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Med-CapSRGAN

**Medical Image Super-Resolution with Generative Adversarial
Networks and Capsule Networks**

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ABSTRACT

Despite rapid advances in medical imaging technology, the imaging devices and techniques employed impact medical image quality due to practical and safety constraints. Super-Resolution, widely studied in medical imaging, seeks to alleviate these challenges. Super-Resolution is a branch in computer vision that transforms a low-resolution image into high-resolution. Various strategies for achieving super-resolution have been introduced throughout the last decade. Deep learning-based methods, such as Generative Adversarial Networks, have recently emerged and outperformed previous methods. However, due to the rising complexity of deep learning and the demand for a vast amount of training data, properly leveraging the technology for medical imaging remains difficult.

This research proposes a novel technique for medical image super-resolution using Generative Adversarial Networks in conjunction with Capsule networks named the Med-CapSRGAN. After an extensive evaluation of existing GAN-based methods and due to hardware limitations, the SRGAN architecture was selected as the primary architecture of the research. The discriminator network of SRGAN is replaced by a capsule network as proposed by the study. The proposed architecture is trained using the Chest X-ray (Covid-19 & Pneumonia) dataset. After extensive qualitative and quantitative testing, the proposed architecture was proven successful. Benchmarking against the original SRGAN further demonstrated the effectiveness of the proposed architecture. The evaluation metrics used for testing include Peak Signal to Noise Ratio (PSNR), Fréchet Inception Distance (FID) and Perceptual Index. The results proved that, unlike SRGAN, the proposed solution doesn't produce unwanted artefacts, and the results are more realistic and closer to the ground truth.

Subject Descriptors:

Computer Vision, Image Processing, Generative Adversarial Networks, Capsule Networks, Medical Imaging

Keywords:

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