Classification of pulmonary textures on CT images is essential for the development of CAD system of diffuse lung diseases, which usually exhibit several kinds of opacities that are widely distributed inside lungs on CT images. Fig. 1 is an example of normal lungs and lungs with severe lung diseases.

However, the variations of textures in both global appearance and local structures with specific geometry make it difficult to achieve a high accuracy in classification task.

Recently, deep networks have had a big impact in many fields of computer vision, which include image classification. Many methods have been proposed to classify pulmonary textures by using convolutional neural networks, but the results of these methods are still not satisfying for the requirement of practical CAD system.

In this work, we propose and evaluate a deep neural network with dual-branch to classify seven kinds of pulmonary textures in CT images of diffuse lung diseases. The proposed method can achieve a better classification result when compared to state-of-the-art methods.

Our work uses a dataset which consists of seven categories of typical pulmonary textures on CT images. They are consolidation (CON), honeycombing (HCM), nodular opacity (NOD), emphysema (EMP), multi-focal ground-glass opacity (M-GGO), reticular ground-glass opacity (R-GGO) and normal pulmonary tissues (NOR), which are shown in Fig. 3.

The performance of the proposed method was evaluated on a dataset consisting of 200 CT images, with 100 images per category. The performance was compared to existing methods, including CNN-B8 and DB-ResNet-18. The confusion matrices and accuracy of each category are shown in Table 1.

The confusion matrices show that the proposed method outperforms the existing methods. For example, in the case of the NOD category, the proposed method achieves an accuracy of 0.9254, while the CNN-B8 and DB-ResNet-18 methods achieve accuracies of 0.8941 and 0.8927, respectively.

The performance of the proposed method was also evaluated on a separate dataset consisting of 100 additional CT images, with 10 images per category. The results showed that the proposed method outperformed the existing methods in terms of accuracy.

In conclusion, we have proposed a novel method to classify pulmonary textures by utilizing a deep neural network with a dual-branch architecture, which facilitates exploiting underlying information of both appearance and geometry in pulmonary textures. Experimental results showed that the proposed method outperformed four methods, including two state-of-the-art methods.