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EDITORIAL

Artificial intelligence in imaging: enhancing accuracy, efficiency and surgical decision-making

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Artificial intelligence (AI) has quickly become a transformative force in modern medicine, with a particularly significant impact on imaging. Perhaps the most widely recognised example is in breast cancer screening, where AI systems are now routinely used alongside radiologists to interpret mammograms. These algorithms can highlight suspicious lesions, reduce false negatives and prioritise studies that require urgent review.[1] For surgeons, this means cancers are being detected earlier and with greater accuracy, directly influencing reconstructive planning and patient counselling. This progress reflects the broader transformation in diagnostic radiology, where AI-powered tools are reshaping how medical images are acquired, analysed and interpreted.[1] Although initial automation efforts focused on specific tasks, such as lesion detection or segmentation, today's AI has comprehensive processing capabilities that enable everything from image reconstruction to triage and predictive analytics.[2,3]

One of the most important contributions of AI has been in workflow optimisation. AI-powered systems now assist radiologists by prioritising abnormal studies, automatically filling in reports and highlighting urgent findings, such as haemorrhage or pneumothorax.[4,5] These advancements are not just about improving efficiency; they also represent notable progress. They mark a shift towards safer, faster and more standardised imaging practices.[1] In plastic surgery, where prompt diagnosis of complications such as haematomas, seromas or implant ruptures is vital, these tools provide significant clinical benefits.

At the heart of this revolution is the development and maturation of deep learning algorithms, especially convolutional neural networks, that have demonstrated superior performance in analysing radiological images, such as X-rays, CT scans and MRI sequences.[6,7] These models can detect subtle imaging features that may even escape the notice of experienced clinicians, helping to minimise diagnostic errors, especially in busy or fatigue-prone settings.[8] Notably, AI has proven particularly useful in oncological imaging, including for breast and skin cancers, which is highly relevant to the plastic surgery community.[9–11]

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Building on these diagnostic and workflow advancements, AI is now extending its utility into more specialised surgical domains. One such area is preoperative planning in microsurgery, where precise imaging analysis is critical for identifying suitable perforator vessels and optimising surgical outcomes.[12] Studies have shown high accuracy and time savings in using these deep learning models.[13–15] This emerging application underscores AI's evolving role, not just as a diagnostic assistant but as a tool that actively supports surgical decision-making through detailed anatomical interpretation and procedural foresight.

Furthermore, the potential of AI to enable precision medicine is becoming increasingly apparent. Algorithms can combine imaging features with clinical and demographic data to predict disease progression, treatment response or surgical outcomes.[16,17] For example, in breast reconstruction, AI models have been able to estimate flap viability or simulate postoperative results using patient-specific inputs, thereby improving shared decision-making and informed consent processes.[18–20] Similarly, AI-driven image analysis is aiding more accurate preoperative planning in craniofacial surgery through better segmentation and virtual simulation.

Recent advances have focused on using generative models, such as generative adversarial networks and vision transformers, to enhance image quality, produce synthetic data for rare conditions and aid in noise reduction for low-dose imaging protocols.[2,17] This is especially important in paediatric and low-resource settings, where balancing diagnostic accuracy with patient safety is crucial.

Despite these promising developments, implementing AI in imaging is not without its challenges. Data heterogeneity, algorithmic bias and a lack of generalisability across populations remain significant barriers to clinical adoption.[21,22] A majority of AI models are trained on data from limited geographic or demographic cohorts, leading to concerns about equity, fairness and clinical validity when applied more broadly.[23] Additionally, the so-called 'black box' problem, wherein AI outputs are not readily interpretable, continues to limit clinician trust and pose medico-legal implications.[16]

Ethical and regulatory frameworks have been slow to keep up with the rapid progress of AI technologies. Protecting patient privacy, obtaining informed consent for data use and ensuring transparency in AI decision-making require robust safeguards. As AI becomes increasingly embedded in diagnostic workflows, it is essential to clearly define accountability and ensure that AI systems are designed to support, rather than replace, clinical judgement.[8,24]

There is also an urgent need for interdisciplinary collaboration. Clinicians, radiologists, data scientists and engineers must work closely to co-develop clinically meaningful AI tools. Plastic surgeons, in particular, should be actively involved in guiding the development of imaging algorithms relevant to their specialty, ensuring that solutions are grounded in clinical need rather than technological novelty.

In the Australian context, the integration of AI into imaging must be aligned with national funding models and specialist training pathways. Currently, the Medicare Benefits Schedule (MBS) does not specifically reimburse AI-assisted radiological tools, posing a barrier to their widespread adoption. Developing dedicated MBS item numbers for validated AI applications, such as triage algorithms or breast density analysis, could enhance uptake, particularly in rural and regional areas where access to subspecialist radiologists is limited. Moreover, surgical training through the Royal Australasian College of Surgeons (RACS) does not yet formally include AI literacy, despite its growing relevance in perioperative imaging and decision-making. Embedding AI education into the RACS curriculum would ensure that future surgeons are prepared to interpret and collaborate with intelligent imaging systems. These reforms are especially crucial in the context of rural and remote healthcare delivery, where AI-enabled tools offer scalable solutions to workforce shortages and diagnostic delays, directly supporting national objectives in digital health and health equity.

AI has fundamentally transformed the landscape of medical imaging. Its capacity to improve diagnostic accuracy, streamline workflows, support personalised care and increase access to high-quality imaging offers an unprecedented opportunity. Yet, to unlock its full potential, the field must tackle complex challenges related to data quality, clinical validation, ethics and education. For the plastic surgery community, especially those involved in oncological imaging, reconstructive planning and perioperative diagnostics, engaging with AI is no longer optional. It is essential. The future of imaging is not just digital; it's intelligent.

Conflict of interest

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References

1 Bhandari A. Revolutionizing radiology with artificial intelligence. *Cureus*. 2024;16(10):e72646. https://doi.org/10.7759/cureus.72646

2 Pinto-Coelho L. How artificial intelligence is shaping medical imaging technology: a survey of innovations and applications. *Bioengineering (Basel)*. 2023;10(12):1435. https://doi.org/10.3390/bioengineering10121435 PMid:38136026 PMCid:PMC10740686

3 Khalifa M, Albadawy M. Using artificial intelligence in academic writing and research: an essential productivity tool. *Comput Methods Programs Biomed Update*. 2024;5:100145. https://doi.org/10.1016/j.cmpbup.2024.100145

4 Sitaraman S. AI-driven diagnostics and imaging: transforming early detection and precision in healthcare. *Int J Sci Res Comput Sci Eng Inf Technol.* 2024;10(6):1258–1267. https://doi.org/10.32628/CSEIT241061167

5 Katal S, York B, Gholamrezanezhad A. AI in radiology: from promise to practice—a guide to effective integration. *Eur J Radiol*. 2024;181:111798. https://doi.org/10.1016/j.ejrad.2024.111798 PMid:39471551

6 Deshmukh A. Artificial intelligence in medical imaging: applications of deep learning for disease detection and diagnosis. *Univers Res Rep*. 2024;11(3):31–36. https://doi.org/10.36676/urr.v11.i3.1284

7 Alanazi M, Almutairi S, Alarjani N, Alghaylan M, Aljawhari M, Alkhulaifi A. Advancements in AI-driven diagnostic radiology: enhancing accuracy and efficiency. *Int J Health Sci*. 2024;5(S2):1402–1414. https://doi.org/10.53730/ijhs.v8nS1.14928

8 Srivastav S, Chandrakar R, Gupta S, et al. ChatGPT in radiology: the advantages and limitations of artificial intelligence for medical imaging diagnosis. *Cureus*. 2023;15(7):e41435. https://doi.org/10.7759/cureus.41435

9 Cevik J, Seth I, Rozen W. Artificial intelligence-generated images in skin cancer education: an experimental study. *Austral J Plast Surg*. 2025;8(1):118181. https://doi.org/10.34239/ajops.118181

10 Rahman T, Khandakar A, Qiblawey Y, et al. Exploring the effect of image enhancement techniques on COVID-19 detection using chest X-ray images. *Comput Biol Med*. 2021;132:104319. https://doi.org/10.1016/j.compbiomed.2021.104319 PMid:33799220 PMCid:PMC7946571

11 Bhure S, Shete V. Revolutionizing healthcare: AI-powered imaging transforms medical diagnosis. In: *2024 2nd DMIHER International Conference on Artificial Intelligence in Healthcare, Education and Industry (IDICAIEI)*. IEEE;2024:1–4. https://doi.org/10.1109/IDICAIEI61867.2024.10842737

12 Shadid O, Seth I, Cuomo R, Rozen WM, Marcaccini G. Artificial intelligence in microsurgical planning: a five-year leap in clinical translation. *J Clin Med*. 2025;14(13):4574. https://doi.org/10.3390/jcm14134574 PMid:40648947 PMCid:PMC12249721

13 Lim B, Cevik J, Seth I, et al. Evaluating artificial intelligence's role in teaching the reporting and interpretation of computed tomographic angiography for preoperative planning of the deep inferior epigastric artery perforator flap. *JPRAS Open*. 2024;40:273–285. https://doi.org/10.1016/j.jpra.2024.03.010 PMid:38708385 PMCid:PMC11067004

14 Mavioso C, Araújo RJ, Oliveira HP, et al. Automatic detection of perforators for microsurgical reconstruction. *Breast*. 2020;50:19–24. https://doi.org/10.1016/j.breast.2020.01.001 PMid:31972533 PMCid:PMC7375543

15 Shen D, Huang X, Huang Y, Zhou D, Ye S. Computed tomography angiography and B-mode ultrasonography under artificial intelligence plaque segmentation algorithm in the perforator localization for preparation of free anterolateral femoral flap. *Contrast Media Mol Imaging*. 2022;2022:4764177. https://doi.org/10.1155/2022/4764177 PMid:36247860 PMCid:PMC9534661

16 Najjar R. Redefining radiology: a review of artificial intelligence integration in medical imaging. *Diagnostics (Basel)*. 2023;13(17):2760. https://doi.org/10.3390/diagnostics13172760 PMid:37685300 PMCid:PMC10487271

17 Kumar Y, Koul A, Singla R, Ijaz MF. Artificial intelligence in disease diagnosis: a systematic literature review, synthesizing framework and future research agenda. *J Ambient Intell Humaniz Comput*. 2023;14(7):8459–8486. https://doi.org/10.1007/s12652-021-03612-z PMid:35039756 PMCid:PMC8754556

18 Seth I, Lim B, Joseph K, et al. Use of artificial intelligence in breast surgery: a narrative review. *Gland Surg*. 2024;13(3):395–411. https://doi.org/10.21037/gs-23-414 PMid:38601286 PMCid:PMC11002485

19 Cevik J, Seth I, Rozen WM. Transforming breast reconstruction: the pioneering role of artificial intelligence in preoperative planning. *Gland Surg*. 2023;12(9):1271–1275. https://doi.org/10.21037/gs-23-265 PMid:37842522 PMCid:PMC10570966

20 Huang RW, Tsai TY, Hsieh YH, et al. Reliability of postoperative free flap monitoring with a novel prediction model based on supervised machine learning. *Plast Reconstr Surg*. 2023;152(5):943e–952e. https://doi.org/10.1097/PRS.0000000000010307 PMid:36790782

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21 Koçak B. Key concepts, common pitfalls, and best practices in artificial intelligence and machine learning: focus on radiomics. *Diagn Interv Radiol*. 2022;28(5):450–462. https://doi.org/10.5152/dir.2022.211297 PMid:36218149 PMCid:PMC9682557

22 Coppola F, Faggioni L, Gabelloni M, et al. Human, all too human? An all-around appraisal of the 'artificial intelligence revolution' in medical imaging. *Front Psychol*. 2021;12:710982. https://doi.org/10.3389/fpsyg.2021.710982 PMid:34650476 PMCid:PMC8505993

23 Celi LA, Cellini J, Charpignon ML, et al. Sources of bias in artificial intelligence that perpetuate healthcare disparities—a global review. *PLOS Digit Health*. 2022;1(3):e0000022. https://doi.org/10.1371/journal.pdig.0000022 PMid:36812532 PMCid:PMC9931338

24 Alowais SA, Alghamdi SS, Alsuhebany N, et al. Revolutionizing healthcare: the role of artificial intelligence in clinical practice. *BMC Med Educ*. 2023;23(1):689. https://doi.org/10.1186/s12909-023-04698-z PMid:37740191 PMCid:PMC10517477