

Data Science Lab-6

Image Compression with SVD

Objective

The objective of this lab is to design and implement a basic image compression technique using Singular Value Decomposition (SVD). Students will learn how the data compression can be done using the simple linear algebra concept of SVD.

We use the following RGB images for implementing SVD from scratch.

• Images source:

1. Smooth image:
<https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTJHcWBQijdk5GD1-y-nSOFIEUvbrH7SP7Dg&s>
2. Edge-dominant image:
<https://www.researchgate.net/publication/271589135/figure/fig1/AS:295174543560710@1447386503276/The-Cameraman-Image-transmitted-from-Alice-to-Bob-This-image-is-extensively-used-as-a.png>
3. Textured image:
<https://www.researchgate.net/profile/Erol-Kurt/publication/313951756/figure/fig4/AS:691783109464064@1541945354189/Plain-Baboon-Image-Figure-7-Cipherd-Baboon-Image.ppm>

Task 1

- Download the images and convert it into grayscale
- Apply SVD function on all the three images
- Analyze and Visualize your results by taking different singular values (n: 1, 5, 10, 20, 40, 50) for each image
- Find a compression ratio for each case

Task 2:

- Use any available image dataset and apply SVD on them. Compare your results with PCA providing proper visualization.
 - Sample datasets:
 - <https://www.kaggle.com/datasets/hojjatk/mnist-dataset>
 - <https://www.kaggle.com/datasets/martininf1n1ty/olivetti-faces-augmented-dataset>
 - <https://www.kaggle.com/datasets/ayush1220/cifar10>

Resource https:

<https://dmicz.github.io/machine-learning/svd-image-compression/>
https://www.youtube.com/watch?v=LO_E_xQHEe8

Note: This assignment will be evaluated by Dr. Praveen sir and grades will be considered as quiz marks. Make sure there is no duplication of your work with your classmates