Article Publisher preview available

MRI Image Fusion Based on Optimized Dictionary Learning and Binary Map Refining in Gradient Domain

Multimedia Tools and Applications

June 2022 · 82(1)

DOI:10.1007/s11042-022-12225-3

Authors:

Qiu Hu
NingboTech university

Shaohai Hu

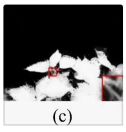
Xiaole Ma
Beijing Jiaotong University

Fengzhen Zhang

Show all 5 authors

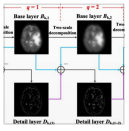
Abstract and Figures

The insufficient ability of edge feature extraction and high complexity limit the ability of sparse representation to obtain better medical image fusion performance. In this letter, we propose a novel multimodal medical image fusion method with optimized dictionary learning and binary map refining. The optimized dictionary learning uses loop iterations between separable FISTA and manifold-based conjugate gradient algorithm to catch detail texture features in detail layer, and the binary map refining solution adopts Gabor energy measurement with GDGIF to reserve structure and brightness characteristics in base layer. Experimental results of various medical images and clinical applications indicate the effectiveness of the proposed method.

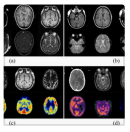


The filtering performanc…

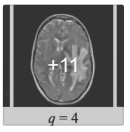
Overall framework …



Schematic of the two-scal…



Multimodal medical…



The effect of decompositi…

Multimedia Tools and Applications (2023) 82:2539–2561
https://doi.org/10.1007/s11042-022-12225-3

MRI Image Fusion Based on Optimized Dictionary Learning and Binary Map Refining in Gradient Domain

Qiu Hu[1,2] · Shaohai Hu[1,2] · Xiaole Ma[1,2] · Fengzhen Zhang[3] · Jing Fang[4]

Received: 6 May 2021 / Revised: 5 January 2022 / Accepted: 10 January 2022 /
Published online: 30 June 2022

Abstract
The insufficient ability of edge feature extraction and high complexity limit the ability of sparse representation to obtain better medical image fusion performance. In this letter, we propose a novel multimodal medical image fusion method with optimized dictionary learning and binary map refining. The optimized dictionary learning uses loop iterations between separable FISTA and manifold-based conjugate gradient algorithm to catch detail texture features in detail layer, and the binary map refining solution adopts Gabor energy measurement with GDGIF to reserve structure and brightness characteristics in base layer. Experimental results of various medical images and clinical applications indicate the effectiveness of the proposed method.

Keywords Clinical application · Medical image fusion · Dictionary learning · Fast iterative shrinkage thresholding algorithm · Gradient domain guided image filtering

Abbreviations

GDGIF	Gradient Domain Guided Image Filtering
CT	Computerized Tomography
MR	Magnetic Resonance
PET	Positron Emission Tomography
SPECT	Single-Photon Emission Computed Tomography
HVS	Human Visual System

✉ Shaohai Hu
shhu@bjtu.edu.cn

[1] Institute of Information Science, Beijing Jiaotong University, Beijing 100044, China

[2] Beijing Key Laboratory of Advanced Information Science and Network Technology, Beijing 100044, China

[3] Key Laboratory of Solar Activity, National Astronomical Observatory, Chinese Academy of Science, Beijing 100101, China

[4] Shandong Province Key Laboratory of Medical Physics and Image Processing Technology, School of Physics and Electronics, Shandong Normal University, Jinan 250014, China

visible image fusion. Leveraging techniques from diverse domains, such as hyperspectral and multispectral image fusion, can lead to innovative solutions and improvements in fusion algorithms [16]. ...

Two-scale decomposition and deep learning fusion for visible and infrared images

Article Full-text available

Apr 2025

Ruhan Bevi Azad · Hari Unnikrishnan · Lokesh Gopinath

View Show abstract

Multi View Image Fusion Using Ensemble Deep Learning Algorithm for Mri and CT Images

Article

Jan 2024

N. Thenmoezhi · B. Perumal · A. Lakshmi

View Show abstract

Modified Iterative Shrinkage Thresholding Algorithm for Image De-blurring in Medical Imaging

Chapter

Mar 2023

Himanshu Choudhary · Kartik Sahoo · Arishi Orra

View Show abstract

Impact of Electric Vehicle Charging Station in Distribution System Using V2G Technology

Chapter

Mar 2023

Naresh Kumar Golla · Sureshkumar Sudabattula · Abhijit Maji · Bandi Kanti Chaitanya

View Show abstract