

Candidate Identification Technique for Lung Cancer

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ABSTRACT

Intensive research work has been done related to lung cancer prognosis. However, the current research mainly emphasises on decreasing the mortality rate, and increasing the survival rate of lung cancer patients. In this paper, the authors argue that an early identification and candidate identification (CI) of this disease can change the early detection treatment of lung cancer and hence can markedly reduce the mortality rate. The proposed technique CI will recognize the disease well in advance and can potentially save the candidate's life. In other words, a candidate of lung cancer is identified and treated in Stage 0 (explained later) instead of in Stage 1 or in the later stages of the lung cancer. In this paper, the authors have introduced a technique, called candidate identification, to identify candidates of the lung cancer. In the proposed technique, a backward forecasting function (BFF) is also proposed to generate Stage 0 data of the patients who have already lung cancer.

KEYWORDS

Abad Shah, Backward Forecasting Function, Candidate Identification, Diagnostic Tool, Lung Cancer, Sadaf Naqvi, VDT

INTRODUCTION

Bioinformatics is an emerging area, and recently there have been evolutionary developments in this area (Albayraktaroglu, Jaleel, Xue et al., 2005). The primary purpose of this area is to manage biological and medical data (Bayat, 2002; Henderson, 2009; "Lung Cancer", 2011). The recent studies and reviews show the importance of bioinformatics in the future (Kanehisa & Bork, 2003; "Lung Cancer", 2011). This area mainly emphasizes on the modeling of large scale and complex biological systems into complete computer-based systems (Henderson, 2009; Kanehisa & Bork, 2003). In other words, bioinformatics is defined as a database management system (DBMS) that provides facility to the users to store, retrieve and manipulate biological data. Bioinformatics plays a vital role in the field of biological research, medicine and drug discovery (Bayat, 2002; Henderson, 2009). Furthermore, it is also essential in cancer-related studies.

Cancer is a disease in which the cells of a human body rapidly increase abnormally (Jemal, Siegel, Xu et al., 2010). The genetic material of a cell is responsible for changing its behavior. The damaged part of Deoxyribonucleic Acid (DNA) which codes the characteristics of a cell in the cell replication process can produce tumors. These tumors are either malignant or benign (Jemal, Siegel, Xu, & Ward, 2010). Recent studies have shown that lung cancer is the most common type of cancer (Jemal, Tiwari, Murray et al., 2004). The cancerous cells proliferate in the lungs and metastasize to other organs through blood vessels, as shown in Figure 1.

DOI: 10.4018/IJRQEH.2021010101

Lung cancer is further classified into two categories; Non-small cell lung cancer (NSCLC) and Small cell lung cancer (SCLC) (Jemal, Bray, Center et al., 2011). NSCLC is the most common type of lung cancer. It usually grows and spreads slowly than SCLC. NSCLC has four (4) stages starting from Stage 1 to Stage 4 (see Figure 4). The life expectancy of a lung cancer patient decreases when it reaches its advanced stages.

Lung cancer is death-causing cancer. Patients who have lung cancer have reduced life expectancy than normal. It is diagnosed, mostly in its advanced stages because its symptoms, usually, do not appear in the initial stages. The late diagnosis of this cancer leads to a low survival rate. According to a survey in 2004, 92% of patients diagnosed with lung cancer in the USA died (Hakulinen & Pukkala, 1981). This mortality rate of lung cancer worldwide has proved to be 86% as reported in (Didkowska, Wojciechowska, Koskinen et al., 2011). Early diagnosing/forecasting techniques for lung cancer involves the studies related to habits of patients and risk factors of cancer (Cesare & Murphy, 2011; Hasegawa, Sone, Takashima et al., 2000; Honda, Johkoh, Sekiguchi et al., 2009). Current research on lung cancer mainly focuses on decreasing the mortality rate of lung cancer patients by analyzing different methods of CT scan images and chest radiographs (Anand, Kunnumakkara, Sundaram et al., 2008; Garcia, Jemal, Ward et al., 2007; Reich & Kim, 2011).

Indeed, early diagnosis of all types of cancers, especially lung cancer, can save the lives of many patients, and also the treatment of this disease can be made less expensive and more effective. However, in this paper, we take a different approach to handle the lung cancer problem. In our proposed approach, we identify *candidates* of lung cancer by using the *candidate identification technique*. In this technique, we have appended a new stage, Stage 0, *before* Stage 1 in the sequence of stages (i. e., Stage 1 – Stage 4) of cancer (see Figure 5). A person in this stage (i. e., Stage 0) means that his lung cells have not yet affected by cancer, but there is a good chance that he can have this disease in the future because patterns of his lung cells (cellular changes) matched the patterns of lung cells of a lung cancer patients when they were in Stage 0 before going to the next stages of cancer. The proposed technique works in the following two steps:

1. It first generates data of lung cancer patients when they were in Stage 0, and then stores it in a repository. This data is generated by using a proposed *backward forecasting function* (BFF);
2. In this step, cell patterns of a person (who has chances of lung cancer and is in Stage 0) are matched with cell patterns in the repository. If the cell patterns of the person match with any cell patterns in the repository, then the person is declared as the *candidate* patient of the lung cancer. In other words, a person can be a lung cancer patient.

The proposed technique is a preemptive measure against lung cancer. The steps mentioned above of the technique are described in detail.

BACKGROUND

In this section, we give some basics of lung cancer disease and its causes. We also give statistics to show deadliness of this, and to advocate later that this disease should be identified and cured before it occurs.

Cancer

In normal circumstances, cell division in a human body is a well-defined and controlled process. If a body loses this control over the cell division, then it starts an uncontrolled and rapid cell growth which causes cancer (Parkin, Pisani, & Ferlay, 1999). It is a kind of disease in which cells proliferate beyond the normal limits causing invasion and destruction of neighboring tissues. This rapid and abnormal growth of cells can form tumors either malignant tumors or benign tumors (Jemal, Siegel,

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