Early Detection of Lung Cancer via Breath Analysis Utilising Electronic Nose

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Abstract:
Lung Cancer (LC), have the highest mortality rate and the second-highest incidence rate of all cancers combined because of a pathophysiological imbalance in the fundamental mechanism of cell proliferation. For patients with LC, prompt diagnosis and treatment are of utmost importance. The orthodox methods employed for detecting LC are characterised by invasiveness, protracted duration, high cost and exhibit reduced efficacy in detecting malignant cells during the initial phases of the ailment. The increasing attention of researchers toward the potential of utilising Volatile Organic Compound (VOC) biomarkers for the non-invasive detection of LC can be attributed to the advancements in techniques and procedures. This study offers a state-of-the-art portable E-nose that has the potential to enhance clinical outcomes associated with the early diagnosis of LC. Three ML models - SVM, AdaBoost, and MLP were employed to discriminate LC from other respiratory breathprint dataset. The MLP model achieved the highest performance accuracy result of 89.05%, specificity 95.12%, and sensitivity of 80%.

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I. Introduction

Lung cancer is thoracic cancer caused by a pathophysiological abnormality in the basic process of cell proliferation; LC has the highest mortality rate and the second-highest incidence rate among all cancer types. It constitute about 18% of all cancer deaths worldwide [1]. During tumorigenesis and the course of cancer, changes to the genome and transcriptome will cause metabolic activities to become out of control and abnormal metabolites to build up [2]. It is a complex disease with several different subgroups that are clinically significant. Of these, the histological profile significantly predicts the overall clinical prognosis and responsiveness to therapy. Non-small cell lung cancer (NSCLC) accounts for about 80% of all initial LC. Adenocarcinoma (ADC) 38% and squamous cell carcinoma (SCC) 15%, originating from columnar and cuboidal in the small airways and pseudostratified in large airway epithelia, are the two most common histological subtypes of NSCLC [3].

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