Biomarker Localization by Combining CNN Classifier and Generative Adversarial Network

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Abstract. This paper proposes a novel deep neural network architecture to effectively localize potential biomarkers in medical images, when only the image-level labels are available during model training. The proposed architecture combines a CNN classifier and a generative adversarial network (GAN) in a novel way, such that the CNN classifier and the discriminator in the GAN can effectively help the encoder-decoder in the GAN to remove biomarkers. Biomarkers in abnormal images can then be easily localized and segmented by subtracting the output of the encoder-decoder from its original input. The proposed approach was evaluated on diabetic retinopathy images with real biomarkers and on skin images with simulated biomarkers, showing state-of-the-art performance in localizing biomarkers even if biomarkers are irregularly scattered and are of various sizes in images.

Keywords: Biomarker localization · Encoder-decoder · Generative adversarial networks

1 Introduction

Visual biomarkers in medical images are important indicators for radiologists to investigate the risks, categories, and status of particular diseases. Therefore, automatic localization and segmentation of existing or potentially novel biomarkers from various medical images would be a key step for intelligent diagnosis and treatment of diseases. While it is relatively easier for human experts to roughly locate biomarkers (e.g., with bounding boxes surrounding biomarker regions), it is challenging, if not impossible, for humans to precisely localize and