Holistic Classification of CT Attenuation Patterns for Interstitial Lung Diseases via Deep Convolutional Neural Networks

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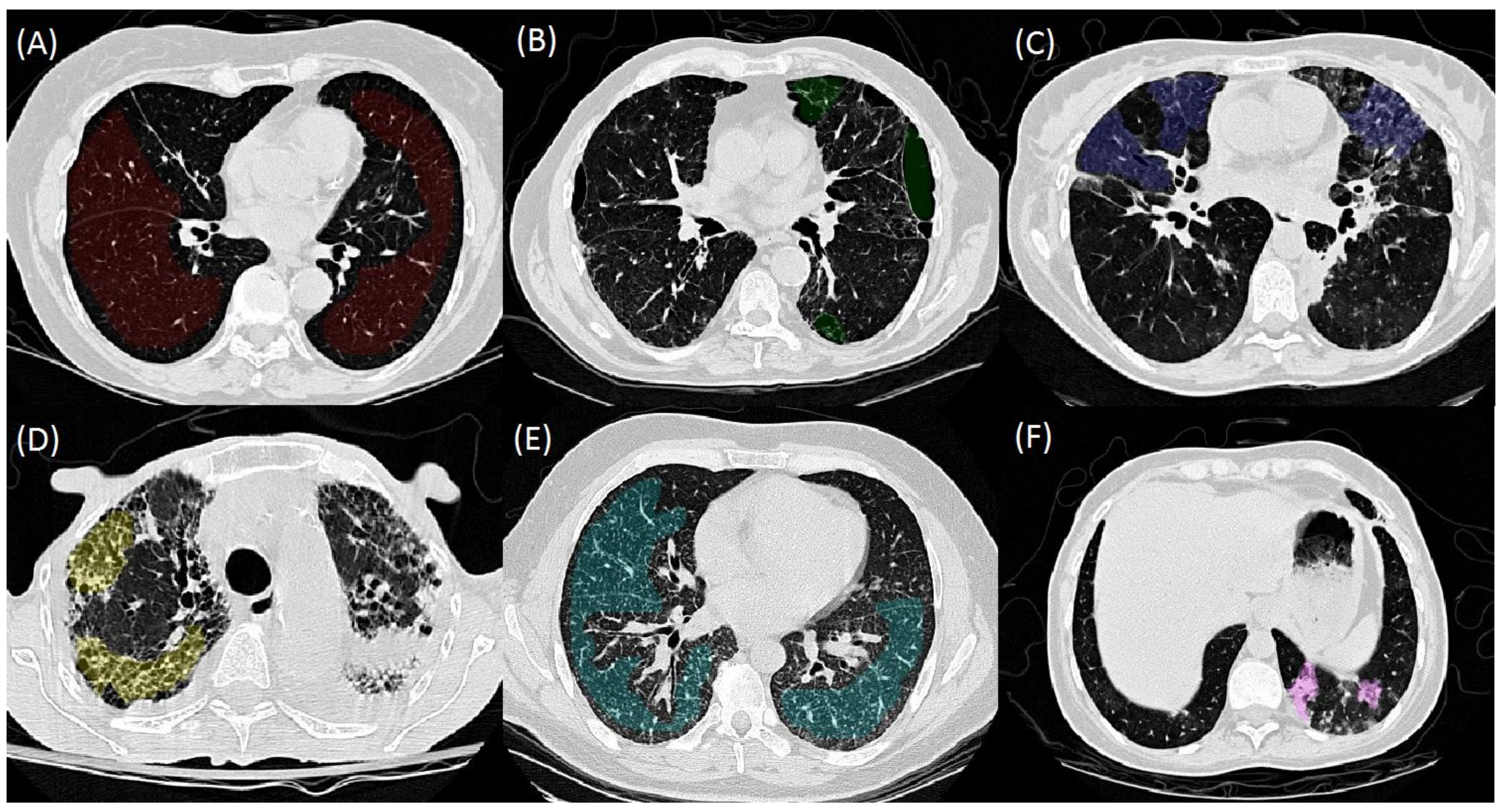
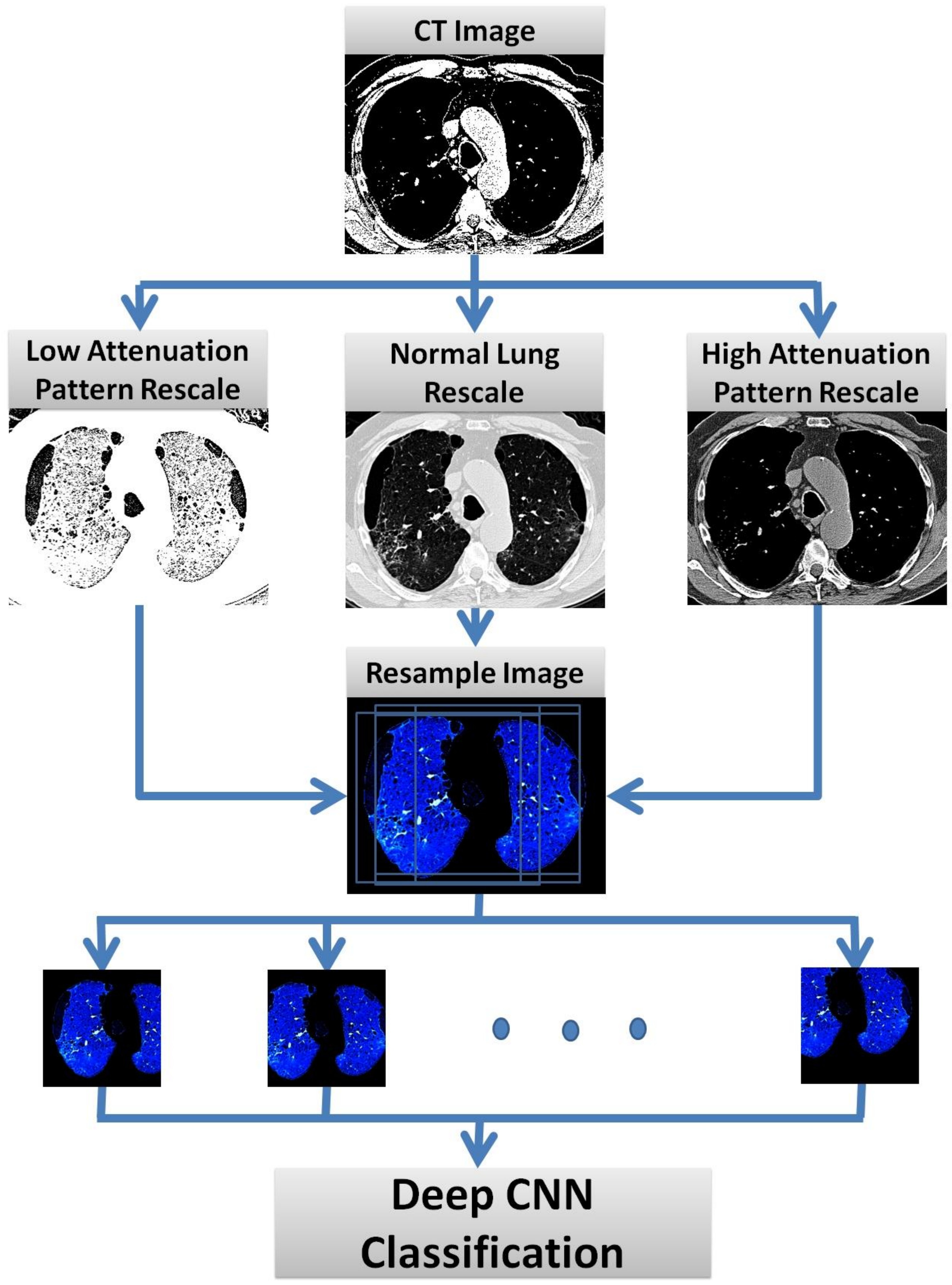
Introduction



(A) Normal (B) Emphysema (C) Ground Glass Opacity
(D) Fibrosis (E) Micronodules (F) Consolidation

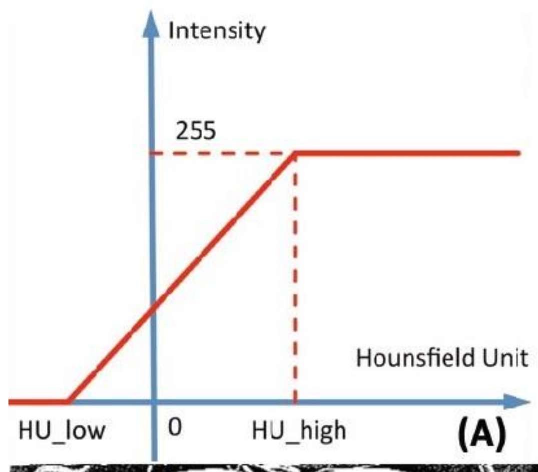
- We present a new representation and approach for interstitial lung disease (ILD) classification.
- Our method with holistic images (i.e., CT slice) as input, is significantly different from previous image patch based algorithms [1]. It addresses a more practical and realistic clinical problem.

Methodology



Framework

- Images are rescaled to three channels.
- Image augmentation: Resampled to generate variant samples, improves the performance ~5% in image classification accuracy
- Feed into deep CNN. The CNN architecture is the same as the one proposed in [2], other than the last final softmax classification layer, which is changed to 6 classes.



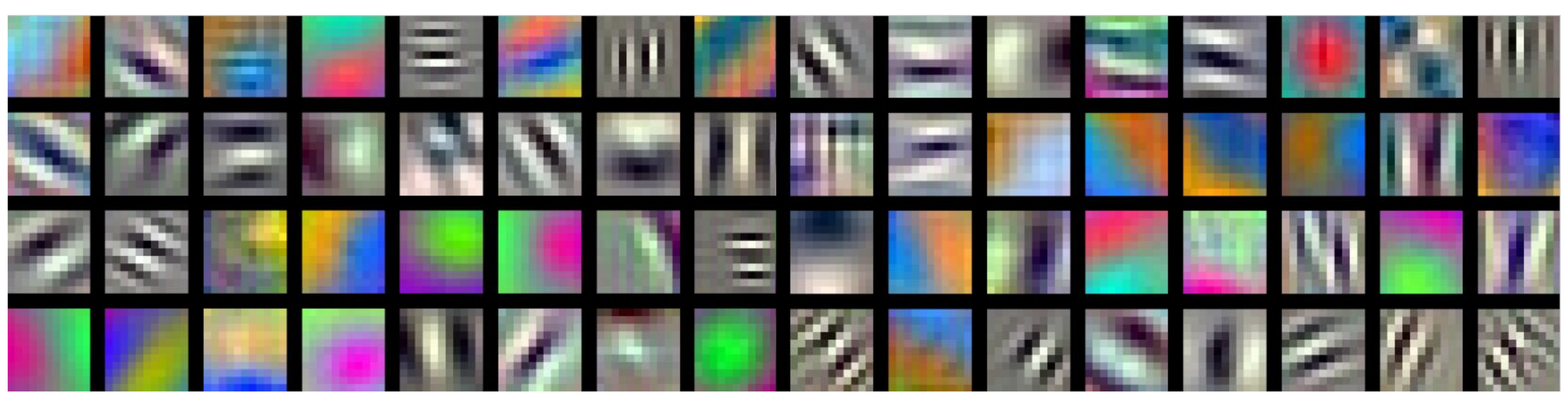
(A) CT attenuation range rescale
(B) Low attenuation range (-1400, -950)
(C) Normal lung range (-1400, 200)
(D) High attenuation range (-160, 240)

Experiments

- The proposed algorithm is validated on a publicly available ILD database [3]. The database contains 120 HRCT scans with 512 × 512 pixels per axial slice, where 17 types of lung tissues are annotated with ROIs.
- For fair comparisons with previous work, we conduct two different settings:
  - Patch based classification, exact the same environmental settings as in previous state-of-the-art work.
  - Slice based classification, our preliminary experimental results have demonstrated the promising feasibility and advantages of the proposed approach.

Table 1. F-score of ILD classifications.

	EM	FB	GG	NM	MN	CD
[14]	0.753	0.841	0.782	0.840	0.857	-
[13]	0.768	**0.872**	0.795	0.877	0.888	-
[8]	0.5449	0.7624	0.7150	0.8395	**0.9096**	-
Ours	**1.0000**	0.8000	0.7500	0.4000	0.5600	**0.5000**
Ours Patch Setting	0.8940	0.8509	**0.8159**	**0.8844**	0.8950	-



References:

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MICCAI 2015 MUNICH

The 18th International Conference on Medical Image Computing and Computer Assisted Intervention

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