Data Augmentation Using Generative Adversarial Networks (GANs) For GAN-Based Detection Of Pneumonia And COVID-19 In Chest X-Ray Images

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Abstract

Successful training of convolutional neural networks (CNNs) requires a substantial amount of data. With small datasets networks generalize poorly. Data Augmentation techniques improve the generalizability of neural networks by using existing training data more effectively. Standard data augmentation methods, however, produce limited plausible alternative data. Generative Adversarial Networks (GANs) have been utilized to generate new data and improve the performance of CNNs. Nevertheless, data augmentation techniques for training GANs are under-explored compared to CNNs. In this work, we propose a new GAN architecture for augmentation of chest X-rays for semi-supervised detection of pneumonia and COVID-19 using generative models. We show that the proposed GAN can be used to effectively augment data and improve classification accuracy of disease in chest X-rays for pneumonia and COVID-19. We compare our augmentation GAN model with Deep Convolutional GAN and traditional augmentation methods (rotate, zoom, etc) on two different X-ray datasets and show our GAN-based augmentation method surpasses other augmentation methods for training a GAN in detecting anomalies in X-ray images.

Full Text

This preprint is available for download as a PDF.

Declarations

Competing interests: The authors declare no competing interests.

Figures

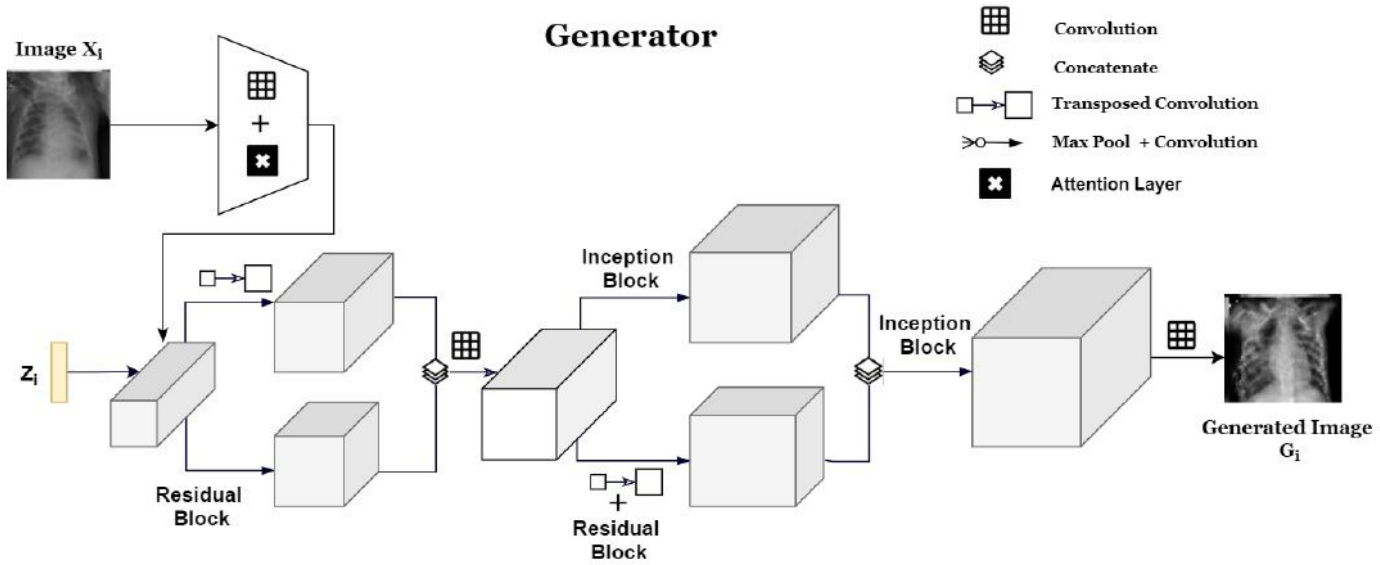

Figure 1

IAGAN's Generator Architecture

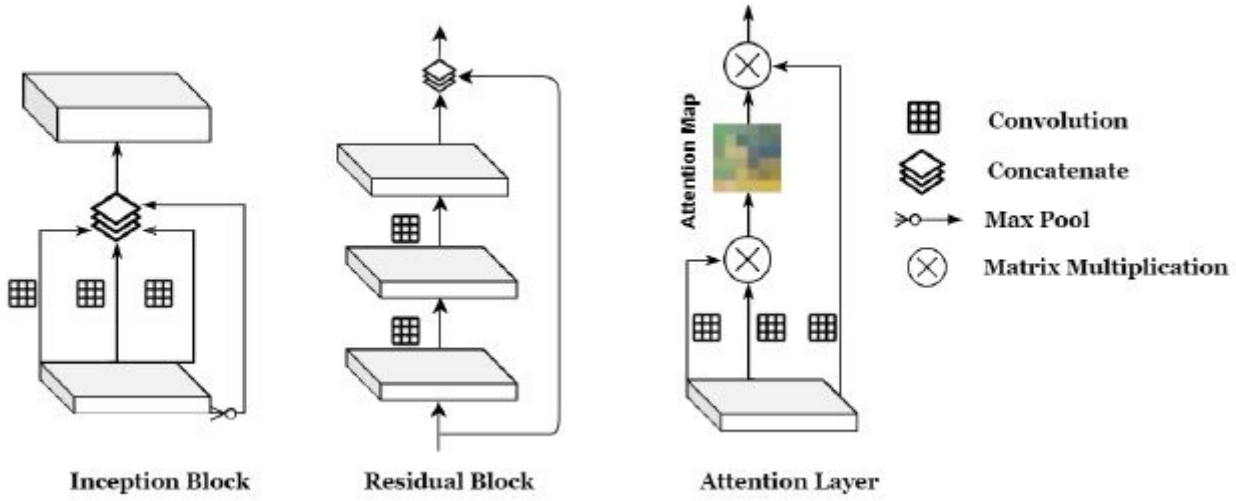

Figure 2

IAGAN's Generator specific architecture breakdown

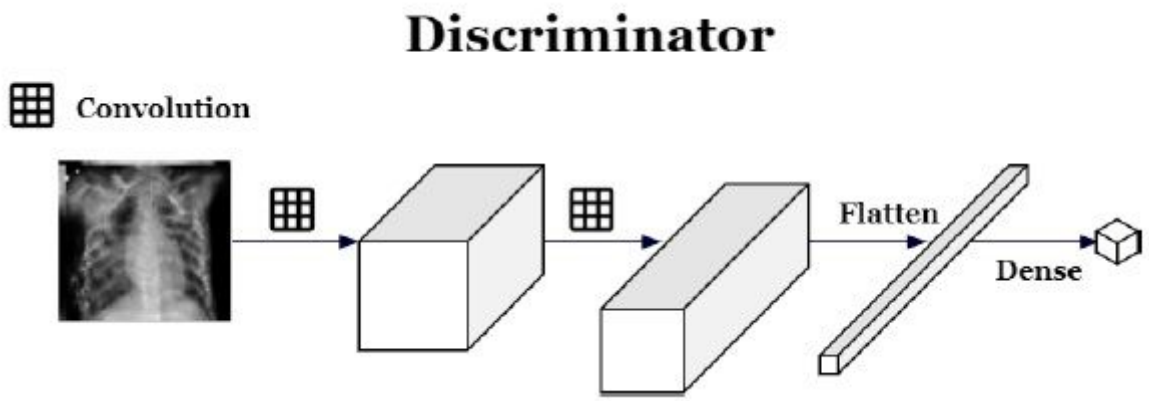

Figure 3

Discriminator Architecture

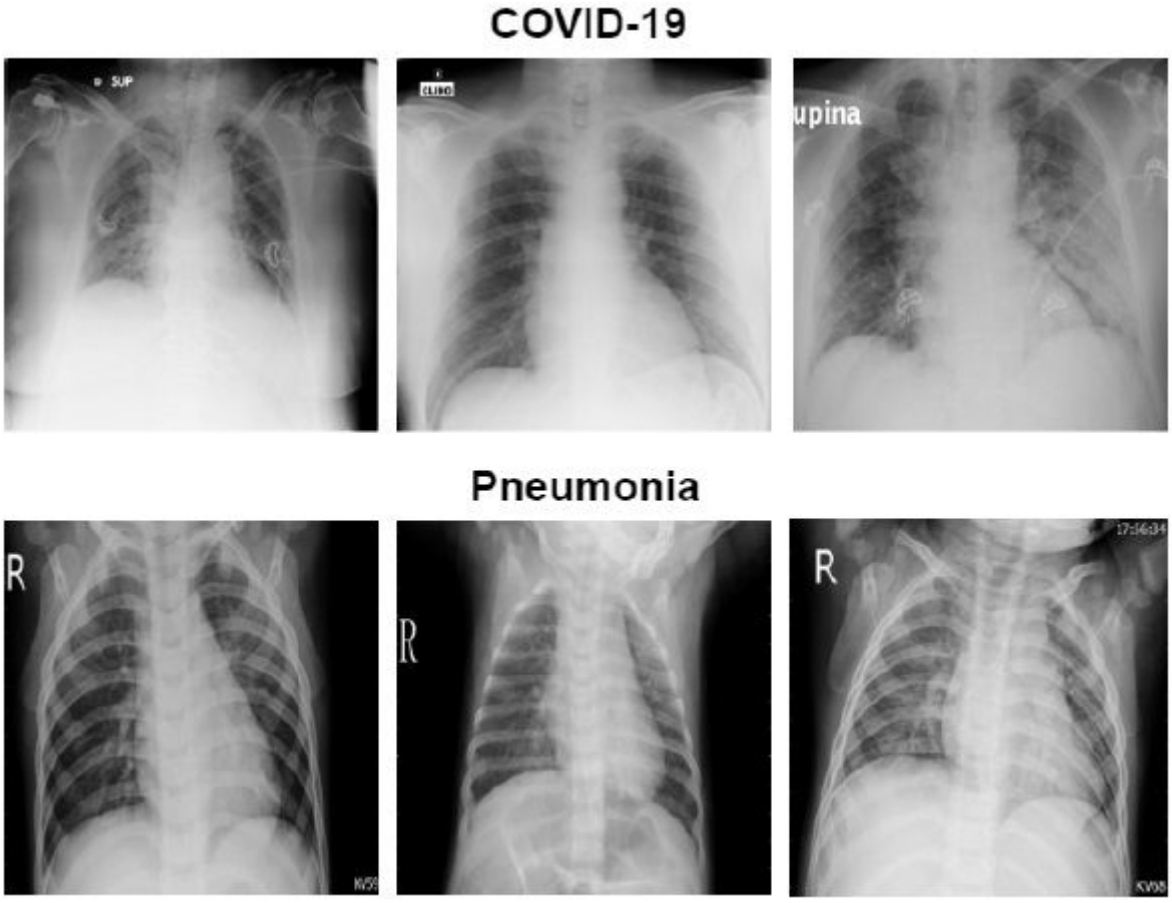

Figure 4

Pneumonia and COVID-19 sample images from COVIDx dataset with class consistent annotations

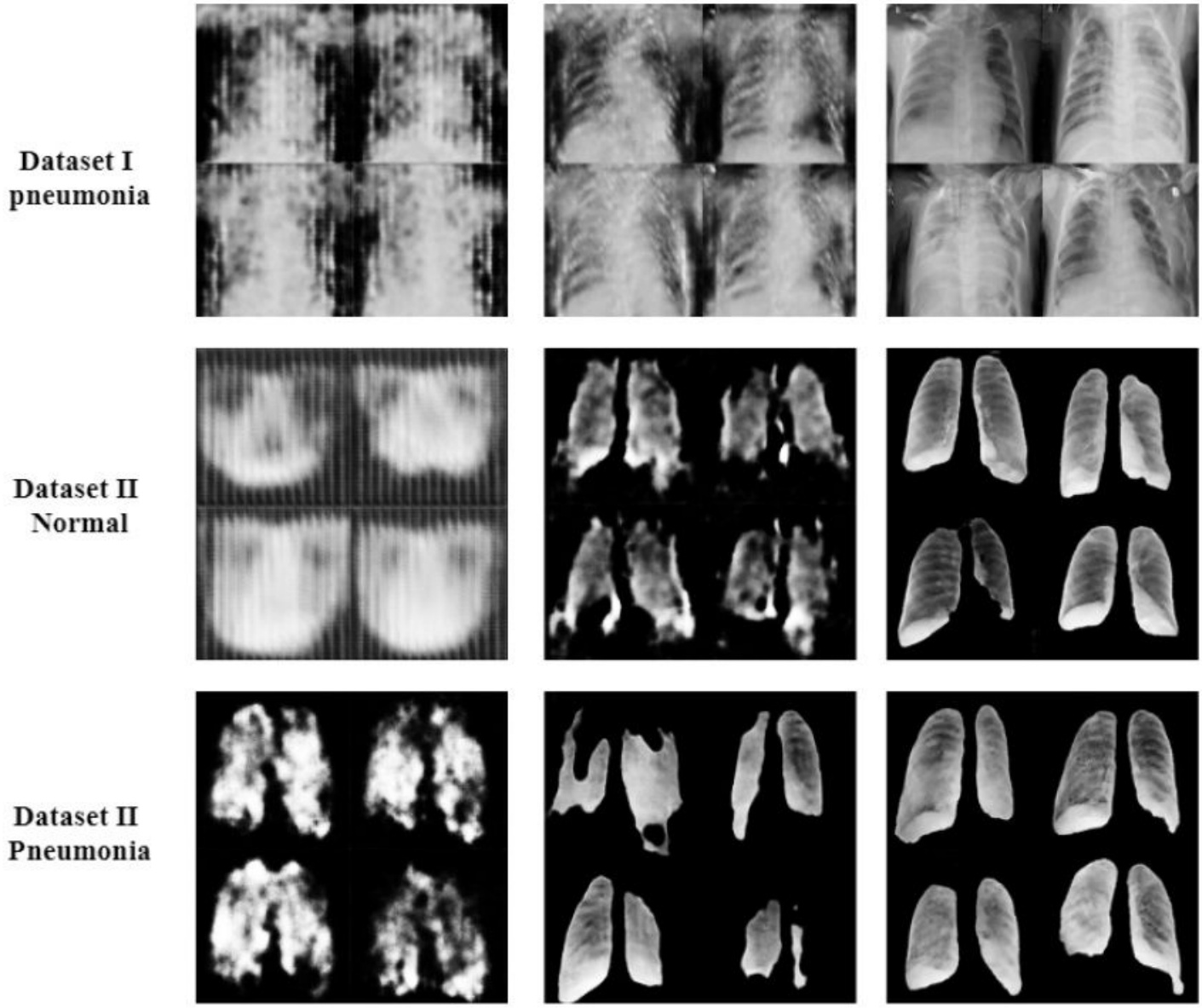

Figure 5

Generator's output during training

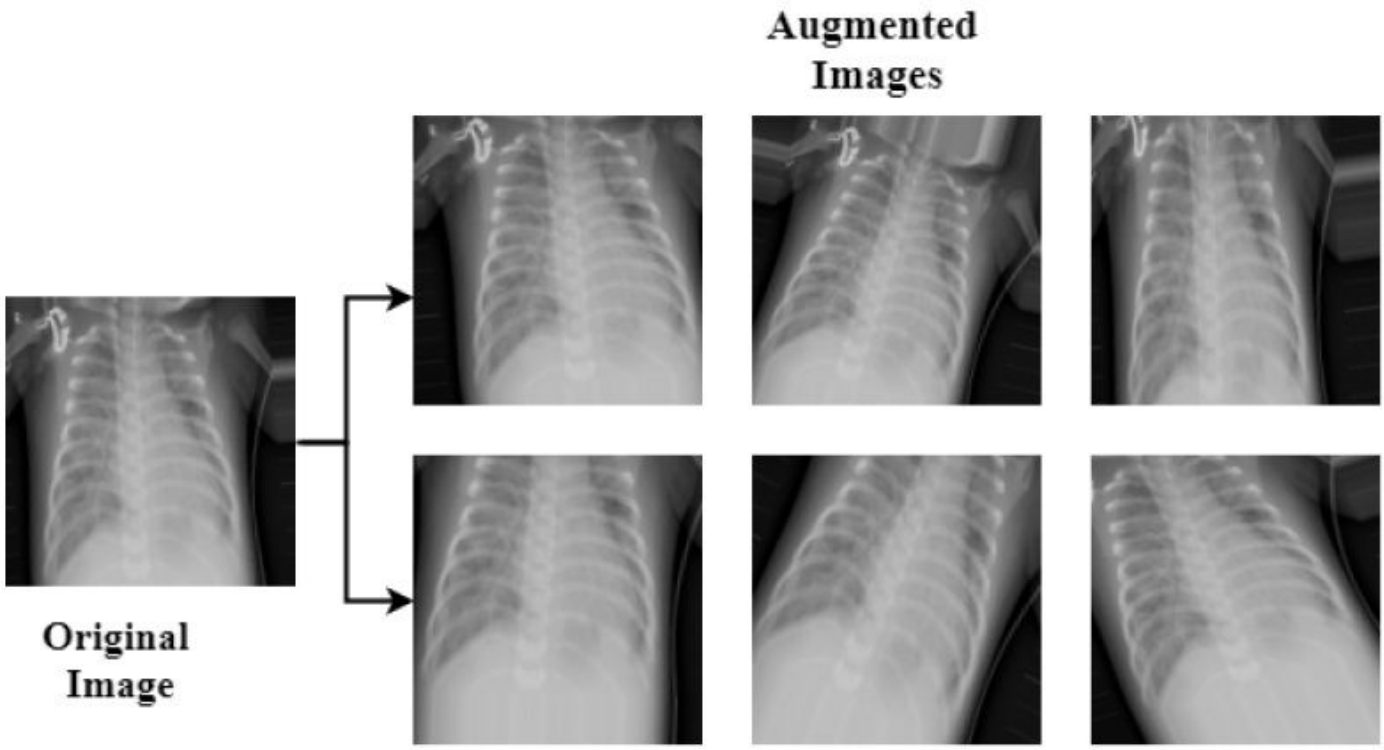

Figure 6

Traditional augmentation output sample

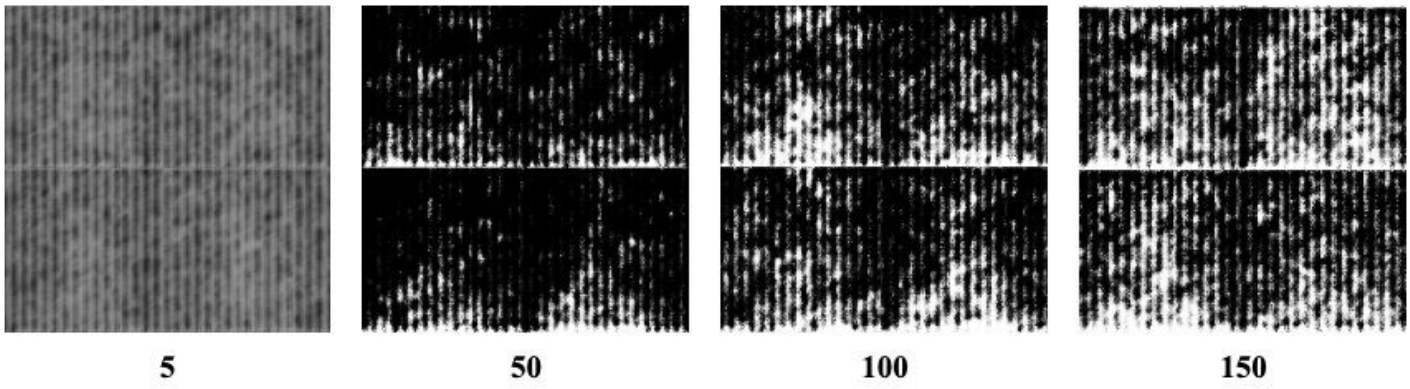

Figure 7

IAGAN's generator output at different epochs of the model training with random generated input images