

A comprehensive review of tubule formation in histopathology images: advancement in tubule and tumor detection techniques

Abstract

Breast cancer, the earliest documented cancer in history, stands as a foremost cause of mortality, accounting for 684,996 deaths globally in 2020 (15.5% of all female cancer cases). Irrespective of socioeconomic factors, geographic locations, race, or ethnicity, breast cancer ranks as the most frequently diagnosed cancer in women. The standard grading for breast cancer utilizes the Nottingham Histopathology Grading (NHG) system, which considers three crucial features: mitotic counts, nuclear pleomorphism, and tubule formation.

Comprehensive reviews on features, for example, mitotic count and nuclear pleomorphism have been available thus far. Nevertheless, a thorough investigation specifically focusing on tubule formation aligned with the NHG system is currently lacking. Motivated by this gap, the present study aims to unravel tubule formation in histopathology images via a comprehensive review of detection approaches involving tubule and tumor features. Without temporal constraints, a structured methodology is established in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, resulting in 12 articles for tubule detection and 67 included articles for tumor detection. Despite the primary focus on breast cancer, the structured search string extends beyond this domain to encompass any cancer type utilizing histopathology images as input, focusing on tubule and tumor detection. This broadened scope is essential. Insights from approaches in tubule and tumor detection for various cancers can be assimilated, integrated, and contributed to an enhanced understanding of tubule formation in breast histopathology images. This study compiles evidence-based analyses into a cohesive document, offering comprehensive information to a diverse audience, including newcomers, experienced researchers, and stakeholders interested in the subject matter.

Keywords

Deep learning; Handcrafted; Histopathology; Tubule detection; Tubule formation; Tumor detection