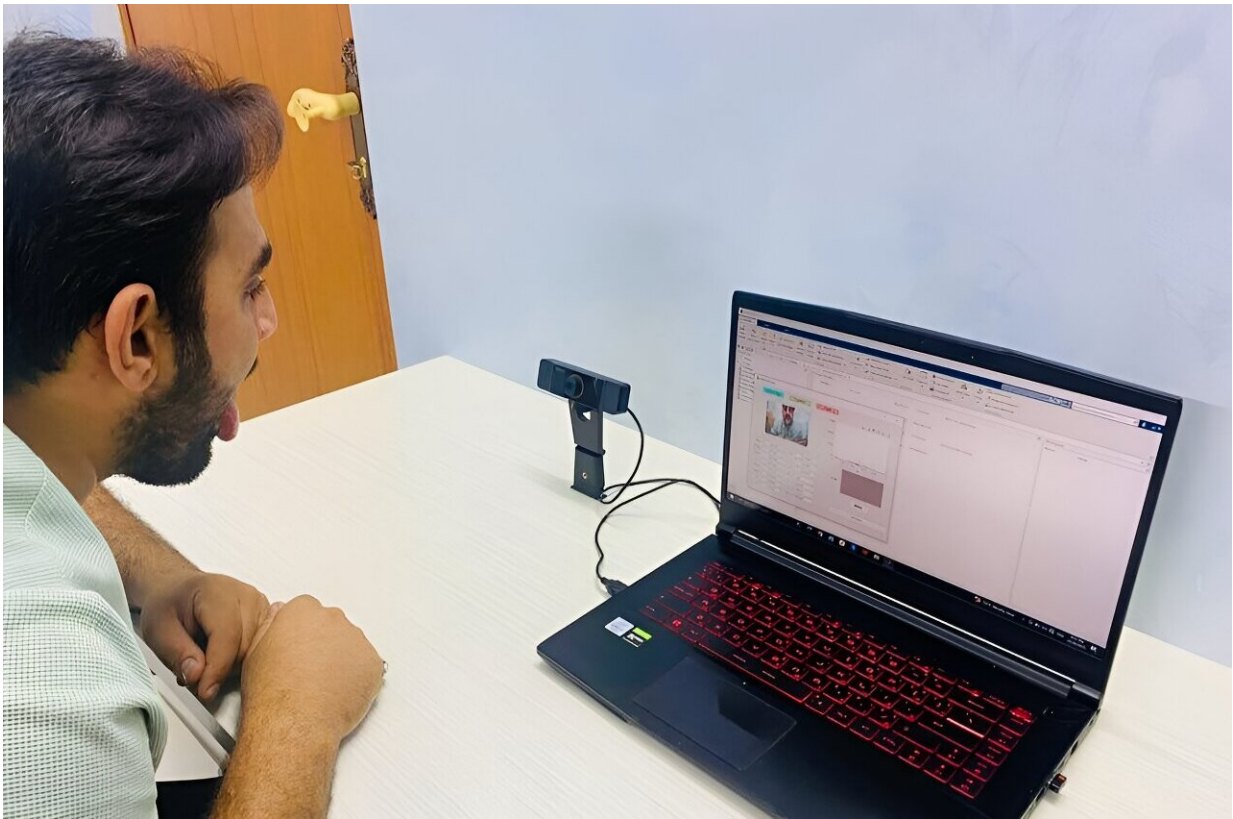# Algorithm achieves 98% accuracy in disease prediction via tongue color

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A researcher demonstrates how a camera captures images of the tongue and analyzes it for disease. Credit: Middle Technical University

A computer algorithm has achieved 98% accuracy in predicting different diseases by analyzing the color of the human tongue.

The proposed imaging system developed by Iraqi and Australian researchers can diagnose diabetes, stroke, anemia, asthma, liver and gallbladder conditions, COVID-19, and a range of vascular and gastrointestinal issues.

Engineering researchers from Middle Technical University (MTU) and the University of South Australia (UniSA) achieved the breakthrough in a series of experiments where they used 5,260 images to train machine learning algorithms to detect tongue color.

Two teaching hospitals in the Middle East supplied 60 tongue images from patients with various health conditions. The artificial intelligence (AI) model was able to match the tongue color with the disease in almost all cases.

A paper published in *Technologies* outlines how the proposed system analyzes tongue color to provide on-the-spot diagnosis, confirming that AI holds the key to many advances in medicine.

Senior author, MTU and UniSA Adjunct Associate Professor Ali Al-Naji, says AI is replicating a 2,000-year-old practice widely used in traditional Chinese medicine—examining the tongue for signs of disease.

"The color, shape and thickness of the tongue can reveal a litany of health conditions," he says.

"Typically, people with diabetes have a yellow tongue; cancer patients a purple tongue with a thick greasy coating; and acute stroke patients present with an unusually shaped red tongue.

"A white tongue can indicate anemia; people with severe cases of COVID-19 are likely to have a deep red tongue; and an indigo or violet

colored tongue indicates vascular and gastrointestinal issues or asthma."

In the study, cameras placed 20 centimeters from a patient captured their tongue color and the imaging system predicted their health condition in real time.

Co-author UniSA Professor Javaan Chahl says that down the track, a smartphone will be used to diagnose disease in this way.

"These results confirm that computerized tongue analysis is a secure, efficient, user-friendly and affordable method for disease screening that backs up modern methods with a centuries-old practice," Prof Chahl says.

More information: Ali Raad Hassoon et al, Tongue Disease Prediction Based on Machine Learning Algorithms, *Technologies* (2024). DOI: 10.3390/technologies12070097

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