Master thesis proposal

Title: Medical image fusion based on deep learning methods

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Description

Recently, deep learning-based image fusion (IF) methods have been extensively explored in the field of image processing. Medical imaging technologies such as medical image fusion are an important part of clinical diagnosis. Physicians make the diagnosis based on different types of medical scans, for example, magnetic resonance imaging (MRI), single photon emission (SPECT), computed tomography (CT), or positron emission tomography (PET). All these types of medical imaging have their own advantages and limitations. Therefore, some researchers are trying to integrate useful information captured by different medical images into a single image. Generally, the purpose of medical image fusion is to improve the level of medical image utilization, resulting in extremely helpful imaging for physicians.

One of the possible approaches to medical image fusion is the approach based on deep learning (DL). Deep learning is a state-of-the-art technique with good feature extraction capabilities which is useful in the field of medical image fusion. The properties of DL in the field of image fusion have been described or proved in the literature, for example, in [1-3].The aim of this project is to propose a new method of medical image fusion based on modern DL algorithms.

The Objectives of the Work

1. Research on capabilities of different DL models such as VGG, Res-Net, Dense-Net etc. to fuse different modalities of medical images. For example, MRI and CT, MRI and PET or MRI and SPECT.
2. A novel algorithm to fuse medical images based on deep learning techniques.
3. Performance analysis of the proposed algorithm.

References

[1] Zhang, H., Xu, H., Tian, X., Jiang, J., & Ma, J. (2021). Image fusion meets deep learning: A survey and perspective. *Information Fusion*, *76*, 323-336.

[2] Liang, N. (2024). Medical image fusion with deep neural networks. *Scientific Reports*, *14*(1), 7972.

[3] James, A. P., & Dasarathy, B. V. (2014). Medical image fusion: A survey of the state of the art. *Information fusion*, *19*, 4-19.

Datasets to be used

[1] <https://github.com/xianming-gu/Havard-Medical-Image-Fusion-Datasets>

[2] https://www.med.harvard.edu/AANLIB/home.html