

AI-Augmented Digital Pathology Predicts Mismatch Repair Deficiency in Colorectal Cancer with Superior Sensitivity to Immunohistochemistry

Dr. Sarah Okafor^{1*}, Dr. Li Wei², Dr. Ahmed Hassan¹

¹Department of Pathology, University of Ibadan, Ibadan, Nigeria

²AI Medical Imaging Center, Tsinghua University, Beijing, China

*Corresponding Author: sarah.okafor@ui.edu.ng



Abstract

Lynch syndrome screening relies on immunohistochemistry (IHC) for mismatch repair (MMR) proteins, which suffers from pre-analytic variability. We developed a deep learning algorithm (PathMMR-AI) trained on 5,000 whole-slide images (WSIs) of colorectal cancer (CRC) to predict MMR deficiency (dMMR) directly from hematoxylin-eosin (H&E) stained slides. The model achieved 96.8% sensitivity and 94.2% specificity, outperforming conventional IHC (sensitivity 89.3%) in a prospective validation cohort of 400 cases. Attention mapping revealed morphological features (tumor-infiltrating lymphocytes, mucinous differentiation, Crohn's-like aggregates) predictive of dMMR status. AI-augmented H&E screening offers a cost-effective, rapid triage tool for universal Lynch syndrome screening in resource-limited settings.

Keywords: artificial intelligence, digital pathology, mismatch repair deficiency, Lynch syndrome, colorectal cancer, deep learning



This work is licensed under a [Creative Commons Attribution Non-Commercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/).