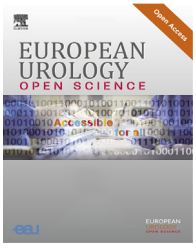
available at www.sciencedirect.com
journal homepage: www.eu-openscience.europeanurology.com



European Association of Urology

Open Horizon – Editorial

Is Artificial Intelligence Replacing Our Radiology Stars in Prostate Magnetic Resonance Imaging? The Stars Do Not Look Big, But They Can Look Brighter

Francesco Giganti [a,b,*], *Valeria Panebianco* [c], *Clare M. Tempany* [d], *Andrei S. Purysko* [e,f]

[a] *Department of Radiology, University College London Hospital NHS Foundation Trust, London, UK;* [b] *Division of Surgery & Interventional Science, University College London, London, UK;* [c] *Department of Radiological Sciences, Oncology and Pathology, Sapienza University/Policlinico Umberto I, Rome, Italy;* [d] *Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA;* [e] *Abdominal Imaging Section and Nuclear Radiology Department, Imaging Institute, Cleveland Clinic, Cleveland, OH, USA;* [f] *Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA*

In this issue of *European Urology Open Science*, Cacciamani and colleagues [1] report preliminary results from their systematic review and diagnostic meta-analysis addressing the lack of data on detection of prostate cancer via multiparametric magnetic resonance imaging (MRI) with and without the assistance of artificial intelligence (AI). They included in their analysis five studies comparing the performance of radiologists and AI alone versus a combination of radiologists aided by a computer-aided diagnosis (CAD) AI system. Interestingly, their analysis shows that the pooled sensitivity (89.1% vs 79.5%) and specificity (78.1% vs 73.1%) were higher for the radiologists + CAD AI combination than for radiologists alone. The pooled diagnostic odds ratio for radiologists + CAD AI was also higher than for radiologists alone (29% vs 11%).

The authors are to be lauded for their timely efforts in shedding light on this relevant topic. It has been estimated that a general radiologist will interpret approximately 225 000 cross-sectional imaging exams (MRI or computed tomography) over the lifespan of a typical 40-yr career. By contrast, a typical AI algorithm can be trained on the same number of examinations and applied to millions of other examinations within a much shorter period [2].

A survey on current practical experience with AI in clinical radiology conducted by the European Society of Radiology was completed by 690 radiologists. The conclusion was that although the assistance of AI algorithms was found to be reliable for different case scenarios, the use of AI-powered systems in clinical radiology is currently limited because there are no robust data on the impact of these tools on reducing radiologists' workload [3]. A similar survey by the American College of Radiology showed that approximately 30% of radiologists are currently using AI, and that among the practices not currently using AI, only 20% plan to purchase AI tools in the next 1–5 yr, meaning that there is only modest penetrance of AI in the clinical setting at present [4].

However, there is room for improvement, especially in prostate MRI. Adoption of prostate MRI has been broad and widespread across the globe. In the prediagnostic setting, MRI plays a crucial role in the MRI-directed pathway for prostate cancer detection [5]. After appropriate patient selection, the process begins with acquisition of high-quality prostate MR images (step 1), which need to be accurately interpreted and reported for precise biopsy planning and targeting (step 2). Finally, the biopsy specimen must be adequately processed and interpreted (step 3).

AI has the potential to be a game-changer for each of these steps, as it can: (1) reduce the amount of time for evaluation of image quality and provide a shorter reporting time (step 1) [6,7]; (2) allow less experienced radiologists to achieve detection performance comparable to that of experienced radiologists and potentially help with second reads (step 2) [8]; and (3) detect and grade prostate cancer on biopsy at a ranking comparable to that of expert histopathologists (step 3) [9].

The recent European Society of Urogenital Radiology and European Association of Urology Section of Urologic

DOI of original article: https://doi.org/10.1016/j.euros.2022.09.024

* Corresponding author. Division of Surgery and Interventional Science, University College London, Charles Bell House, 43–45 Foley Street, London W1W 7TY, UK.
E-mail address: f.giganti@ucl.ac.uk (F. Giganti).

https://doi.org/10.1016/j.euros.2022.11.021

Imaging position paper on AI for precision diagnosis of prostate cancer using MRI has reiterated that dedicated AI systems need to focus on classification of lesions using the Prostate Imaging-Reporting and Data System and suitability for biopsy, with the goal of ensuring that the benefits of biopsy avoidance are delivered with consistently high specificity [10]. In addition, AI could help radiologists (1) in quick identification of negative studies, (2) in comparison of serial scans (eg, in the active surveillance setting), and (3) in preliminary prioritisation of reporting (triage).

The following challenges remain:

- Multiple open image data sets are available for AI development, but they are relatively small and vary in quality, leaving many questions still unanswered. To foster the development of trustworthy AI algorithms for prostate MRI, there is a pressing need for more AI grand challenges with larger data sets obtained using scanners from multiple vendors, with different imaging protocols, and in more diverse populations in order to minimise bias.
- It is critical to recognise the human factor. As in all imaging, prostate MRI is much more than simple interpretation of images: it is a complex multifactorial process involving clinical data, experience, and a profound understanding of the disease. In short, general AI algorithms are not empathic and do not incorporate all these factors. Thus, as radiologists, we are essential in the AI world, as we play a crucial role in data interpretation, and we must work closely with data scientists who build the AI algorithms.
- Neither the medicolegal aspects of AI implementation in prostate MRI (Who will be responsible for a diagnosis missed using CAD-AI alone?) nor the sustainability of system performance over time (Is there a system in place that will check any drop in performance of the system and operator? Is there a potential risk of over-reliance on the CAD system?) have been thoroughly investigated.

In conclusion, we believe that the preliminary results presented by Cacciamani and colleagues [1] are encouraging and highlight the potential of AI systems for improving radiologists' performance. We welcome these findings and look to the future with optimism. In response to the question "Is AI replacing our radiology stars?", our answer is "No". We believe that radiology stars who use AI will replace those who do not, as they will shine more brightly. Follow those stars.

Conflicts of interest: Francesco Giganti is the recipient of a 2020 Young Investigator Award (20YOUN15) funded by the Prostate Cancer Foundation/CRIS Cancer Foundation and has received consulting fees from Lucida Medical outside of the submitted work. The remaining authors have nothing to disclose.

References

[1] Cacciamani G, Sanford DI, Chu T, et al. Is artificial intelligence replacing our radiology stars? Not yet! Eur Urol Open Sci 2023:48. https://doi.org/10.1016/j.euros.2022.09.024.
[2] Mintz Y, Brodie R. Introduction to artificial intelligence in medicine. Minim Invasive Ther Allied Technol 2019;28:73–81.
[3] European Society of Radiology. Current practical experience with artificial intelligence in clinical radiology: a survey of the European Society of Radiology. Insights Imaging 2022;13:107.
[4] Allen B, Agarwal S, Coombs L, Wald C, Dreyer K. 2020 ACR Data Science Institute artificial intelligence survey. J Am Coll Radiol 2021;18:1153–9.
[5] Padhani AR, Barentsz J, Villeirs G, et al. PI-RADS Steering Committee: The PI-RADS multiparametric MRI and MRI-directed biopsy pathway. Radiology 2019;292:464–74.
[6] Giganti F, Lindner S, Piper JW, et al. Multiparametric prostate MRI quality assessment using a semi-automated PI-QUAL software program. Eur Radiol Exp 2021;5:48.
[7] Cipollari S, Pecoraro M, Forookhi A, et al. Biparametric prostate MRI: impact of a deep learning-based software and of quantitative ADC values on the inter-reader agreement of experienced and inexperienced readers. Radiol Med 2022;127:1245–53.
[8] Labus S, Altmann MM, Huisman H, et al. A concurrent, deep learning-based computer-aided detection system for prostate multiparametric MRI: a performance study involving experienced and less experienced radiologists. Eur Radiol. In press. https://doi.org/10.1007/s00330-022-08978-y.
[9] Ström P, Kartasalo K, Olsson H, et al. Artificial intelligence for diagnosis and grading of prostate cancer in biopsies: a population-based, diagnostic study. Lancet Oncol 2020;21:222–32.
[10] Penzkofer T, Padhani AR, Turkbey B, et al. ESUR/ESUI position paper: developing artificial intelligence for precision diagnosis of prostate cancer using magnetic resonance imaging. Eur Radiol 2021;31:9567–78.