TRANSFORMATION OF RGB IMAGES INTO HYPERSPECTRAL USING MACHINE LEARNING ALGORITHMS

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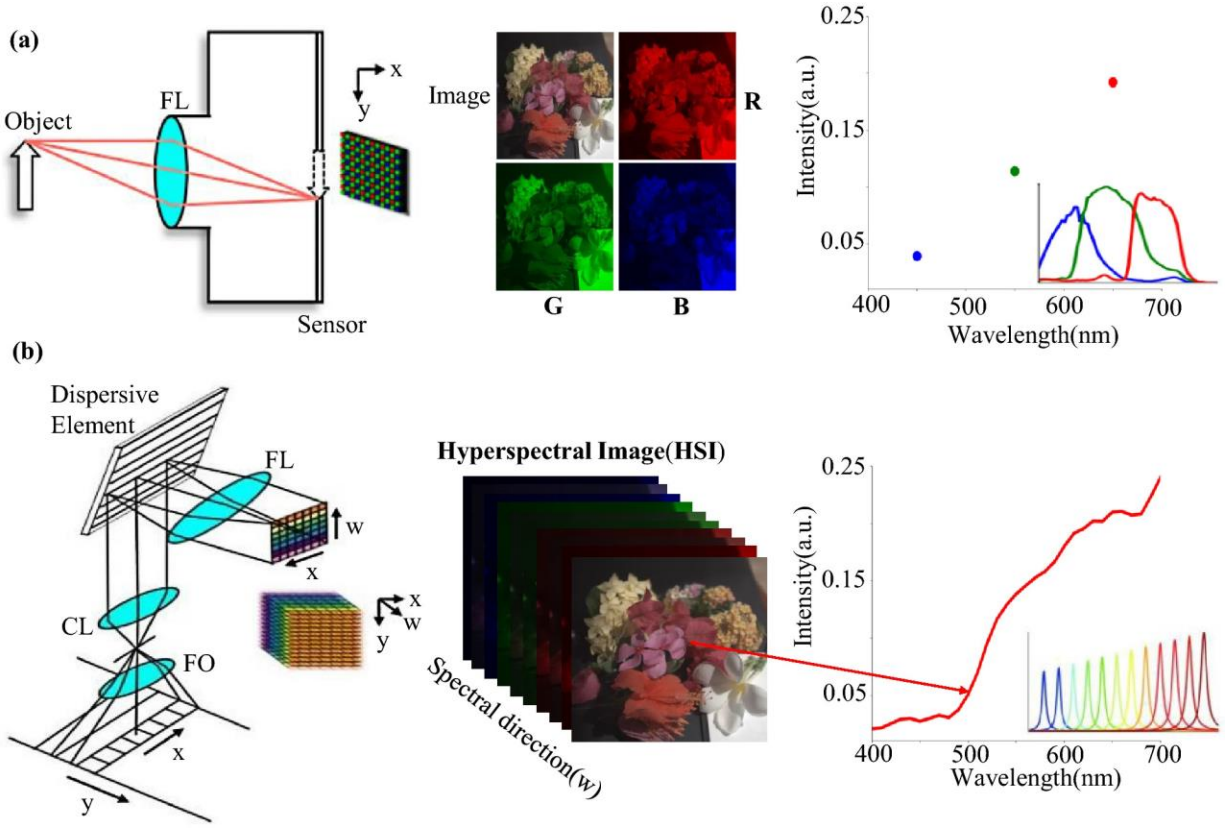
Hyperspectral images

- Hyperspectral images(HSI) are images that contain information in a wide range of wavelengths across the electromagnetic spectrum, typically from the visible to the near-infrared range.
- Hyperspectral technology gives detailed information about objects in different spectra, which helps to gain additional data, which can be used to make much more precise conclusions.
- HIS are used in various fields such as remote sensing, electronics and bioengineering.



Zhang, J., Su, R., Fu, Q., Ren, W., Heide, F., & Nie, Y. (2022). A survey on computational spectral reconstruction methods from RGB to hyperspectral imaging. *Scientific reports*, *12*(1), 11905.

Problem

- Devices that gain hyperspectral images are much more expensive and require more time and effort to make a picture than the common RGB camera
- The method of reconstruction of RGB images to HS images was proposed

Case 1:

Case 2:

Results and Experiments

Performance of RGB to HSI model on different datasets

	KAUST	ARAD	Both
MRAE	0.3928	0.4682	0.4642
RMSE	0.1667	0.1649	0.1796

Comparison of the model performance with different sizes of the input images

		480x512	256x256
RGB to HSI	MRAE	0.4642	0.4812
	RMSE	0.1796	**0.1499**
Binary classification	Binary Entropy	0.6978	0.6934
	AUC	0.5442	**0.5874**

Results and Experiments

Comparison of the model performance with ReLU and LeakyReLU activation functions in RGB to HSI model

		ReLU	LeakyReLU
RGB to HSI	MRAE	0.4812	0.55
	RMSE	0.1499	0.1385
Binary classification	Binary Entropy	0.7111	0.6932
	AUC	0.5842	0.5475

Comparison of the model performance with trainable and non-trainable weights of RGB to HSI model

	Non-trainable RGB to HSI model	Trainable RGB to HSI model
Binary Entropy	0.7111	0.6934
AUC	0.5842	0.5874

Results and Experiments

Comparison of the model performance with trainable and non-trainable weights of RGB to HSI model

	Non-trainable RGB to HSI model	Trainable RGB to HSI model
Binary Entropy	0.7111	0.6934
AUC	0.5842	0.5874

Final comparison

	EfficientNet solo	EfficientNet with RGB to HSI model
Binary Entropy	0.6822	0.6934
AUC	0.6056	0.5874

Problems and further work

- **Computational resources problem**

Since model's input and output are very large in terms of memory, the resources given by the Google Colab are not enough to use a large batch size while training.

- **Lack of data problem**

Due to the high cost of acquiring HS images, there are not much open datasets that can be used for research.

- **Metrics**

The metrics that are used for the HSI reconstruction don't fit this problem as the focus should be placed on the preciseness of the spectre, not the spatial characteristics.

- **Model architecture**

A great way to improve the results is to find a better model architecture that is more suitable for this problem then U-net.

Thank you!