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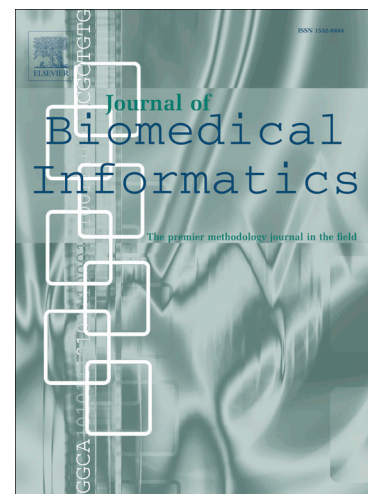
A Sensor-Based Wrist Pulse Signal Processing and Lung Cancer Recognition

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# A Sensor-Based Wrist Pulse Signal Processing and Lung Cancer Recognition

Zhichao Zhang, Yuan Zhang\*, Houbing Song\*, Lina Yao, and Anton Kos

**Abstract** Pulse diagnosis is an efficient method in traditional Chinese medicine for detecting the health status of a person in a non-invasive and convenient way. Jin's pulse diagnosis (JPD) is a very efficient recent development that is gradually recognized and well validated by the medical community in recent years. However, no acceptable results have been achieved for lung cancer recognition in the field of biomedical signal processing using JPD. More so, there is no standard JPD pulse feature defined with respect to pulse signals. Our work is designed mainly for care giving service conveniently at home to the people having lung cancer by proposing a novel wrist pulse signal processing method, having an insight from JPD. We developed an iterative slide window (ISW) algorithm to segment the de-noised signal into single periods. We analyzed the characteristics of the segmented pulse waveform and for the first time summarized 26 features to classify the pulse waveforms of healthy individuals and lung cancer patients using a cubic support vector machine (CSVM). The result achieved by the proposed method is found to be 78.13% accurate.

**Index Terms**—lung cancer recognition; pulse signal processing and analysis; iterative sliding window (ISW); feature extraction; Jin's Pulse Diagnosis (JPD); cubic support vector machine (CSVM)

## I. INTRODUCTION

Traditional Chinese medicine (TCM) with its history dating back to thousands of years includes inspection, listening and smelling, inquiry and palpation [1]. Wrist pulse diagnosis, which is the core of TCM, is convenient and has no side effect [2].

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In western medicine, the wrist pulse diagnosis theory is explained by hemodynamics [3]. Lung cancer causes changes in the lungs of an individual suffering from it; this further leads to different feelings when being diagnosed using the pulse method [4, 5]. E.g. when there is a tumor in an organ, some blood vessels will be squeezed. Accordingly the blood speed will be changed and there will be a vortex. Since the vortex makes the blood in that location to be slow, more pressure is experienced by the blood vessel. The altered pressure in the position of wrist can be captured by the pressure sensors [4].

Usually, doctors in TCM diagnose health status by using three fingers to feel the radial pulse at Cun, Guan, and Chi [6-8]. However, full mastery of skills and expertise relies on long-term extensive training and experiences on multiple

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