# Developing a Low-Cost Portable Electronic Nose for the Detection of Colorectal Cancer by Using Convolutional Neural Networks

Lei, Mei Fong (School: Escola Kao Yip)
Wang, Yuelong (School: Escola Kao Yip)
Liang, Jiahao (School: Escola Kao Yip)

Colorectal cancer is one of the most common malignancies of the digestive system. It has the third highest incidence of cancer in the world. Thus, it is important to process detection and treatment early. Current screening method is immune fecal occult blood (iFOB) with a fair sensitivity (around 80%), therefore, it is necessary to develop a more efficient detection method. This study has developed a low-cost electronic nose based on the 10 different types of MQ module. It can be applied to collect the VOCs released by feces samples rapidly. Then training a deep learning model to achieve non-invasive preliminary screening. In the study, 70 sets of volatile gases released by feces were sampled within 1 to 3 minutes in each and after feature extraction, obtained a data set which size 12,325. In feature extraction, we calculate the average rate of change for each sensor as a new feature, two convolutional layers were used by considering the co-reacting rate. The results showed that the accuracy rate on the validation set reached 99.95%. In addition, the model processed blind-tested using another 14 samples. The results showed that accuracy was 98.63%, sensitivity was 97.78%, and specificity was 100%. The electronic nose has improved to be faster, more accurate, and less expensive than current initial examination methods.

**Awards Won:**