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Title	Artificial Computed Tomography Images with Progressively Growing Generative Adversarial Network
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Abstract

Applications of artificial intelligence in medical imaging include classification, segmentation, and treatment planning. Using current deep-learning techniques, developing these systems requires large amounts of labelled training data. Obtaining this data is challenging due to costs, required expertise, inconsistency of imaging procedures and formatting, and patient privacy concerns. Generative adversarial networks (GANs) may alleviate some of these issues by supplying realistic artificial medical images. In this study, we trained progressively growing (PG)GAN to synthesize full-sized computed tomography (CT) images and succeeded. Performance of the PGGAN was evaluated using Fréchet Inception Distance (FID), Inception Score (IS), and Precision (P) and Recall (R). These metrics were calculated for generated, training, and validation images. The influence of dataset size was explored by varying the number of samples used to calculate each metric; this affected FID, P, and R, but not IS, which has obvious implications for comparing studies. The FID between artificial CT images from PGGAN and real validation images was 42; interestingly, FID between real training and validation images was 24. This suggests that a further reduction of 18 could be achieved by improving the generative model. Overall, artificial CT images generated by PGGAN were almost indistinguishable from real images to the human eye, although computational metrics could identify differences between them. In future work, GANs may be deployed to augment data for training medical AI systems.