

Abstract Reference: 20526

Mode of Presentation: Oral Presentation

Topic: Parasitology - Molecular Parasitology

Artificial intelligence for filariasis detection at the point of care

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Abstract Content

Filariasis presents substantial health burdens in endemic regions worldwide. The accurate detection and differentiation of filaria parasites are essential for providing timely access to treatment and effective disease management. Optical microscopy remains the gold standard method for filariasis diagnosis, however, it suffers from low sensitivity, time-consuming procedures, and the need for skilled analysts. We present a robotic AI system that automatically detects microfilariae in real time in blood smears, upgrading a conventional microscope and without the need for internet connection. The components of the system include a mobile phone securely attached to a microscope eyepiece through a 3D-printed adapter and a mechanical system controlled by the smartphone app, which moves the sample along the X and Y axes and automatically adjusts the focus along the Z axis. The app acquires images with the mobile camera and detects microfilariae species using an AI algorithm on the edge. The system can scan a whole blood smear with a 10x or 40x objective, digitize images, and run real-time AI analysis in under 3 or 15 minutes, respectively. The AI model showed a precision and recall of 94% and 92% for microfilariae detection, and 95% and 98% for species differentiation, including *Loa loa*, *Mansonella perstans*, *Wuchereria bancrofti*, and *Brugia malayi*. We envision a simple and robust device able to upgrade existing optical microscopes in low-resource settings and transform them into AI-driven diagnostic systems, scalable to other parasitic diseases and contributing to reducing the burden of neglected tropical diseases worldwide.