Artificial Intelligence in Health Informatics: Hype or Reality?

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Summary

Objectives: To provide an introduction to the 2019 International Medical Informatics Association (IMIA) Yearbook by the editors.
Methods: This editorial presents an overview and introduction to the 2019 IMIA Yearbook which includes the special topic "Artificial Intelligence in Health: New Opportunities, Challenges, and Practical Implications". The special topic is discussed, the IMIA President's statement is introduced, and changes in the Yearbook editorial team are described.
Results: Artificial intelligence (AI) in Medicine arose in the 1970's from new approaches for representing expert knowledge with computers. Since then, AI in medicine has gradually evolved toward essentially data-driven approaches with great results in image analysis. However, data integration, storage, and management still present clear challenges among which the lack of explanability of the results produced by data–driven AI methods.
Conclusion: With more health data availability, and the recent developments of efficient and improved machine learning algorithms, there is a renewed interest for AI in medicine. The objective is to help health professionals improve patient care while also reduce costs. However, the other costs of AI, including ethical issues when processing personal health data by algorithms, should be included.

Keywords

Informatics, medical; health information technology; IMIA Yearbook of Medical Informatics; artificial intelligence

Artificial Intelligence and Health Informatics

Artificial intelligence (AI) in Medicine arose in the 1970's. First AI systems were essentially knowledge-based decision support systems and first machine learning methods were used for inferring classification rules from labelled datasets. These first systems had good performance. However, they were never used routinely on real patients. One reason was that these systems were stand alone systems, not connected with patient electronic health records (EHRs). Another reason was that, due to the subjectivity of the expertise expressed in the knowledge bases of these expert systems, the systems developed here were not accepted there, and most of them turned out to be more useful for teaching than for clinical practice.

After some « winters », the hype of AI is back with new machine learning methods focusing around complex « Deep Learning » through the generation of "deeper" multi-layered connectionist artificial neural networks. As these new AI methods emerge and almost as quickly become news, one naturally grows concerned with the level of control we are conceding when reviewing the pace at which new AI methods are being introduced and the pressure to quickly adopt them. In May 2019, teams at Google and New York University reported that deep learning models for lung cancer diagnosis can improve accuracy [1], and the study quickly generated headlines for many newspapers and journals. In some ways, the news about the *Nature Medicine* report seemed to exagerate the success of the method (e.g., the *New York Times* article was "A.I. Took a Test to Detect Lung Cancer. It Got an A" [2]). And just as many articles appear with ideas that AI can improve understanding of biological processes and therapeutic methods to combat disease, there are as many articles to caution the use and unrealistic expectations of AI methods. Some titles of the caution over AI include: "Artificial intelligence in health care: will the value match the hype?" [3] and "Better medicine through machine learning: What's real, and what's artificial?" [4].

For all these reasons, the editors of the International Medical Informatics Association (IMIA) Yearbook, working with IMIA working groups decided that the special topic of the IMIA Yearbook in 2019 would be: "Artificial Intelligence in Health: New Opportunities, Challenges, and Practical Implications". The aim is to focus on the new wave of AI in medicine and describe what are the new opportunities for such tools, the new challenges, and if there are any applications on medical practices, healthcare quality, or costs.

Highlights in this Year's Yearbook

This year's keynote paper, "The price of artificial intelligence", contributed by Enrico Coiera at the Australian Institute of Health Innovation, Macquarie University, Australia, looks at digital scribes and the experience of radiologists using AI. There is much discussion of the potential benefits of AI in healthcare and the keynote explains that in

addition to the steady stream of AI applications becoming available, there are added costs to develop the new technology and prepare the AI we want, including changes in the way healthcare is practiced, patients are engaged, medical records are created, and work is reimbursed.

In keeping with the theme of this year's edition of the Yearbook, E.H. Shortliffe at Columbia University, USA, presents an excellent and thoughtful review of AI through a long history of use in medical informatics. E.H. (Ted) Shortliffe looks at the beginning of artificial intelligence work in the US with US Department of Defense and subsequent work on AI from the National Institute of Medicine (NIH). In particular, Prof. Shortliffe describes some of the issues brought up by the organization of AI in Medicine Europe (AIME) where key questions such as how do we include user needs, training, and funding when we develop AI projects. The answers to those questions as noted in the paper require our attention to keep all informatics work progressing. As E.H. Shortliffe remarks in his contribution, "(f)or those of us who have been engaged with research on artificial intelligence in medicine and health care for decades, the current visibility and enthusiasm regarding our field is both refreshing and frightening."

The second contribution in the History of Medical Informatics section of the Yearbook is authored by Casimir A. Kulikowski at Rutgers University, USA. Casimir A. Kulikowski provides an overview of early directions in AI in medicine and some subsequent developments motivated by the very different goals of scientific inquiry for biomedical research. He describes computational modeling of clinical reasoning and more general healthcare problem solving from the perspective of today's "AI-Deep Learning Boom". He also reminds us how "humanistic models of treatment that respond to patient and practitioner narrative exchanges" are important, "since it is the stories and insights of human experts which encourage what Norbert Weiner termed the ethical 'human use of human beings', so central to adherence to the Hippocratic Oath".

The 2019 Yearbook special section on AI looks at the best papers published in 2018 on AI in medicine. The editors of the special section found papers that described an artificial intelligence approach that integrates a physiologic model with learning of states and parameters from empiric data, overcoming some of the limitations of both imperfect models and sparse data as well as those addressing the very important problem of enabling privacy-preserving federated learning in healthcare and significantly advanced field by presenting an approach for a complex learning problem that is highly challenging for federated setting with privacy constraints (i.e., learning context specific patient similarity measures and querying for similar patients across sites). The need for large data sets and data sharing is addressed in AI studies as well and in informatics as we are always in need of the best ways to harness large data sets that answer questions. The special section presents several issues with machine learning for large and heterogenous data and it is exciting to see that new work in AI helps us understand how data might be quickly processed and used.

IMIA President's Statement

Make sure to check out the letter from IMIA President Christoph Ulrich Lehmann, MD, FAAP, FACMI, FIAHSI. He talks about some IMIA projects such as the new academy, the International Academy of Health Sciences Informatics, that is now under the presidency of past IMIA President Prof. Reinhold Haux, the exciting and record-breaking number of submissions to MEDINFO 2019 organized in Lyon by the French Association of Medical Informatics, and a call to action for IMIA to leverage information to improve the health and wellbeing of patients globally. We are deeply grateful for the hard work and tremendous leadership we have had from President Lehmann as he turns the gavel over to Prof. Sabine Koch in Lyon, France at MEDINFO 2019. Thank you very much Dr. Lehmann!

Changes in the Yearbook's Editorial Team

The Yearbook editorial team has been partly renewed in 2019. First, Kate Fultz Hollis, research associate of Medical Informatics and Clinical Epidemiology at Oregon Health and Science University (Oregon, USA), has replaced John H. Holmes, and we welcome Kate as a chief editor of the Yearbook. Readers would be pleased to see that, this year, the Bioinformatics and Translational Informatics (BTI) section is back to the Yearbook. Congratulations are due to the two editors of the BTI section, Malika Smaïl-Tabbone, associate professor of Computer Science at Lorraine University (Nancy, France), and Bastien Rance, associate professor of Medical Informatics at Paris University (Paris, France).

Pierre Zweigenbaum and Aurélie Névéol who had launched the Natural Language Processing (NLP) section of the Yearbook in 2014 left the editorial team in 2018 offering the editorial responsibility of the NLP section to Natalia Grabar, researcher in clinical language processing at Lille University (Lille, France) and Cyril Grouin, research engineer at Paris-Saclay University (Orsay, France). We want to publically thank them for that!

We are also pleased to welcome Christian Baumgartner, professor at the Institute of Health Care Engineering with European Testing Center of Medical Devices (Graz, Austria), Sébastien Cossin, university hospital assistant at Bordeaux University (Bordeaux, France), and Yalini Senathirajah, associate professor of the Department of Biomedical Informatics at the University of Pittsburgh School of Medicine (Pittsburgh, USA), who served this year as section editors of Sensors, Signals, and Imaging Informatics, Public Health and Epidemiology Informatics, and Human Factors and Organizational Issues sections, respectively.

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