CARE: Class Attention to Regions of Lesion for Classification on Imbalanced Data

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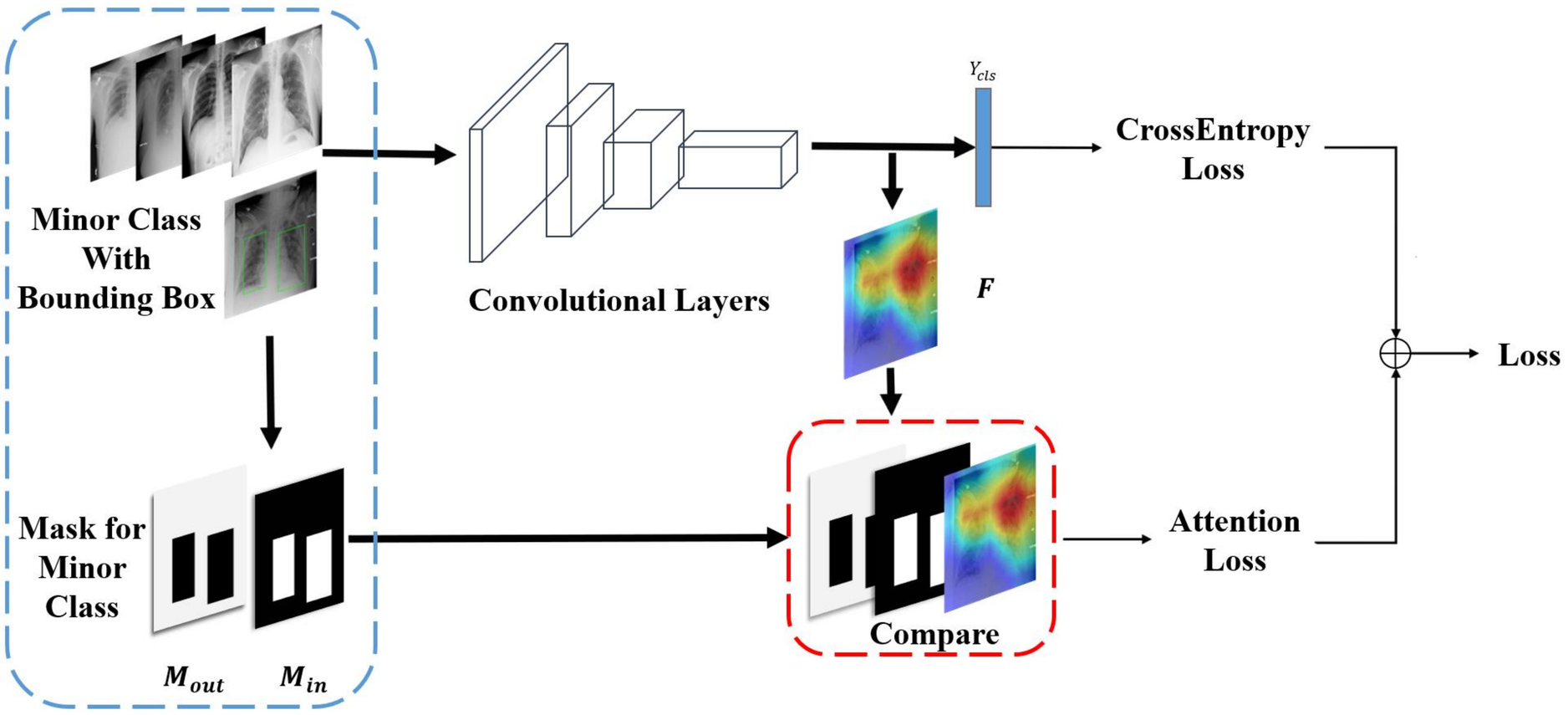
Introduction

In order to effectively learn from imbalanced data, especially with large samples of common disease and much smaller samples of rare ones, we propose a novel approach to embed attention into the machine learning process, particularly for learning characteristics of rare diseases.

Methods

Our CARE method introduces an additional new "attention loss" during CNN model training, without modifying the model structure.



- Attention loss: $L_a = L_{in} + \lambda L_{out}$, where

$$L_{in} = -\min\left(\frac{\Sigma_{i,j} M_{in}(i,j) \cdot F(i,j)}{\Sigma_{i,j} M_{in}(i,j)}, \tau\right), \quad L_{out} = \frac{\Sigma_{i,j} M_{out}(i,j) \cdot F(i,j)}{\Sigma_{i,j} M_{out}(i,j)}$$

M_{in} and M_{out} denote masks images.

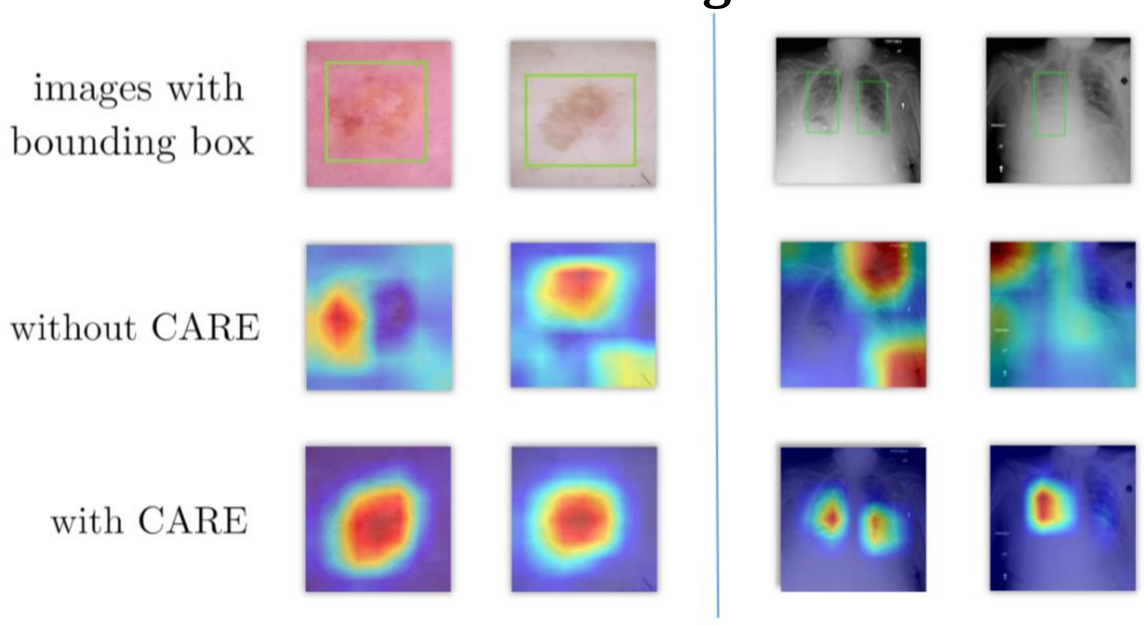
- The inner loss L_{in} helps the classifier learn to attend to lesion regions.
- The outer loss L_{out} helps the classifier learn to decrease the attention outside lesion regions.

Experiments

CARE outperforms widely-used methods for handling data imbalance

	Penuomia Dataset		Skin Dataset	
Model	recall(%)	MCA(%)	recall	MCA(%)
baseline	7.41	56.77	47.83	75.75
CARE (ours)	**31.12**	**63.29**	**52.17**	**76.16**
CSL	11.11	57.88	61.91	80.21
CARE+CSL (ours)	45.04	65.23	**65.22**	**81**
FL	11.14	58.41	38.3	72.72
CARE+FL (ours)	**49.44**	**66.72**	**40.28**	**74.06**
DA	20.06	59.64	56.62	54.41
CARE+DA(ours)	**45.18**	**65.97**	**60.32**	**56.22**

CARE model can learn to focus on lesion regions



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