# AI breakthroughs promise to transform pathology with more precise and efficient cancer diagnosis



Researchers are making significant strides in the development of artificial intelligence tools aimed at revolutionising disease diagnosis, particularly within the field of pathology. Traditionally, pathologists analyse tissue samples to diagnose conditions such as cancer; however, this essential role is becoming increasingly strained. Demand for pathological services far exceeds supply, and pathologists are confronting rising workloads and complexities within their profession. According to a report in Nature, while digital image-recognition tools have started to aid in the process by identifying patterns in tissue and highlighting suspicious areas, newer AI models are emerging that can potentially distinguish cancer subtypes and detect metastases. Though these advancements are promising, they are not yet clinically validated, raising concerns around issues such as AI hallucinations and the opacity of decision-making processes. Nevertheless, some experts regard these tools as a “transformative technological advancement” that could reshape the landscape of pathology.

One notable AI tool, developed by researchers at the Perelman School of Medicine, is called iStar. This advanced system offers unparalleled clarity in interpreting medical images, allowing clinicians to identify cancer cells that may otherwise go unnoticed. iStar is capable of assessing whether safe margins were achieved during cancer surgeries and can autonomously annotate microscopic images, which may herald a new era of molecular disease diagnosis at the cellular level. Such precision could significantly enhance the quality of pathology and patient outcomes.

Similarly, a project at Stanford Medicine has produced nuclei.io, a customisable AI tool that allows pathologists to tailor its functionality according to specific requirements. This adaptability not only improves diagnostic accuracy but also substantially reduces the time needed for analysis—from an average of 209 seconds to just 79 seconds for certain types of tissue samples. By empowering pathologists with tools that can be specifically trained to their context, the potential to enhance efficiency and efficacy in diagnosis becomes clear.

In addition, the Virchow model represents a pivotal advancement in computational pathology, trained on a vast dataset of 1.5 million whole slide images encompassing a variety of tissue types. This model has demonstrated high accuracy in detecting multiple cancer types, achieving an AUC score of 0.949 across 17 different categories. Such comprehensive training positions the Virchow model as a front-runner in the reporting of diagnostic results with substantial reliability.

Furthermore, researchers from Harvard Medical School have introduced an AI model named CHIEF, which improves upon existing technologies in numerous areas, including cancer detection and predicting patient outcomes. CHIEF has realised an impressive accuracy rate of nearly 94% in cancer detection, outperforming other leading methods by up to 36%. This tool’s performance holds strong regardless of how the tumour samples are obtained or digitised, showcasing its versatility across different clinical settings.

Moreover, innovations are not limited only to AI tools specifically tailored for cancer diagnosis. A recent development in interpretable machine learning systems for colorectal cancer analysis promises to enhance diagnostic accuracy further. This system classifies pathology slides based on the severity of dysplasia and has achieved a remarkable accuracy of 93.44%, demonstrating an effective blend of advanced technology and pathologist knowledge.

Lastly, the Galen platform, developed by Ibex Medical Analytics, stands out with its suite of AI solutions designed to facilitate diagnoses across various organs and pathologies. With its initial solution, Galen Breast, now CE-marked and approved by regulatory bodies in the EU and the UK, the platform illustrates the potential for real-world clinical application of these AI tools. As the validation of such technologies progresses, the integration of AI in pathological practice appears increasingly viable, paving the way for a new and more efficient paradigm in disease diagnosis.

In summary, while significant challenges remain in the field of pathology, the advent of sophisticated AI tools signals a promising future. These innovations not only aim to alleviate the pressures faced by pathologists but also to enhance the accuracy and efficiency of disease diagnosis, ultimately improving patient care in critical ways.

Source: [Noah Wire Services](https://www.noahwire.com)

## Bibliography

1. <https://www.semafor.com/newsletter/05/29/2025/semafor-flagship-win-some-lose-some> - Please view link - unable to able to access data
2. <https://www.pennmedicine.org/news/news-releases/2024/january/ai-tool-brings-precision-pathology-for-cancer-into-focus> - Researchers at the Perelman School of Medicine have developed iStar, an AI tool that interprets medical images with unprecedented clarity. iStar provides detailed views of individual cells and broader insights into gene activities, enabling clinicians to detect cancer cells that might otherwise remain undetected. This tool can determine whether safe margins were achieved during cancer surgeries and automatically annotate microscopic images, paving the way for molecular disease diagnosis at the cellular level.
3. <https://med.stanford.edu/news/all-news/2024/06/digital-pathology> - Stanford Medicine researchers have developed a customizable AI tool named nuclei.io to assist pathologists in identifying diseased cells. Unlike one-size-fits-all AI solutions, nuclei.io can be trained by pathologists to meet their specific needs, enhancing the accuracy and speed of disease diagnosis. The tool has demonstrated significant reductions in diagnosis time, from 209 to 79 seconds, when used to identify immune cells in uterine biopsy images and colon cancer cells in lymph nodes.
4. <https://arxiv.org/abs/2309.07778> - The Virchow model is a foundation model for computational pathology, trained on 1.5 million whole slide images from diverse tissue and specimen types. It enables the development of a pan-cancer detection system with an overall specimen-level AUC of 0.949 across 17 different cancer types and 0.937 AUC on 7 rare cancer types. The model sets the state-of-the-art on internal and external image tile level benchmarks and slide level biomarker prediction tasks.
5. <https://hms.harvard.edu/news/new-artificial-intelligence-tool-cancer> - Harvard Medical School researchers have developed CHIEF, an AI tool that outperforms other state-of-the-art AI methods by up to 36% on tasks such as cancer cell detection, tumor origin identification, predicting patient outcomes, and identifying the presence of genes and DNA patterns related to treatment response. CHIEF achieved nearly 94% accuracy in cancer detection and performed equally well regardless of how the tumor cells were obtained or digitized.
6. <https://arxiv.org/abs/2301.02608> - An interpretable machine learning system for colorectal cancer diagnosis from pathology slides has been developed. The system predicts, for the patch-based tiles, a class based on the severity of the dysplasia and uses that information to classify the whole slide. It is trained with an interpretable mixed-supervision scheme to leverage the domain knowledge introduced by pathologists through spatial annotations. The method shows an accuracy of 93.44% on the internal dataset and a sensitivity of 0.996 between positive and non-neoplastic samples.
7. <https://pmc.ncbi.nlm.nih.gov/articles/PMC10705335/> - The Galen platform, developed by Ibex Medical Analytics, represents a suite of AI solutions used to facilitate diagnosis across multiple organs and pathologies. The first of these solutions is Galen Breast, currently CE-marked under the In Vitro Diagnostic Directive (IVDD) in the EU and registered with the UK Medicines and Healthcare products Regulatory Agency (MHRA), as well as with the Brazilian Health Regulatory Agency (ANVISA). The validation and real-world clinical application study of the solution was published in December 2022.