A PROBABILISTIC GRAPHICAL MODEL FOR CHRONIC OBSTRUCTIVE PULMONARY (COPD) DISEASE DIAGNOSIS AND *PHENOTYPING*

ABSTRACT

The World Health Organization lists COPD as the fourth leading cause of the death worldwide yet the disease is both treatable and preventable [1-3]. Smoking of tobacco products, alpha-1-antitrypsin (A1At), and air pollution are the major risk factors associated with the development and progression of COPD [4-6]. COPD is usually either undiagnosed or under-diagnosed due to a number of factors including the slow progression of the development of COPD symptoms[7]. Besides, differential diagnosis is usually applied during COPD diagnosis because differentiating COPD patients from those with e.g. chronic asthma may not be so easy [2-3]. So far, a number of research considered to be related to this topic have incorporated pulmonary function test results in the diagnosis and classification of COPD cases. None of such research has attempted to classify COPD cases based on the phenotype the patient may be suffering from. As a result, this research provides a model for COPD diagnosis and classification of the cases into phenotypes; General COPD, Chronic bronchitis, Emphysema, and the Asthmatic COPD using a Bayesian network (BN). A BN is a probabilistic modeling tool composed of random variables and the relationships of such variables is based on probabilities that maximize certain outcomes. Results show that the BN model achieved a 100% classification of both COPD and Asthma cases. Moreover, we validated our BN model using a neural network application developed using the Levenberg-Marquardt (LM) algorithm. The F_1 score results also show that the BN is a better model for COPD classification than the LM algorithm. This research is the first attempt to classify COPD cases into phenotypes using computational techniques and the results we have achieved show that this classification is quite achievable.