World Academy of Science, Engineering and Technology
International Journal of Computer and Systems Engineering
Vol:14, No:07, 2020

Deep Feature Augmentation with Generative Adversarial Networks for Class Imbalance Learning in Medical Images

Authors : Rongbo Shen, Jianhua Yao, Kezhou Yan, Kuan Tian, Cheng Jiang, Ke Zhou

Abstract : This study proposes a generative adversarial networks (GAN) framework to perform synthetic sampling in feature space, i.e., feature augmentation, to address the class imbalance problem in medical image analysis. A feature extraction network is first trained to convert images into feature space. Then the GAN framework incorporates adversarial learning to train a feature generator for the minority class through playing a minimax game with a discriminator. The feature generator then generates features for minority class from arbitrary latent distributions to balance the data between the majority class and the minority class. Additionally, a data cleaning technique, i.e., Tomek link, is employed to clean up undesirable conflicting features introduced from the feature augmentation and thus establish well-defined class clusters for the training. The experiment section evaluates the proposed method on two medical image analysis tasks, i.e., mass classification on mammogram and cancer metastasis classification on histopathological images. Experimental results suggest that the proposed method obtains superior or comparable performance over the state-of-the-art counterparts. Compared to all counterparts, our proposed method improves more than 1.5 percentage of accuracy.

Keywords : class imbalance, synthetic sampling, feature augmentation, generative adversarial networks, data cleaning
Conference Title : ICDM 2020 : International Conference on Data Mining
Conference Location : Dublin, Ireland
Conference Dates : July 30-31, 2020