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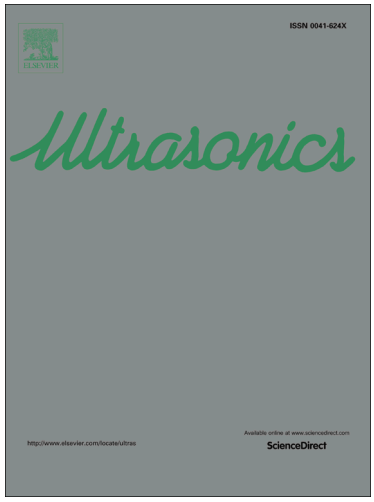

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Jinlian Ma, Fa Wu, Jiang Zhu, Dong Xu, Dexing Kong

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A Pre-trained Convolutional Neural Network Based Method for Thyroid Nodule Diagnosis

Jinlian Ma[a], Fa Wu[a], Jiang Zhu[b], Dong Xu[c], Dexing Kong[a,*]

[a]*School of Mathematical Sciences, Zhejiang University, Hangzhou 310027, China*
[b]*Department of Ultrasound, Sir Run Run Shaw Hospital, Zhejiang University School of Medicine, Hangzhou 310020, China*
[c]*Department of Ultrasound, Zhejiang Cancer Hospital, Hangzhou 310022, China*

Abstract

In ultrasound images, most thyroid nodules are in heterogeneous appearances with various internal components and also have vague boundaries, so it is difficult for physicians to discriminate malignant thyroid nodules from benign ones. In this study, we propose a hybrid method for thyroid nodule diagnosis, which is a fusion of two pre-trained convolutional neural networks (CNNs) with different convolutional layers and fully-connected layers. Firstly, the two networks pre-trained with ImageNet database are separately trained. Secondly, we fuse feature maps learned by trained convolutional filters, pooling and normalization operations of the two CNNs. Finally, with the fused feature maps, a softmax classifier is used to diagnose thyroid nodules. The proposed method is validated on 15,000 ultrasound images collected from two local hospitals. Experiment results show that the proposed CNN based methods can accurately and effectively diagnose thyroid nodules. In addition, the fusion of the two CNN based models lead to significant performance improvement, with an accuracy of 83.02% $\pm$ 0.72%. These demonstrate the potential clinical applications of this method.

Research highlights

*Corresponding author
Email address: dkong@zju.edu.cn. (Dexing Kong)

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