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Lung Pattern Classification for Interstitial Lung Diseases Using a Deep Convolutional Neural Network

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Abstract
In order to contribute to the protection of the environment and the development of secondary We propose and evaluate the convolutional neural network designed for classification of ILD patterns. The 7outputs of ILD patterns: healthy, ground glass opacity (GGO), micro nodules, consolidation, reticulation, honeycombing and a combination of GGO/reticulation. To train and evaluate the CNN, we used first deep CNN designed for the specific problem. Finally we classify the performance will be demonstrate the potential of CNNs in analyzing lung patterns.

***Keywords*- Interstitial lung diseases, CNN, Soft Thresholding.**

I. INTRODUCTION

Symptoms of ILD primarily includes shortness of breath. Almost everyone who develops this disease is likely to suffer from breathlessness which becomes even worse with time. Other symptoms may include:

- Cough which is mostly dry and nonproductive
- Breathlessness found mostly in people with CoP or BooP.

In more general cases of ILD, the problem of breathlessness develops slowly over months. In case of interstitial pneumonias or acute interstitial pneumonitis, symptoms develop more rapidly (maybe in hours or in days).

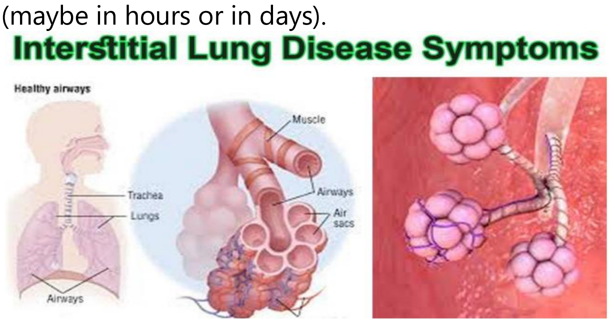

Fig.1 Symptoms of ILD.

II. METHODOLOGY

1. PROPOSED SYSTEM

- The scans were produced by different CT scanners with slightly different pixel spacing so a pre-processing step was applied.
- The image intensity values were cropped and segmented the images.
- The six most relevant ILD patterns, namely GGO,reticulation, consolidation, micro nodules, honeycombing and a combination of GGO and reticulation. Healthy tissue was also added, leading to 7 classes.
- The annotators tried to avoid the bronchovascular tree which should be segmented and removed, before applying the fixed-scale classier.
- Annotation of the lung fields was also performed for all scans.
- The classification performance will be demonstrate the potential of CNNs in analyzing lung patterns

2. ARCHITECTURE DIAGRAM

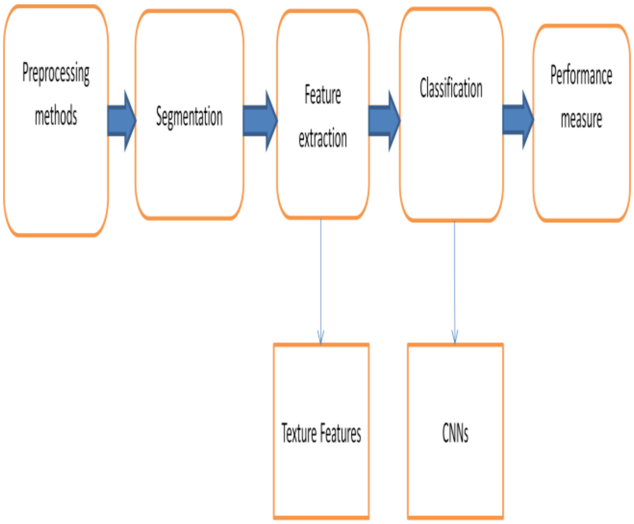

Fig.2 Architecture Diagram of proposed work

3. Flow Diagram

Modules:

- Pre-processing
- Segmentation
- Feature extraction
- Classification
- Performance measure

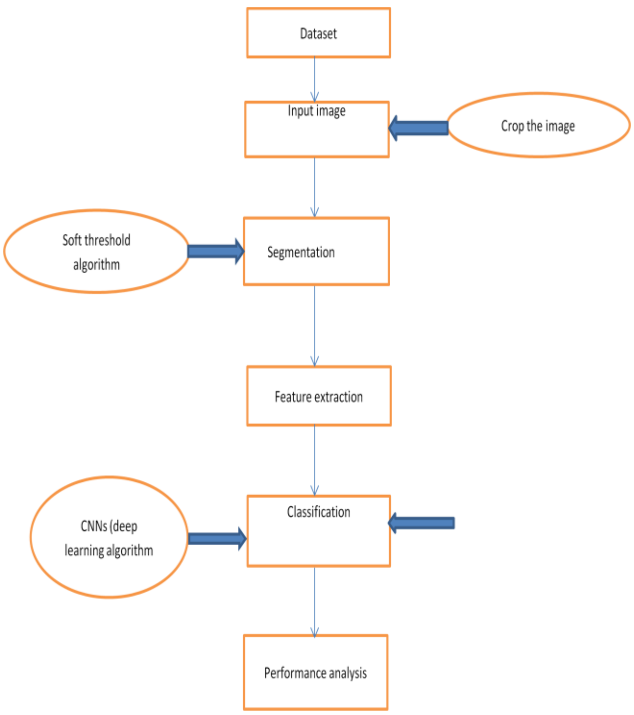

Fig.3 Flow diagram of proposed work.

III. RESULT

Convolutional Neural Networks are feed forward Artificial Neural Network (ANN) which are inspired by the biological events and developed to identify patterns from pixel images directly by integrating feature extraction and classification. In this paper, propose deep CNN for the classification of ILD patterns. CT images of ILD patterns are distinguished by local textural features.ILD textural Patterns in lung CT scan are: reticulation, honeycombing, Ground Glass Opacity (GGO), consolidation and micro nodules. The results indicate that the proposed deep learning method is able to classify lung patterns on CT images with high accuracy, even in challenging cases, e.g. reticulation and reticulation with GGO. Furthermore, the study shows the potential of knowledge transfer from natural to medical images; this could be beneficial for many applications with limited available medical data and/or annotations. The automatically generated map of pathologies and their spatial distribution statistics may assist physicians in clinical practice to diagnose ILDs and could also provide a probabilistic differential diagnosis.

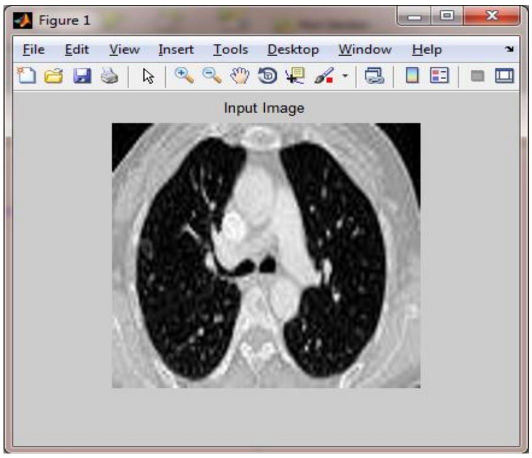

Fig.4 Input Image

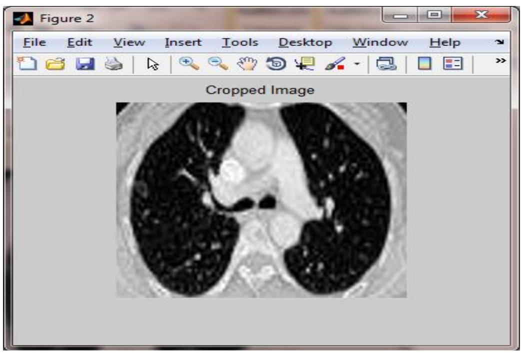

Fig.5 Cropped Image.

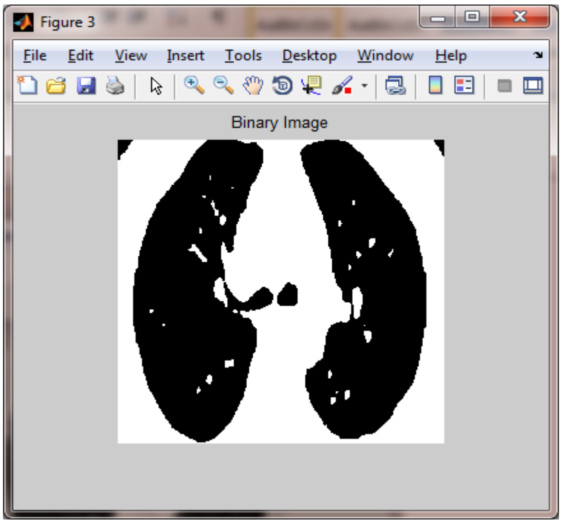

Fig.6 Binary Image.

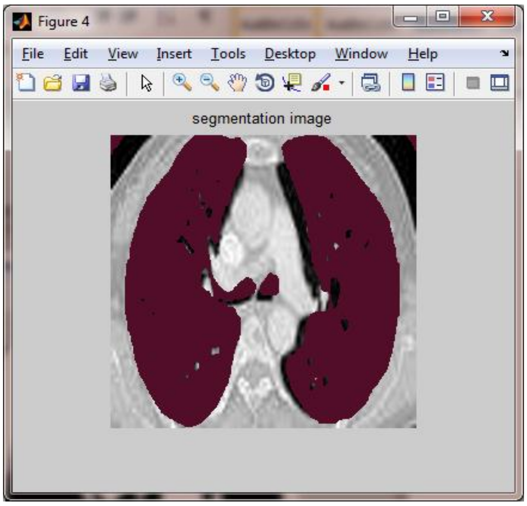

Fig.7 Segmentation Image.

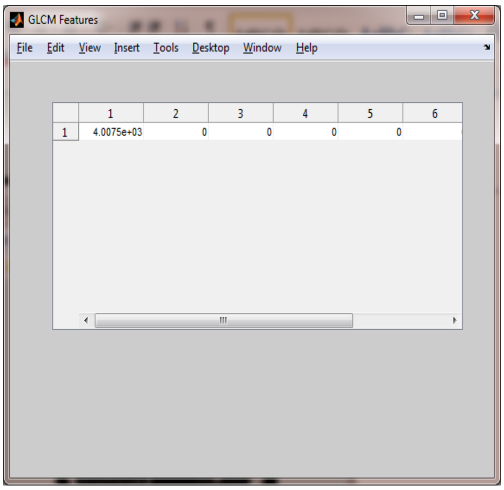

Fig.8 Feature Extraction by GLCM algorithm.

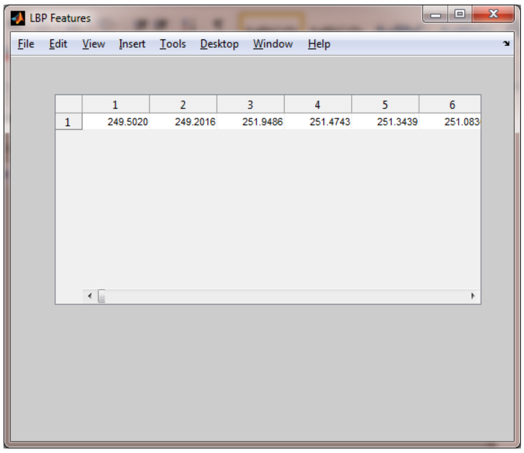

Fig.9 Feature Extraction by LBP algorithm.

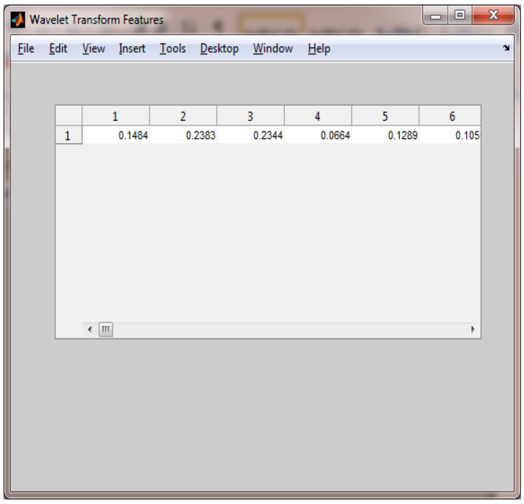

Fig.10 Feature Extraction by Wavelet transforms.

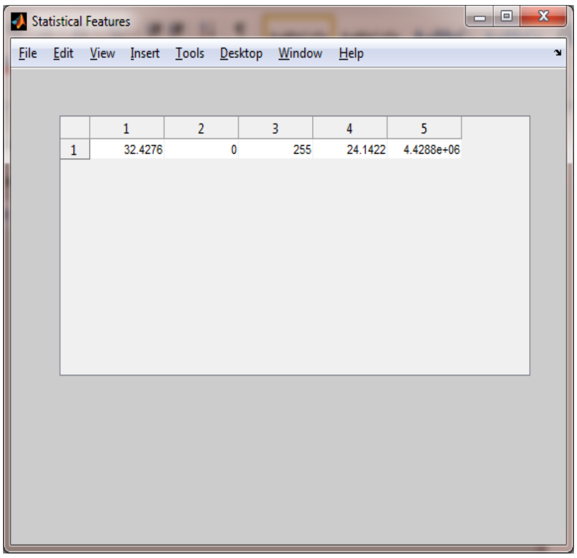

Fig.11 Feature Extraction by Statistical feature.

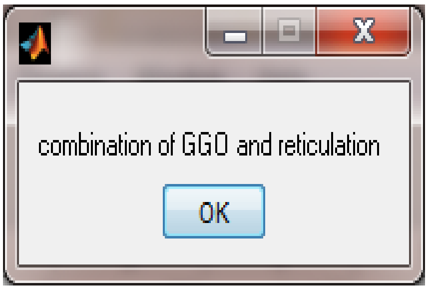

Fig.12 GGO and reticulation output in Classification stage.

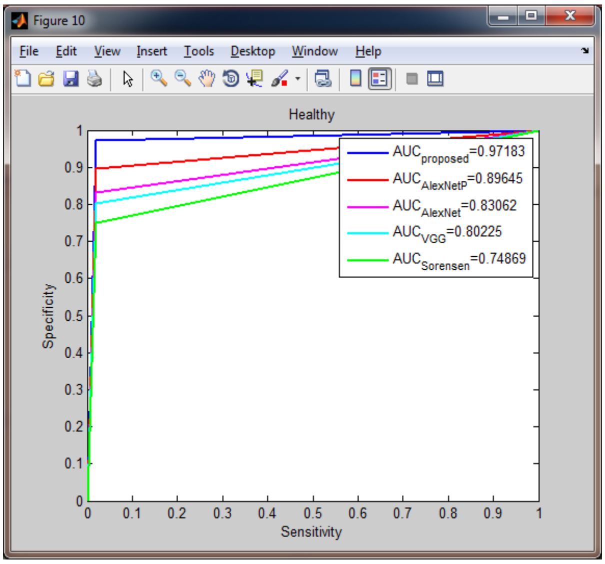

Fig.13 Healthy output.

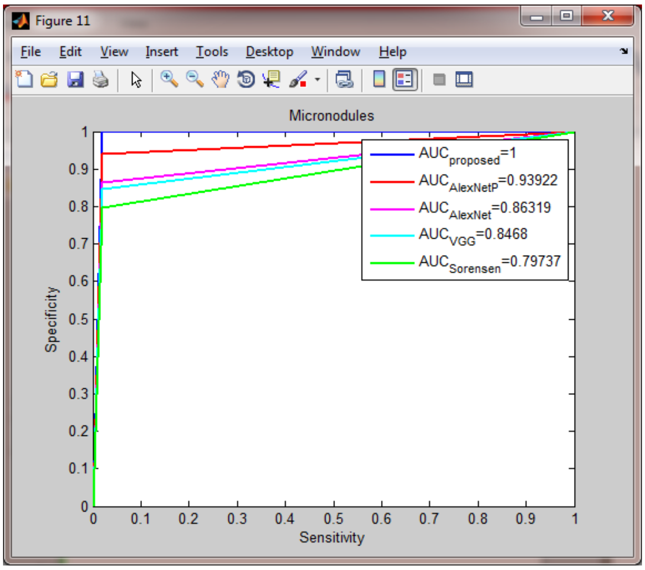

Fig.14 Micro nodules output.

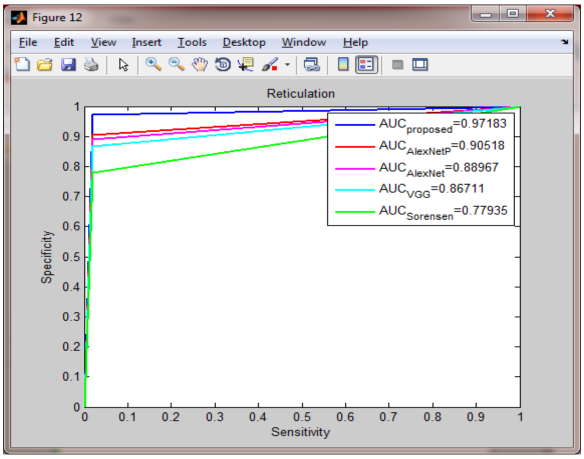

Fig.15 Reticulation output.

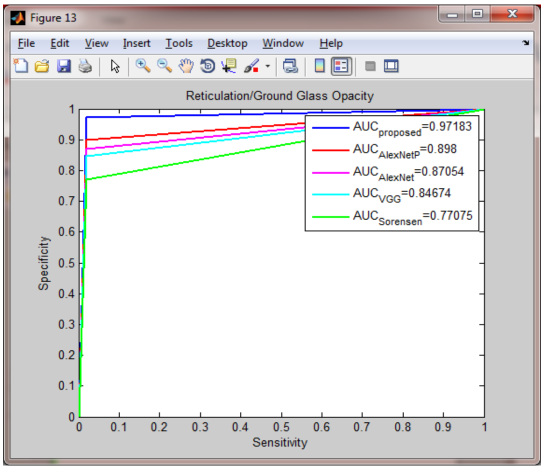

Fig.16 Reticulation/ Ground Glass Opacity output.

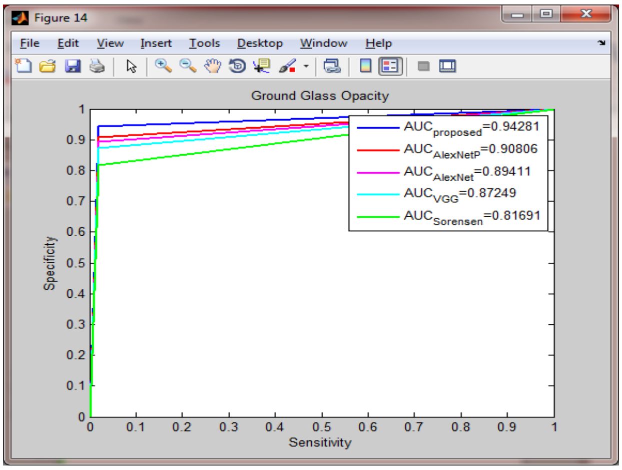

Fig.17 Ground Glass Opacity Output.

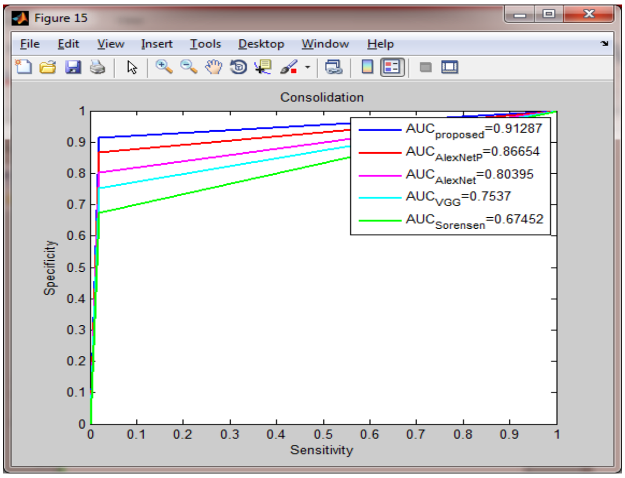

Fig.18 Consolidation Output.

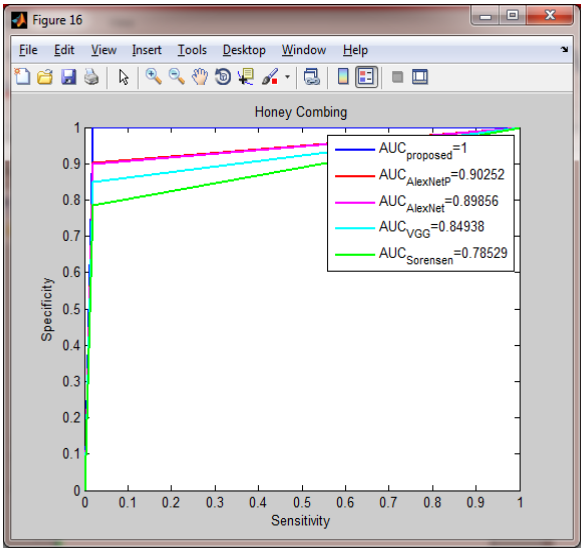

Fig.19 Honey Combing Output.

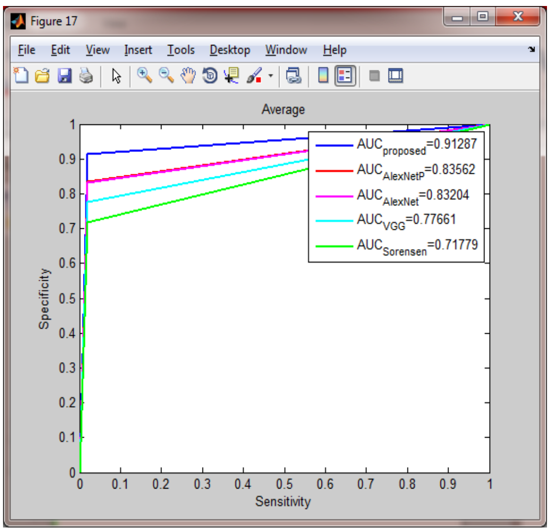

Fig.20 Performance Analysis form of Average.

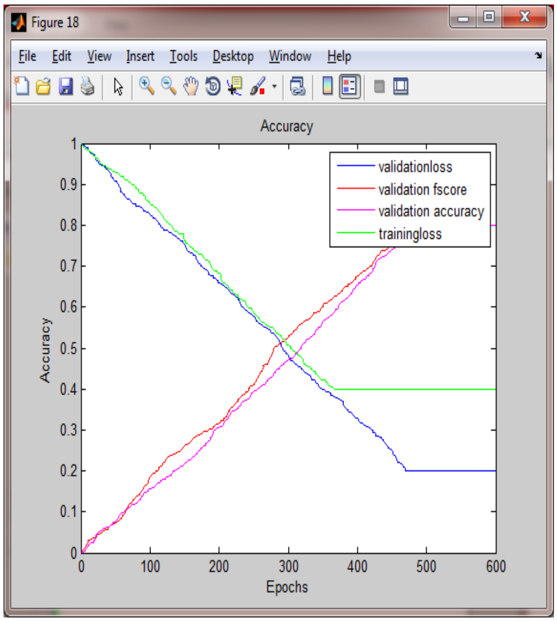

Fig.21 Performance analysis form of accuracy.

IV. CONCLUSION

The accurate diagnosis of interstitial lung diseases (ILDs) is crucial for optimizing the treatment and avoiding invasive biopsies. Computer-aided diagnosis systems may assist in this by providing automatic ILD pattern recognition based on machine learning techniques. Deep learning methods have recently excited interest after their impressive performance in a variety of tasks. In this study, we present and evaluate a Convolutional neural network (CNN) designed for the classification of pathological tissue in ILDs and which was effectively trained by transferring knowledge from multiple other classification tasks. The last dense layer has 7 outputs, equivalent to the classes considered: normal, ground glass opacity (GGO), micro nodules, consolidation, reticulation, honeycombing and a combination of GGO/reticulation (image). Knowledge transfer was achieved by pre-training a number of CNNs on general texture image databases and then finetuning them on the task of ILD pattern classification; finally an ensemble of these CNNs was used to train the proposed CNN. We propose and evaluate the Convolutional neural network designed for classification of ILD patterns. To train and evaluate the CNN, we used first deep CNN designed for the specific problem. Finally we classify the performance 85% will be demonstrate the potential of CNNs in analyzing lung patterns.

REFERENCE

[1] Negahdar, M., & Beymer, D. (2o19, March). Lung tissue characterization for emphysema differential diagnosis using deep convolutional neural networks. In Medical Imaging 2o19: Computer-Aided Diagnosis (Vol. 1o95o, p. 1o95o3R). International Society for Optics and Photonics.

[2] Negahdar, M., Coy, A., & Beymer, D. (2o19, July). An End-to-End Deep Learning Pipeline for Emphysema Quantification Using Multi-label Learning. In 2o19 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) (pp. 929-932). IEEE.

[3] Wang, C., Moriya, T., Hayashi, Y., Roth, H., Lu, L., Oda, M., ... & Mori, K. (2o19, March). Weakly-supervised deep learning of interstitial lung disease types on CT images. In Medical Imaging 2o19: Computer-Aided Diagnosis (Vol. 1o95o, p. 1o95o1H). International Society for Optics and Photonics.

[4] Tang, R., Tushar, F. I., Han, S., Hou, R., Rubin, G. D., & Lo, J. Y. (2o19, March). Classification of chest CT using case-level weak supervision. In Medical Imaging 2o19: Computer-Aided Diagnosis (Vol. 1o95o, p. 1o95o17). International Society for Optics and Photonics.

[5] Christe, A., Peters, A. A., Drakopoulos, D., Heverhagen, J. T., Geiser, T., Stathopoulou, T., ... & Ebner, L. (2o19). Computer-aided diagnosis of pulmonary fibrosis using deep learning and CT images. Investigative radiology, 54(1o), 627.

[6] Park, B., Park, H., Lee, S. M., Seo, J. B., & Kim, N. (2o19). Lung Segmentation on HRCT and Volumetric CT for Diffuse Interstitial Lung Disease Using Deep Convolutional Neural Networks. Journal of Digital Imaging, 32(6), 1o19-1o26.

[7] Peng, L., Lin, L., Hu, H., Zhang, Q., Li, H., Chen, Q., ... & Tong, R. (2o2o). Multi-scale Deep Convolutional Neural Networks for Emphysema Classification and Quantification. In Deep Learning in Healthcare (pp. 149-164). Springer, Cham.

[8] Chen, Y. C., Hong, D. J. K., Wu, C. W., & Mupparapu, M. (2o19). The Use of Deep Convolutional Neural Networks in Biomedical Imaging: A Review. Journal of Orofacial Sciences, 11(1), 3.

[9] Nezamabadi, K., Naseri, Z., Moghaddam, H. A., Modarresi, M., Pak, N., & Mahdizade, M. (2o19). Lung HRCT pattern classification for cystic fibrosis using convolutional neural network. Signal, Image and Video Processing, 1-8.

[10] Gao, M., Bagci, U., Lu, L., Wu, A., Buty, M., Shin, H. C., ... & Xu, Z. (2o18). Holistic classification of CT attenuation patterns for interstitial lung diseases via deep convolutional neural networks. Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization, 6(1), 1-6.