Medical writing in the era of artificial intelligence

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Abstract

The increasing amount of data available together with advances in computer science are converting computers from simple tools that execute commands into self-taught, self-correcting machines that make decisions. This is the beginning of the era of artificial intelligence (AI) that promises a revolution in the way we live and work. AI has entered apace the fields of healthcare and medicine and has started to affect the work of medical writers. A recent survey has revealed that 40% of scientists are still unfamiliar with the use of AI in healthcare with opinions ranging from panic to over-optimism. These are big challenges for all medical writers (MWs). This article discusses the critical role MWs play in an AI-driven healthcare, describes how AI can empower medical writers in various domains (regulatory, medical affairs, redaction, and publishing), and highlights the importance of staying up-to-date with the AI world.

Artificial intelligence

Artificial intelligence (AI), is a general term describing the computer systems that have the ability to model human intelligence and perform in a human-like fashion. Visual and speech recognition, language processing, and decision-making are some of the human tasks performed by AI thanks to algorithms. Machine learning, a sub-domain of AI, is the study of algorithms that can educate and improve themselves through analysing an input, usually a large amount of relevant data. Two key facts are the main drivers for the AI revolution: i. recent advances in computing architecture and in AI technologies that provide the required computational power,[1] and ii. ability to accumulate large amounts of data (big data). Feed a huge list of chess games and the computer will learn chess by itself.[2] And that was in 1996, before the era of advanced machine-learning algorithms. Almost 20 years later, there were algorithms that played GO, a strategy game way more complex than chess.[3] And just recently, AI outperformed poker professional players.[4]

The latter is considered a landmark in AI history, as it is the first time AI outperformed human reasoning and intelligence in a situation with multiple non-linear interactions and with incomplete information where game theory needs to be applied. What makes AI superior is its ability to collect data, analyse them, identify patterns, learn from it, and extract an output without any human intervention. It rapidly creates its own logic using artificial neural networks that resemble biological neural networks, offering increased performance, subjectivity, and automation.

AI has shown incredible potential in many domains, including healthcare and medicine,[5] with concomitant changes to medical writers (MWs). Thus, in this article, we discuss the potential benefits of AI in the everyday life and work of medical writers and the reason why MWs should remain at the forefront of the AI revolution.

AI-driven healthcare

Medical diagnosis, digital health, and medical devices

As mentioned above, the accumulation of data is a huge driver for AI in any sector. Newly developed AI algorithms work well with medical images, including, but not limited to, biopsy images, magnetic resonance imaging, computed tomography, and electrocardiography (ECG).[6,7] AI reduces errors and increases the sensitivity, specificity, and speed of diagnosis by identifying patterns not identifiable by the human eye.[8] Besides, there has been an exponential growth in the amount of medical data that can be collected via wearable devices, mobile telephone applications (apps), and other interconnected medical devices (Internet of Medical Things – IoMT).[9] It is impossible for a human to analyse this data. Personalised medicine can be exercised through continuous and remote monitoring in real time thus reducing site visits and providing an online support network with quality interactions by using, for example, chatbots and apps, that improve patient engagement, management, and adherence. In addition, patients and consumers are becoming more open to constant monitoring by AI-driven healthcare, from wearable devices to robot-assisted surgeries.[10] However, healthcare professionals feel uncomfortable about relying on AI-powered softwares,[11] a gap that needs to be bridged.

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Drug development

In clinical trials, success depends not only on the selection of the right patients, but also on the support they feel they receive throughout the trial. AI can help in many aspects of clinical trials,[12] including patient enrollment and management. AI tools can analyse electronic medical records and preclinical and clinical data and select a cohort of patients that would benefit from a given clinical trial. It can also help in creating the optimal trial design and protocol.[13] Several biotechnology startups are being created and established companies are entering the AI field with the goal of increasing speed and efficiency of the drug development process. Machine-learning algorithms have been developed to help in several steps of the process, from drug design[14] and Quantitative Structure-Activity Relationship (QSAR) modelling[15] to toxicity assays and side-effect predictions.[16] Sophisticated algorithms could analyse simultaneously a plethora of data, such as multi-omics datasets combined with preclinical and patient data, and make predictions.

While several such cases have shown the potential of AI,[17] in saving time and money, most of these approaches are far from becoming the norm; therefore, we will not discuss them further in this article. But as the field advances rapidly, MWs should be prepared for the time when AI-based innovations knock on their door daily.

Scientific publishing and editing

More and more authors of scientific studies are becoming frustrated with the traditional peer review process highlighting, among others, serious problems in fighting bias,[18] slow speed,[19] or lack of transparency.[20] AI tools can give a hand in most of the laborious processes of peer review. For example, AI-based programs can identify and control parallel communication strategies with reviewers until the required number of reviews has been reached.[21] Plagiarism, bad reporting, and manipulated image detection tools are being tested by journals[22] and, if used with caution, they can improve the publishing process. In a similar manner, editing can be automated with AI-based tools that can automatically control and amend documents to comply with required styles and formats.

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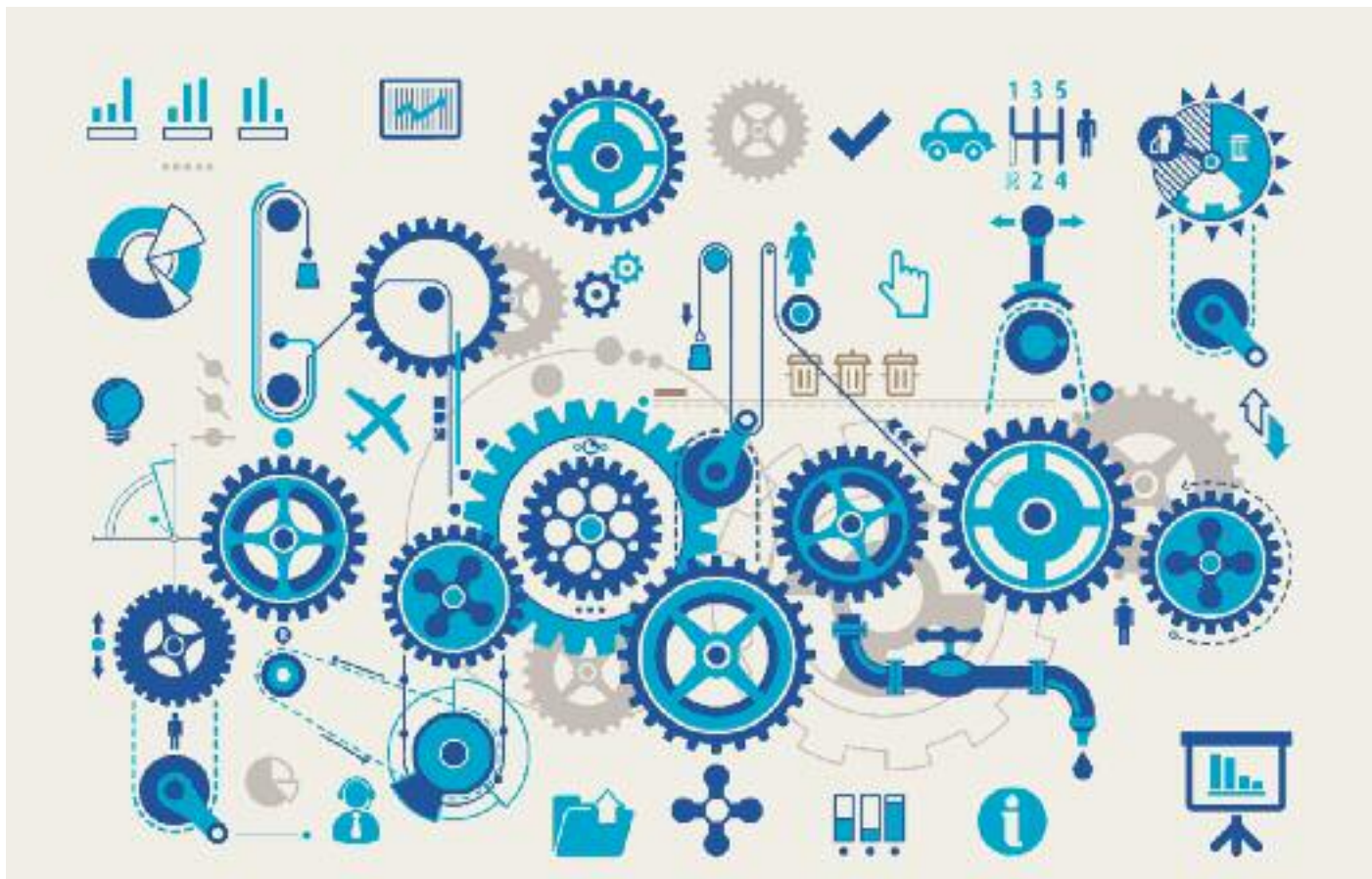
Regulatory writing

Earlier we talked about machine-learning algorithms. At this point, it would be helpful to talk about natural language processing (NLP), the AI technology that helps computers understand the natural language of humans, beyond the ones and zeros. We come across NLP several times in our daily lives: Google Translate, Gmail autocomplete, text processors such as MS Word or Grammarly, personal assistants such as Siri, Alexa, etc. Interestingly, Yahoo! generates millions of automatic reports and match recaps to engage with its fantasy football fans in a personalised manner.[23] Writers and journalists have started to experiment with AI to help them generate original writing.[24]

Along the same lines, MWs care about the readability of their writing, as this will dictate the reach, comprehension, and the impact of the written material. A good writer pays attention to the audience and knows how to adjust the text to its readers. Thus, the four major elements of readability – content, style, format, and organisation – constitute the readability formulas that famous text processors, such as MS Word and Hemingway editor, use to score readability.[25,26] However, these tools are based only on static metrics like number of words per sentence, syllables per word etc., and do not have the ability to understand complex grammar, context, or feelings expressed by the words. Thus, they cannot create original text. An AI tool based on NLP can use the same information as input, teach itself, and produce a variety of texts adapted to different audiences in a fraction of a time, such as nursing narratives,[27] or conversion of electronic health records into plain language.[28] Interestingly, this has worked in a variety of fields such as oncology,[29,30] radiology,[31] and others.[32]

Similarly, NLP algorithms may soon help

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MWs replace one of their most time-consuming, tedious tasks, offering at the same time, the highest degree of security: authoring structured content. MWs retrieve information from various documents in order to, for example, transfer it to a different place in another document with minor modifications. A large portion of clinical protocols and clinical study reports can be automatically created by AI tools in a matter of hours, instead of weeks, so that the MW can focus on activities that require a higher level of scientific interpretation.[33] Such tasks can be achieved with the highest transparency and security of personal data, as no human eye will have seen the confidential information. Achieving such a high level of productivity, confidentiality, and consistent compliance with regulations is the big promise of AI to regulatory writers.

Table 1. Further reading on artificial intelligence in healthcare

Source	Description	link
The timeline of AI	Wikipedia page	https://en.wikipedia.org/wiki/Timeline_of_artificial_intelligence
The Medical Futurist	The latest news in medical innovation	https://medicalfuturist.com/
Forbes Magazine	AI And Healthcare: A Giant Opportunity	https://www.forbes.com/sites/insights-intelai/2019/02/11/ai-and-healthcare-a-giant-opportunity/#42f5a98d4c68
MIT Technology Review	the latest advances in machine learning, neural networks, and robots	https://www.technologyreview.com/artificial-intelligence/
Take Traction	14 AI & Machine Learning podcasts you should really be listening to	http://taketraction.com/blog/14-artificial-intelligence-and-machine-learning-podcasts/
Brain Inspired	A podcast where neuroscience and AI converge	https://braininspired.co/
AI weekly	A weekly collection of the best news and resources on Artificial Intelligence and Machine Learning	http://aiweekly.co/
Artificial Intelligence for Healthcare: Opportunities and Challenges	MOOC	https://www.classcentral.com/course/futurelearn-artificial-intelligence-for-healthcare-opportunities-and-challenges-13302

Abbreviations: AI, artificial intelligence; MIT, Massachusetts Institute of Technology; MOOC, massive open online course.

Medical affairs

In addition to data, text, and image analysis, AI algorithms can analyse networks.[34] AI tools can scan the vast medical literature and the scattered available networks of physicians and scientists to create a list of key opinion leaders as well as the best strategy to make contact. Deeper relationships can be formed, not by simple web searches, but from sophisticated expert information, trend identification, and sentiment analytics.[35] And this does not need to be repeated to remain up-to-date; it happens in real time. Similarly, AI tools can educate MWs and medical affair professionals with the essential information that will produce automatically by scanning the databases, gathering scientific insights, and producing summaries.[36]

Collection and analysis of medical writing metrics

In order to stay on top of one's work or business, MW managers need to be able to collect metrics,

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create graphs, analyse data, and make decisions in order to improve businesses. An AI-based system can automatically perform these tasks in real time and reduce the burden of performing them manually. Some metrics relevant to a medical writer's job have been analysed by Haycock and Dawes, for example, basic document and client information, departmental head count, and skill sets, workload distribution, timelines, or budgets.[37] Besides, AI tools, as unbiased as they may be, can collect and analyse all types of metrics even those that, initially, may have seemed irrelevant by a human. And once analysed, graphs or narratives can be automatically created. Interestingly, those narratives can be created in a variety of ways, depending on who the target reader is. For example, a CEO may want to see different metrics than a line manager or a medical writer.

Why and how to stay up-to-date

As the impact of AI in healthcare grows, so does

the hype. Medical writers, as the gatekeepers of accurate translation of medical breakthroughs, need to understand basic concepts of AI in order to avoid overly optimistic claims.[38] In addition, it is becoming critical that MWs know how to communicate with AI-based systems in the era of profound transformation. AI is not magic and it is only as good as the quality of data used to train and test the model. Thus, AI requires strict regulations, appropriate datasets, and specific questions.

Table 1 contains a variety of sources through which anyone can introduce oneself to AI and stay up-to-date with current advances. Completing online courses, subscribing to newsletters, listening to podcasts or reading specialised blogs from experts can become a daily habit so that reporting of new AI-driven innovations becomes accurate.

Conclusion

Think of the numerous mundane tasks most MWs perform. While these tasks are considered a waste of talent and of scientific expertise of the medical writer, they are important and they need to be done. AI is becoming a useful tool in the hands of MWs by empowering them to

streamline such processes. While it seems very unlikely that AI will completely overtake the job of MWs, it is likely that MWs who embrace AI will overtake those who do not. But MWs should embrace it not only for their own benefit, but also for the benefit of society. As a strategic healthcare stakeholder, an AI-literate MW can separate science fiction from science and report future innovations in healthcare and medicine accurately.

Disclaimers

The opinions expressed in this article are the author's own and not necessarily shared by his employer or EMWA.

Conflicts of interest

The author declares no conflicts of interest and no affiliation whatsoever with the companies mentioned in the text.

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