POINT OF VIEW

How AI meets healthcare?

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Abstract: Today, AI is a reality in many areas, even in healthcare. This communication aims to provide a point of view of how AI can play a larger role in healthcare and be entirely integrated in the different healthcare departments and how trustworthy AI principles can help to adopt AI more easily in healthcare.

Keywords: Healthcare; trustworthy AI; health data collection

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1. How could wider adoption of Artificial Intelligence (AI) technologies improve healthcare delivery? Is AI likely to play a larger role in healthcare in the future?

Providing care is just one step in a much larger context: the health course. Around the care, the health course includes an upstream phase dedicated to the prevention or detection of a disease, and a downstream phase dedicated to the management of the disease (access and coordination of care, avoid aggravation). The challenge in health, more than ever, is not limited to providing care but rather to bring to the patients the best possible quality of life with their chronic or long-term disease. Therefore, the health course is extended to return home and remote monitoring. By intervening in each stage, by providing a personalized response adapted to each person and available not far from where they live, by managing this health course as a whole, then we can improve the quality of life of our fellow citizens. AI can help in all those situations.

The caregivers do a remarkable job every day and it is important that our health systems remain anthropo-centric so that the human relationship continues to be at the heart of the care. The contribution of AI must in this way allows patients and caregivers to have additional means to improve the quality of the medical service provided, to tend towards optimal organizations (availability, permanence and proximity) and to strengthen their expertise and decision-making capacity in order to provide the best care. [**Patrick MALLEA**]

2. Could AI and machine learning be deployed to optimise healthcare provision within the context of COVID-19, for example by predicting patient needs and identifying at-risk groups?

It should be noted that it is still very difficult to collect large volumes of data, that it is even more difficult to have quality data. Legal requirements do not contribute to shortening the deadlines as well. This makes very difficult the realization of AI programs, whether in France, Europe or across the world. The question today is no longer to produce algorithms, but to do it in a short time: from data collection until solution deployment in production.

In COVID-19 context, we must deal with health data. Obviously, it required to be GDPR compliant, but your research protocol must be granted by authorities of your country. An alternative is to collect anonymized data even if this operation is far from easy. The healthcare facilities must then be mobilized to get their agreement to anonymize and transfer the data. In addition, some staff, already in high demand, must carry out these operations. Do not think the job is done once the AI solution is produced and evaluated: you must integrate it to the healthcare environment to feed the AI solution with patients' data and integrate AI results into the work process.

For several years, our company, NEHS Digital, has been working to industrialize those steps as much as possible in the world of healthcare, in particular that of medical images. In association with French institutions (SFR and CERF), we organized the collection of anonymized data from chest CT-scans having a suspicion of COVID-19. In collaboration with AI4EU and radiologists participating in scientific boards, the project has started in March 2020, and data began to be collected in our health data hosting infrastructure in May. An AI project targeting to predict the probability of COVID-19 from CT-scans has been initiated in June and data scientists start to work on the dataset in August. In December 2020 we deployed a first version in a pre-production

environment. This was done in 9 months. So, yes, it is possible to do somethings and bring good results, but some significant efforts have to be made to get there. [**Jeremy CLECH**]

3. What key features are necessary to ensure AI programmes are human-centred? Why is this important? How is the data which informs AI programmes gathered? What measures are in place to ensure the security of users' data?

Technological progress and its acceleration in the 21st century cannot be conceived for me without an ethical approach. As such, the work undertaken by the European Commission in the context of the trustworthy AI constitutes good ethical practice and must govern any AI approach. Those principles are: Respect for Human Autonomy, Prevention of harm, Fairness and Explicability. And, as a result, 7 requirements can be defined: Human agency and oversight, Technical robustness and safety, Transparency, Diversity, non-discrimination and fairness, Societal and environmental wellbeing and Accountability.

AI is a set of methods and tools and it is only its using which defines a positive or dangerous behaviour. We see through the first feedbacks that the results can be derived. In healthcare, AI works to strengthen the caregiver's capacity, but only the caregiver and the patient are likely to make the decision. The trustworthy AI provides an accurate framework. This should allow data scientists and software engineers to handle those questions ideally during the design phase or, at least, to check them before delivering their products on the market.

In the healthcare context, explainability is both essential and necessary today since it allows better acceptability by users. They can thus fully learn these new tools by understanding their strengths and weaknesses regarding their own expertise. For instance, when an AI solution says a CT-scan has signs of COVID-19 with 98% of confidence and argues to base its prediction on pixels outside the lungs, radiologists can easily ignore this result. In some other cases, AI should instead provide some evidence and radiologists will take them into account to confirm or revise their initial diagnosis. It is a utopia to believe that we are not brainwashed by the digital revolution but, above all, AI must be at the service of businesses or decisions.

There are 2 ways to collect health data: pseudonymization or anonymization. Pseudonymization is preferred when it is necessary to be able to re-identify a patient, for example to gather additional data. Authorization is required and the research project must demonstrate why requested data are necessary for the project. Anonymization, on the other hand, must guarantee the absence of risk of re-identification by ensuring that there is no individualization, no correlation and no inference. Concretely, it implies to realize some simple operations (deletion of name, date of birth, etc.), some recoding operations (generate new and irreversible identifiers, grouping into age groups…) but also some data analyses to verify that by crossing various data we cannot find the patient.

Regarding the security of the data, the French legislators have placed specific regulations on the hosting of personal health data. This decree of 2006 describes the requirements and the best practices. Moreover, thanks to the GDPR, the Informatic Services Branch of the facilities are widely aware of this subject and check where and how those data are transmitted to the companies which requested those data. [**Patrick MALLEA**]

4. Is data interoperability between healthcare departments a significant factor in integrating AI technologies into healthcare? How can this be achieved?

Interoperability is indeed the cornerstone for the transmission and consolidation of health information managed in Health Information Systems (HIS). In 1998, the Integrating Healthcare Enterprise (IHE) has been created by the healthcare industry to organize itself. IHE goals to collaboratively promote and define technical guidelines. The HL7 standard and the DICOM standard provide a framework for exchanging structured data between various departments of one or many facilities. This obviously makes much easier to gather data of a single patient coming from several departments or facilities.

Even if all areas of health have not the same maturity level, it is converging thanks to customer's requirements. To take the example of the medical imaging industry, which is highly industrialized, the integration of a Computer Aided Diagnostic (CAD) result (such as mammography or pulmonology) is done using the DICOM standard. Thus, the CAD editor has "only" to define the overlays containing the marks to be displayed on the diagnostic console and the report without any custom integration. Therefore, the first step for the start-ups is much lower than I started 20 years ago!

However, as the use cases keep getting richer, standards must continue to be developed. It is why, NEHS Digital and its AI partners are making a proposal to include AI results directly in the Radiological Information System (RIS) rather than having to display that additional information in another tool which is not convenient for the user (too many screens) and the AI partner (more developments to do). For example, it is more efficient that an AI service which analyses bone failure can directly send its result to the RIS which can flag the patient

record directly in the worklist of its main application rather than show the results on another screen or tablet. It is faster and safer.

Finally, in those last few years, interoperability goals to provide a higher level of interpretability of the data by adding a higher semantic level. For doing that, shared dictionaries such as LOINC or ontologies like SNOMED CT are used in structure reports which follow the CDA-R2 standard (XML based). There are 2 advantages of that. The first one is that an AI algorithm can more easily "understand" the meaning of a report and extract the information parts it needs. The second one is that AI algorithms can more easily produce such reports. [**Jeremy CLECH**]