Pathology informatics selected abstracts

Editor: Liron Pantanowitz, MD, PhD, MHA, chair of the Department of Pathology and professor of pathology, University of Pittsburgh Medical Center.

Forecast for computational pathology by 2030: results of a Delphi study

May 2023—Computational pathology is a subspecialty of pathology that exploits computational analysis to analyze patient specimens and that often uses multiple sources of related data. Artificial intelligence systems are typically used in this subspecialty. The field of pathology is rapidly being transformed by the development of AI algorithms trained to perform diagnostic, prognostic, and predictive tasks. However, routine use of artificial intelligence in anatomic pathology remains limited, making it difficult to measure the long-term clinical impact of AI. With this issue in mind, the authors surveyed 24 subject matter experts worldwide regarding the anticipated role of AI in pathology by the year 2030. They used the Delphi technique to garner perspectives and expectations from the survey participants. Consensus opinions were reached for 78.3 percent (141 of 180) of survey questions. The participants agreed that AI would be used routinely and meaningfully in AP clinical practice by 2030. They indicated that, due to the integration of AI into pathology, diagnostic accuracy and detection of rare events—for example, small metastases—will increase and the diagnosis and grading of tumors will become more standardized. They also indicated that AI-based tools would likely be used routinely to detect lymph node metastases and microorganisms, quantify mitoses, automate the ordering of stains, and prioritize cases, as well as for quality control checks of scanned slides. The participants predicted that by 2030, the medical community would likely define new categories of patients based on data made available through AI. Furthermore, the participants predicted that digital pathology support for pathologists will become part of the routine workflow and that the number of specialized computational pathologists will greatly increase. In summary, the survey findings indicate that the era of AI in pathology has arrived. However, the survey participants raised important practical, ethical, and legal concerns that will need to be addressed before AI can be fully and successfully implemented in clinical practice. These concerns apply to developing guidelines for integrating AI into pathology, defining validation procedures for AI tools, addressing legal disputes that may arise over liability for diagnostic errors caused by AI, incorporating AI into educational curricula, and dealing with potential ethical challenges pertaining to replacing pathologists with AI.

Berbís MA, McClintock DS, Bychkov A, et al. Computational pathology in 2030: a Delphi study forecasting the role of AI in pathology within the next decade. *EBioMedicine.* 2023. https://doi.org/10.1016/j.ebiom.2022.104427

Correspondence: Dr. Jeanne Shen at jeannes@stanford.edu

Artificial intelligence-based tools for microbiology

Artificial intelligence is increasingly being applied to anatomic and clinical pathology. In the realm of clinical pathology, several AI-based tools have been developed to assist pathology laboratories with diagnosing microbiological diseases. However, manual microscopic examination is still being used to identify many microbes, despite being a time-consuming process requiring skilled staff. Artificial intelligence may significantly increase diagnostic accuracy and reduce turnaround time for such tasks, especially during an emerging infection or health care worker shortage. The authors performed a systematic literature search for studies that address the application of AI to pathology microbiology specimens. They found 110 articles that met their inclusion criteria. The articles were published between 1973 and 2022, and the studies involved 23,552 patients collectively. The AI-based tools were most frequently used to diagnose malaria in peripheral blood smears (54 studies). The tools were shown to reliably classify various Plasmodium species and estimate the proportion of parasitemia, sometimes in as little as 10 seconds. This was followed, in frequency, by the use of AI systems to detect bacteria, including mycobacteria and *Helicobacter pylori* (28 studies), nematodes (14 studies), other protozoa (11 studies), and some viruses and fungi (10 studies). The vast majority (86 percent) of studies described AI algorithms designed to examine cytology (versus tissue) samples, including blood and bone marrow, sputum, stool, urine, and skin

scrapes. Most studies employed static digital images acquired using cameras attached to a light microscope or paired with a smartphone. Whole slide images were used in 18 percent of the studies, and dynamic (live) images were used in only four percent. Those who conducted the studies used a variety of deep-learning strategies. Overall, the studies reported satisfactory results, thereby supporting adoption of these AI-based tools to routinely assist pathologists in detecting microorganisms. However, the majority of AI algorithms featured in the studies were not validated on an external data set, making it difficult to determine whether they will perform adequately in various clinical settings. Moreover, most of the data sets used in training these systems are not available publicly, making it hard to corroborate results.

Marletta S, L'Imperio V, Eccher A, et al. Artificial intelligence-based tools applied to pathological diagnosis of microbiological diseases. *Pathology—Research and Practice.* 2023. https://doi.org/10.1016/j.prp.2023.154362

Correspondence: Dr. Albino Eccher at albino.eccher@aovr.veneto.it