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Title: Noise Adaptation Generative Adversarial Network for Medical Image Analysis

Machine learning has been widely used in medical image analysis under an assumption that the training and test data are under the same feature distributions. However, medical images from difference devices or the same device with different parameter settings are often contaminated with different amount and types of noises, which violate the above assumption. Therefore, the models trained using data from one device or setting often fail to work for that from another. Moreover, it is very expensive and tedious to label data and re-train models for all different devices or settings. To overcome this noise adaptation issue, it is necessary to leverage on the models trained with data from one device or setting for new data. In this work, we reformulate this noise adaptation task as an image-to-image translation task such that the noise patterns from the test data are modified to be similar to those from the training data while the contents of the data are unchanged. We propose a novel Noise Adaptation Generative Adversarial Network (NAGAN), which contains a generator and two discriminators. The generator aims to map the data from source domain to target domain. Among the two discriminators, one discriminator enforces the generated images to have the same noise patterns as

those from the target domain, and the second discriminator enforces the content to be preserved in the generated images. We apply the proposed NAGAN on both optical coherence tomography (OCT) images and ultrasound images. Results show that the method is able to translate the noise style. In addition, we also evaluate our proposed method with segmentation task in OCT and classification task in ultrasound. The experimental results show that the proposed NAGAN improves the analysis outcome.