 Observations

AI is enfolding in a broad range of fields, bringing new solutions and applications that reimagine the way how we interact with machines. Given the many uncertainties of where AI is moving toward, and

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[21] A. Valavanidis, 'Improving Early Cancer Diagnosis by Artificial Intelligence Algorithms and Machine Learning Models', 2020, 1, p. 1-26.

[22] K. Mak and M. Pichika, 'Artificial intelligence in drug development: present status and future prospects', Drug Discovery Today, 2019, 24(3), p. 773-780.

how our interaction with AI is developing, we wondered what purposes AI serves and how it is adding value. We aimed to discover such applications of 'worthy AI' by reviewing it from the perspective of the seven Corporal Works of Mercy.

AI provide many opportunities to assist those in need. But, is AI also able to adequately address current social matters? We found that AI solutions are not only individual solutions, but also geared to meta problems such as food waste and clean drinking water. Retrieving examples of how AI is adding value to the Works of Mercy is not as easy for each of them. Those physical/bodily needs related to feeding the hungry and giving drink to the thirsty already receive much attention. This was less so for the more individual social works as burying the dead. In the absence of hierarchy among the Works of Mercy, these should not be left out.

As pointed out by the Rome Call for AI Ethics, the current developments have great potential, for the whole human society and for our common home: to deal with pandemics; to address questions raised by the growing global population; reduce poverty and dealing with the marginalized. These are areas where the Church and technology should meet, for finding a solution. With the Rome Call, the Church may take a leading and guiding role to keep reminding us to develop 'worthy AI' that is adding value to human and humankind.