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Brief communications

May Artificial Intelligence Get Dementia? The Challenge of Detecting Malfunctions In AI Diagnostics

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This comment highlights the need for tools to ensure the clinical relevance of AI-generated solutions. Doctors have medical Concilium, AI does not. AI tries to be the best on its own. AI uses formal data processing logic, and therefore may not consider the limitations of medical data. AI may “forget and ignore” data that do not fit into its own solution. A doctor can diagnose dementia in a human but how to detect formally correct but clinically wrong suggestions by AI? Explainable AI is a good step in solving the problem of clinical relevance. However, much more must be done to translate the logic of a Doctors Concilium into tools embedded in AI diagnostics.

Keywords: Artificial Intelligence, medical diagnostic, data relevance in AI diagnostic.
Artificial Intelligence entered medicine and raised many concerns. Will it be better than doctors? After all, AI begins to mimic human intelligence. If AI mimics humans, would AI suffer from the same issues humans have? This question sounds like a ridiculous one. However, the black-box model of data processing in AI spells worries. A standard computer software would expose a problem with an error code message. AI may not do that because AI has to deliver a result. The result should be the best possible solution, or at least it should look like the best. How do we recognize whether the solution is indeed the best? An independent validation of the solution is missing.

A human may pretend to be the best, but a reality check clarifies the claims. AI is inclined to claim the best but does not have inbuilt independent validation. AI has already had several embarrassments by delivering non-relevant or dangerous recommendations to a patient [1-3]. Luckily, doctors identified problems, and no harm was done to patients.

Some of the AI challenges are clinically irrelevant performance metrics, methodological research flaws, lack of quality clinical data, bias and inequality of data processing, the inability to catch and correct AI errors, and privacy concerns (Figure 1). AI-based image analysis has progressed, but AI-based molecular diagnosis and treatment management still have challenges.

![Figure 1. Presentation of challenges of medical AI, or a good doctor vs an AI-“doctor”.](image)

Algorithms for managing a patient are shown as key steps. Note that the good-doctor algorithm includes a validation step before confirming a final diagnosis (Dx) and has a monitoring step. AI diagnostics are limited to one-step diagnostics, even if large datasets can be used by AI compared to what may be remembered by a doctor. Benefits, shortcomings, remedies, and solutions for diagnostics are annotated.
AI can modify its algorithm, and therefore, it is prone to accumulation of errors that could be hidden within the modified algorithm. Dementia results in the malfunction of neural transmission and the elimination of memory. Programs can also accumulate malfunctional and error-prone codes, e.g., erroneous nodes, edges, quantification, equations, and iteration algorithms (Figure 1). The AI black-box model of data processing facilitates the generation and preservation of such errors in the model as long as errors do not lead to a critical failure [4, 5].

An integrated validation step is required to prevent dementia-like errors in data processing. In clinical trials, one must employ training and validation datasets. Only training is not acceptable. Recognition of this challenge comes with introducing Explainable AI (XAI) [5, 6]. XAI is a good step for securing the quality of medical AI. However, XAI still needs a doctor to validate the solution proposed by AI. A doctor is still irreplaceable.

The challenge of data processing is a strong indication of the need for a careful evaluation of AI for medical relevance. AI has to think like a human, use the strength of collected knowledge, recognize limitations, self-diagnose malfunctions, and safeguard against damaging solutions. Medical AI needs built-in mechanisms for progressive evolution (Figure 1).

The AI challenges remind famous laws of robotics. Medical AI should prevent solutions that are harmful to humans. For that, medical AI should have built-in filters and block algorithms that may damage a patient. Medical AI should be able to run a self-check of performance. Medical AI should be transparent in the generation of solutions.

One day, medical AI will be a valuable tool for diagnosing and managing patients. Imaging AI shows that such expectations are real. However, today, medical AI is like a first-year student. It has to learn the subject, how to use the accumulated knowledge, and have inbuild “do not harm patient” safeguard.

References


