Project: Tensor-based methods for Hyperspectral Imaging

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In real world, data sets from many fields consist of more than two dimensions, for example, video data, medical imaging data, hyperspectral data, fMRI data and so on. Traditional vector or matrix based tools are not flexible enough to capture all the degrees of freedom contained in the multi-dimensional (or multi-way) structures. As a multi-linear generalization of vector and matrix, tensor is more powerful and informative, it provides a natural representation of such data. The tensor decomposition techniques play an important role in efficient storage, factor analysis of multidimensional datasets. In this project, we will study tensor-based methods for hyperspectral imaging which collects information from the object by taking pixels at different wavelengths. See Figure 1 for example. The purpose of hyperspectral imaging is to find objects, identify materials, or detect processes. In this project, we will study tensor decompositions in hyperspectral imaging analysis and analysis the pros and cods of different tensor decompositions in tasks in hyperspectral imaging.

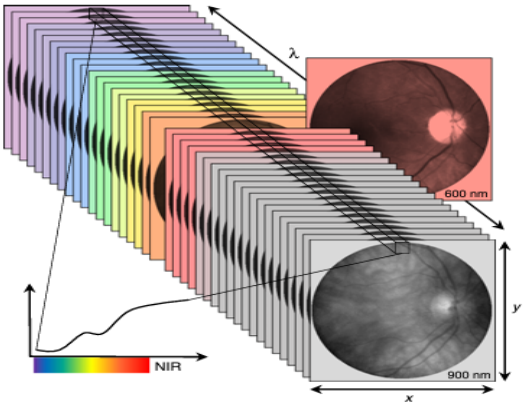

Figure 1: Retinal hyperspectral (HS) imaging [1].

Prerequisites: Linear Algebra/Numerical Linear Algebra, Numerical Algorithm, MATLAB.

References

[1] Xavier Hadoux et al. "Non-invasive in vivo hyperspectral imaging of the retina for potential biomarker use in Alzheimer's disease." Nature communications 10.1 (2019): 4227.