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# CT IMAGE ANALYSIS FOR EARLY DETECTION OF LUNG CANCER

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Abstract. *An automatic Computer-Aided Diagnosis (CAD) system for early detection of lung cancer by analysis of chest 3D Computed Tomography (CT) images is proposed in this paper. Our system differs from previous implementations of CAD systems in two major aspects: 1) It provides automatic extraction of the lung regions from 3D-CT images based on the bit-plane slicing technique, which has improved accuracy and sharpness. 2) Unsupervised segmentation of the extracted lung regions, our regions of interests (ROIs), using a modified version of Hopfield Neural Network (HNN), was able to segment the lung area into regions with crisp contours. These regions may include true lung nodules, and normal structures consisting mainly of blood vessels. To distinguish between true and false candidate nodules, we have adopted a rule-based approach consisting of two steps: 1) We calculate the area, the maximum drawable circle (MDC), and the mean intensity value of each segmented region. 2) A set of diagnostic rules has been formulated based on the extracted features, which aims at eliminating (as far as possible) non-cancerous candidate nodules or false positives (FPs) without sacrificing cancerous candidates or true positives (TPs). We have evaluated our system using a database of 2668 CT slices from 11 patients. We have obtained 90% sensitivity, with 0.05 false positives per slice. The proposed CAD system is capable of detecting lung nodules with diameter equal to or greater than two millimeters.*
**Keywords:** Chest CT images, Artificial neural networks, Segmentation, Lung cancer diagnosis

1. **Introduction.** The mortality rate of lung cancer is the highest of all types of cancer, and it is one of the most serious cancers in the world, with the smallest survival rate after diagnosis and showing a gradual increase in the number of deaths every year. Survival from lung cancer is directly related to its growth size at the time of detection. The earlier the detection is, the higher the chances of successful treatment are. An estimated 85% of lung cancer cases in males and 75% in females are caused by cigarette smoking [1].

In 2005, approximately 1,372,910 new cancer cases are expected and about 570,280 cancer deaths are expected to occur in the United States. It is estimated that 163,510, or 29% of all cancer deaths, will be from lung cancer. The overall survival rate for all types of cancer is 63%. Although surgery, radiation therapy, and chemotherapy have all been used in the treatment of lung cancer, the five-year survival rate for all stages combined is only 14%, and this has not changed in the past three decades [2].