MedicalXpress

New study uses AI to predict malaria outbreaks in South Asia

April 24 2024

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Researchers from NDORMS in collaboration with international institutions have demonstrated the potential of using environmental measurements and deep learning modeling to predict malaria outbreaks

in South Asia. The study offers promising insights into improving early warning systems for one of the world's deadliest diseases.

Malaria remains a significant global health challenge, with approximately half of the world's population at risk of infection, particularly in African and South Asian countries. Despite being preventable, the changing nature of the climate, socio-demographic, and environmental risk factors have made outbreak prediction difficult.

Led by Associate Professor Sara Khalid of the Planetary Health Informatics Group at NDORMS, University of Oxford in collaboration with the Lahore University of Management Sciences, the research team wanted to address this challenge and explore whether an environment-based machine learning approach could offer the potential for location-specific early warning tools for malaria.

They developed a multi-dimensional LSTM (M-LSTM) model that simultaneously analyzed environmental indicators including temperature, rainfall, vegetation measures, and night-time light data to predict malaria incidence in the South Asian belt spanning Pakistan, India, and Bangladesh.

The data was plotted against district-level malaria incidence rates for each country between 2000 and 2017, obtained from the US Agency for International Development's Demographic and Health Survey datasets.

The results, which have been published in *The Lancet Planetary Health*, show that the proposed M-LSTM model consistently outperforms the state-of-the-art conventional LSTM model with 94.5%, 99.7%, and 99.8% lower error rates for Pakistan, India, and Bangladesh, respectively.

In general, higher accuracy and reduced error rates were achieved with

increased model complexity, highlighting the effectiveness of the approach.

Sara explained, "This approach is generalizable and as such our modeling carries significant implications for public health policy. For example, it could be applied to other infectious diseases, or be scaled up to other high-risk areas with a disproportionately high burden of malaria cases and deaths in WHO Africa regions. It has the potential to help decision-makers implement more proactive measures to manage malaria outbreaks early and accurately.

"The real attraction is the ability to analyze pretty much anywhere and everywhere on earth, thanks to the rapid advancements in earth observation, deep learning and AI, and the availability of high-performance computers. This could lead to more targeted interventions and a better allocation of resources in the ongoing efforts to eradicate malaria and enhance public health outcomes worldwide."

More information: Usman Nazir et al, Predicting malaria outbreaks using earth observation measurements and spatiotemporal deep learning modelling: a South Asian case study from 2000 to 2017, *The Lancet Planetary Health* (2024). DOI: 10.1016/S2542-5196(24)00082-2

Provided by University of Oxford