Revolutionizing Histopathology: Utilizing Large Language Model for Report Interpretation and Medical Education

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ABSTRACT

The arrival of large language models like Open AI's ChatGPT, Microsoft's Copilot and Google's Gemini AI heralds a revolutionary era in various medical fields including the interpretation of histopathology reports. Histopathology is a foundation in diagnostic medicine which traditionally depends on the skill of a histopathologist to interpret cytology and tissue biopsies. However, a fusion of large language models (artificial intelligence) has enhanced diagnostic accuracy and lessened the workload burden on pathologists especially in human resource-constrained setups. This editorial explores the merits and demerits of integrating large language models for interpreting histopathology reports supported by evidence.

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EDITORIAL

Large language models like ChatGPT and Gemini AI can diagnose and interpret patient reports in different diagnostic modalities like radiology and pathology. Anatomic pathology reports are the cornerstone of diagnostics, but complex reports take time. The fact is, histopathology reports are not standardized and even expert pathologists may misinterpret the reports due to different wordings. The feature of natural language processing in the large language models has benefited the reporting in histopathology for patients and physicians. Often these reports are beyond the comprehension of a common person or a patient. Chatbots have made these reports understandable for the patient and as main stakeholders, patients are equally aware of the disease with the help of large language model usage.

While reporting, a pathologist comments on not only the architecture but also the cytology of that tissue. Multi-scale focal convolutional neural networks in large language models are designed especially for image analysis at multiple levels or scales. Thus, it serves for multiscale (Tissue architecture and cell image) analysis. These models segment histopathology images to differentiate between normal and abnormal tissue. This feature helped pathologists with the accuracy of diagnosis and interpretation.

Technical human resource constraints setups took help from artificial intelligence for quality control. Insufficient pathologists' workforce increases the likelihood of human error. A Korean hospital developed and implemented an AI classifier model combined with digital pathology and lab information systems for an independent artificial intelligence quality control system. This system helped improve the quality of reports despite having an insufficient pathologist workforce.

Digital pathology and its integration with large language models/ artificial intelligence have decreased the dependency of histopathology trainees on their seniors regarding learning and case discussion. Digital pathology provides access to a vast range of complex cases and artificial intelligence empowers the trainees by provision of feedback from automated systems about their initial assessment. Hence, artificial intelligence has revolutionized medical education and training of histopathology trainees as well as decreasing their dependency on their mentors.

Natural language processing models (ChatGPT) can grasp and handle theoretical ideas. It can solve higher-order thinking queries related to pathology general knowledge. It can interact with humans (academicians and students) and generate meaningful responses. So it is recommended to use artificial intelligence for improved clinical reasoning, cognitive perception and decision-making in histopathology.

Along with merits, large language models have demerits as well. A study where ChatGPT as a large language model and pathologists' capability was compared in aspects of knowledge about disease, differential diagnosis and the ability of immunohistochemical integration as well as radiological and

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clinical information. The results of the study concluded poor accuracy of ChatGPT and recommended careful and judicial use of artificial intelligence. Large language models cannot surpass the judgement and acuity of histopathologists. It could be possibly due to limitations of the model used or incorrect prompt engineering.

Moreover, dependency on artificial intelligence for decision-making regarding diagnosis of disease will be increased. Misinterpretation of reports and diagnostic bias are other pitfalls.

In conclusion, while offering benefits like improving reporting quality, diagnostic accuracy, higher-order thinking solutions, and histopathology segmentation for reporting, large language models have also drawbacks like the misinterpretation of reports, dependency on artificial intelligence and diagnostic bias. So, careful human-AI collaboration is emphasized to attain robust potential of large language model deployment for histopathology diagnosis. In our context, however, judicial use of artificial intelligence can mitigate the impact of human resource constraints.

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CONFLICT OF INTEREST

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