User Guide

Jhao-Ting Lin[†]

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Description

Based on our research paper "PRIME: Unsupervised multispectral unmixing using virtual quantum prism and convex geometry," we prepare a demo file for researchers to investigate our algorithm. The users can select two modes about data with ground-truth (i.e., mode=0) and data without ground-truth (i.e., mode=1), respectively.

Python Package Requirements

- pytorch==2.0.0 pytorch-cuda=11.7 -c pytorch -c nvidia
- torchvision
- torchmetrics
- einops
- pennylane 0.36.0

Run the code (Tested by MATLAB R2023b and python 3.9 on Linux OS)

- Firstly, please download the CVX from the following link: `https://cvxr.com/cvx/download/`.
- Run the MATLAB program "demo.m" to observe the quantitative and qualitative performances of PRIME.
- We suggest using PRIME when the number of materials is no greater than 8. Furthermore, when the number of spectral bands exceeds the number of materials, we directly apply a fast unmixing algorithm, HyperCSI [1].
- When the number of spectral bands is 4, following the experimental setup in the article, we perform spectral super-resolution to generate 8 bands. For computational efficiency, when the number of bands is 5, 6, or 7, we also super-resolve them into 8 bands. To achieve this, we apply slightly different light-splitting strategies depending on the number of input bands; for example, we split bands 2, 3, and 4 for 5-band data, bands 2 and 5 for 6-band data, and band 4 for 7-band data.

[†] Institute of Computer and Communication Engineering, Department of Electrical Engineering, National Cheng Kung University, Tainan, Taiwan (R.O.C.) E-mail: `q38091534@gs.ncku.edu.tw`.

- If you want to run this code with your own data **with ground-truth**, you need to prepare the reference hyperspectral image (HSI) and follow Lin's protocol as described in Section IV-A of the article. Then, place your simulated data in the "data" folder and modify line 5 in "demo.m" accordingly.
- If you want to run this code with your own data **without ground-truth**, you need to change the mode by modifying line 10 in "demo.m". Then, place your data in the "data" folder and modify line 5 in "demo.m" accordingly.

Reference

[1] C.-H. Lin *et al.*, "A fast hyperplane-based minimum-volume enclosing simplex algorithm for blind hyperspectral unmixing," *IEEE Transactions on Signal Processing*, vol. 64, no. 8, pp. 1946-1961, Apr. 2016.

Citation

If you find our work useful in your research or publication, please kindly cite our work:

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