

# Stick out your tongue: Neural network tests tongue and symptoms for remote diagnosis

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Physicians often ask their patients to "Please stick out your tongue". The tongue can betray signs of illness, which combined with other symptoms such as a cough, fever, presence of jaundice, headache or bowel habits, can help the physician offer a diagnosis. For people in remote areas who do not have ready access to a physician, a new diagnostic system is reported in the *International Journal of Biomedical Engineering and Technology* that works to combine the soft inputs of described symptoms with a digital analysis of an image of the patient's tongue.

Karthik Ramamurthy of the Department of Information Technology, Rajalakshmi Engineering College, in Chennai, India, and colleagues, have trained a neural network that can take soft inputs such as standard questions about symptoms and a digitized image of the patient's tongue and offer a likely diagnosis so that professional healthcare might then be sought if needed. The digitized images of the patient's tongue reveal discoloration, engorgement, texture and other factors that might be linked to illness.

Smoothness and "beefiness" might reveal vitamin B12, iron, or folate deficiency, and anemia. Black discoloration could be indicative of fungal overgrowth in HIV patients or prolonged antibiotic use. Longitudinal furrows on the tongue are associated with syphilis. Ulcers may indicate the presence of Crohn's disease or colitis and various other conditions. The team's automated diagnostic, however, utilizes the condition of the tongue in combination with other symptoms to identify whether a patient has any of various illnesses: common cold, flu, bronchitis, streptococcal

throat infection, sinusitis, allergies, asthma, pulmonary edema, food poisoning and diverticulitis.

The current system allows [diagnosis](#) of fourteen distinct conditions but the team adds that they will be able to add eye images and use those as an additional hard input for their [neural network](#) and so extend its repertoire significantly.

**More information:** *Int. J. Biomedical Engineering and Technology*, Vol. 16, No. 4, pp.329-342.

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