Recreating Images Using Neural Networks

Motivation

Recreating or restoring an image is one of the most exciting and interesting topics. A system capable of recreating an image using less memory and computation time can be helpful in preserving our past and important documents. For details, refer to https://en.wikipedia.org/wiki/Image_restoration .

This project aims to use Neural Networks for this task.

Process

The project aims to recreate an image using the **MLP Regression** tool of **sklearn**. Regression is a supervised learning technique having $X \in \mathbb{R}^m$ and $y \in \mathbb{R}$. That is, the values of the dependent variable, y are real numbers. Note that in the case of classification the values of y are discrete. The steps in the process are as follows:

1. **Read the image**:

   The **imread** method of the **matplotlib.pyplot** helps us to read a given image into an array.

2. **Convert the image into grayscale**:

   This can be done by extracting the three 2-D arrays from a RGB image and using the following formula

$$0.2989 \times r + 0.5870 \times g + 0.1140 \times b$$

3. **Flattening**:

   Flatten the image by using the **np.reshape** method of **numpy**.

4. **Train Test**:

   Divide the data into train and test by using the **random.permutation** method

5. **Distorted Image**:

   The values at the indices indicated by the **test_indices** can be set to zero to get an idea of the distorted image.

6. **Prediction**:

   Now use the **MPLRegressor** to predict the value of the test indices.

7. **Performance**:

   Your aim should be to minimize the root mean square error. In order to do so, you can change the number of hidden layers and the number of neurons in the hidden layer, along with the learning rate.

Flow

Figure 1 depicts the outline of the project.

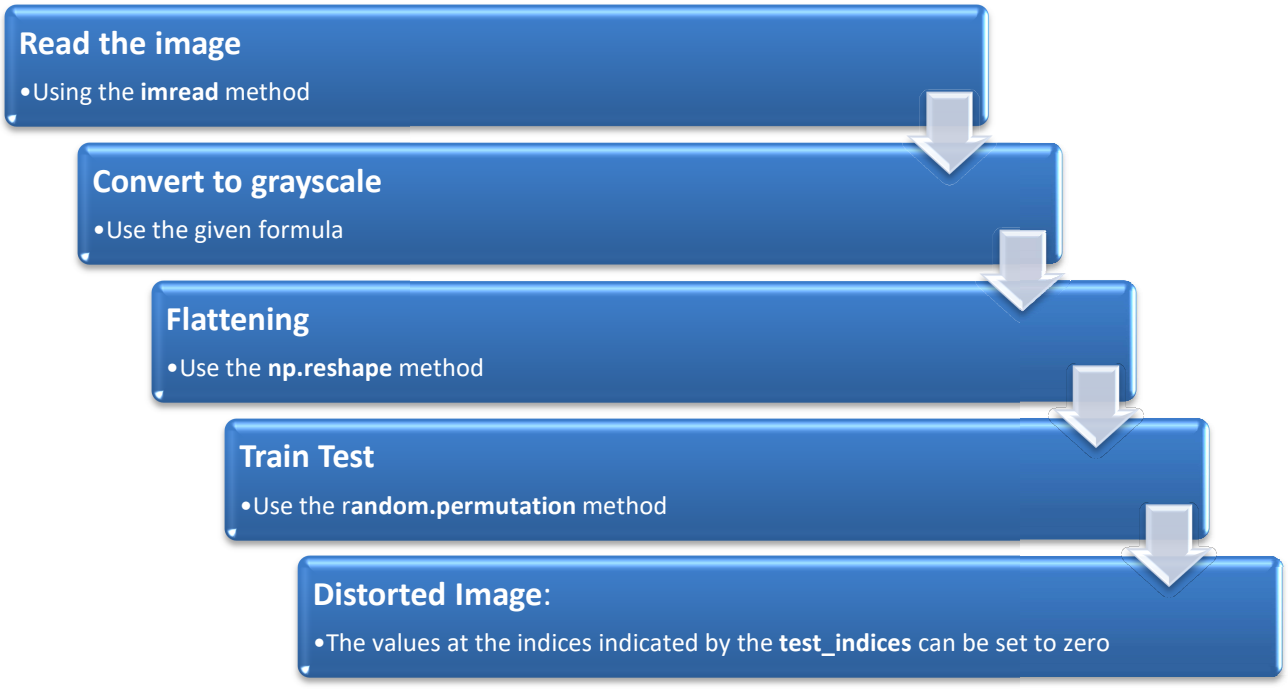

Figure 1: Flow of the project

Experiments

Report the **rmse** by changing the following

- Number of hidden layers (Set to 1, 2, and 3)
- Change the number of units in the hidden layers.
- Change the learning rate.

Future Scope

This project aims to find the relation between the pixel intensities and the indices of flattened images. Try relating the coordinates of 2D array as the independent variables.

References

You can use the following references for preparing your report.

1. **Regression and Supervised Learning**: http://cs229.stanford.edu/notes/cs229-notes1.pdf
2. **Neural Networks:** http://www.cs.stir.ac.uk/courses/ITNP4B/lectures/kms/1-Intro.pdf
3. **Implicit representation:** https://openreview.net/forum?id=BJeem3C9F7
4. **MLPRegressor:** https://scikit-learn.org/stable/modules/generated/sklearn.neural_network.MLPRegressor.html