Introduction to Computer Vision

Topics covered in the week:

- Introduction to Computer Vision
  - What is Computer Vision
  - Application of Computer Vision
- Approaches to Computer Vision
- Digital Images and Pixels
- Digitization (Analog to Digital)
  - Digital Image Sizing
  - Digital Noise
  - De-noise Images
- Case Study

Introduction to Computer Vision

- It enables computing systems to understand and process digital photographs, videos, displays etc. and behave as if they have a vision just as the living beings.
- Computer Vision includes the following tasks:
  - Image Classification
  - Object detection / localization / segmentation
  - Similarity Learning
  - Image Captioning
  - Generative Modelling
  - Video Analysis

Pixel intensity histograms:

- Analyze digital images based on pixel intensity histograms. This histogram is a graph showing the number of pixels in an image at each different intensity value found in that image.

Convolutional Neural Networks (CNN):

- CNN typically work on pixel intensity value changes and learn to process them in a way that makes it possible to accomplish a certain computer vision task, such as image recognition.

Digital Image and Neighborhood:

- The values at a pixel in new image generated during digital image processing using CNN, will be dependent on the same pixel on the original image.

Digitization:

- A digital signal is represented by colour and intensity (R, G, B in the range of 0 to 255)

Grayscale:

- A colour image can be converted into an grayscale, which is international standard.
- In between absolute black and absolute white, there are various shades of gray.

Digital Image Sizing:

- Each layer i.e. (R, G, B) can take value from 0 – 255, total 256 values.
- So we need 8 bits to store 256 values because 2^8 = 256.
- Therefore we need 3 bytes (for R, G and B layers) for every pixel.
- In grayscale image, each pixel needs only 8 bits/ 1 byte to hold its shade of gray.
- Black and white image, each pixel need only 1 bit. There is loss of information in B&W image.

Image as a function:

- A 2-D grayscale image can be plotted in 3-Dimensional plot where x, y represent the position of the pixel and the third dimension represents the intensity of pixel.

Edges as Features:

- Edges are those positions where the pixel intensity changes considerably.

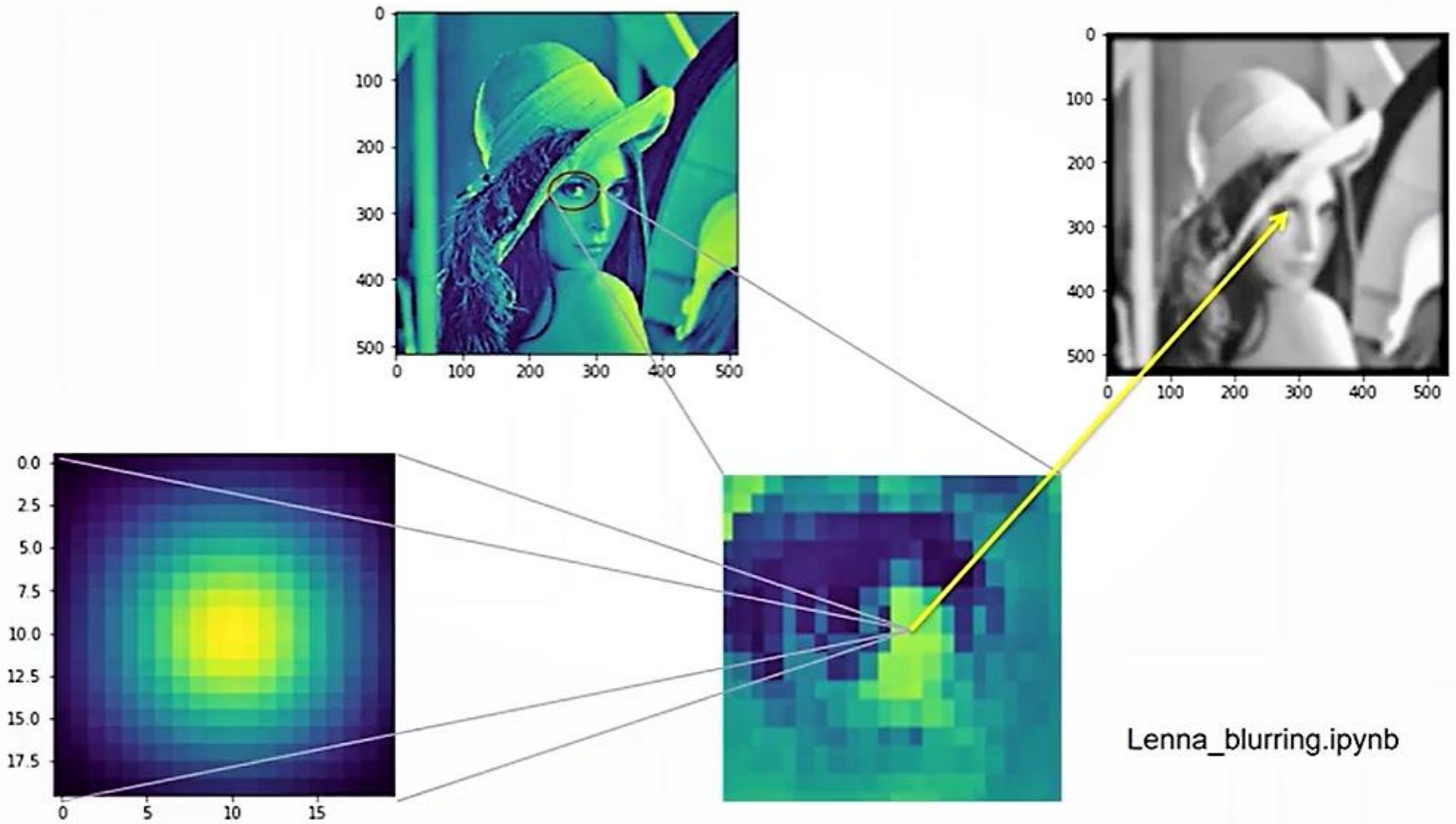
Digital Noise:

- Noise can artificially create edges (features) where there are none.
- This noise can lead to misinterpretation as the genuine feature for the algorithm.
- The model start to over fit when it start capturing the noise in the data.

Fixing Noise in Images:

- Addressing noise through blurring / Gaussian Blurring.
- During blurring, the values of surrounding pixels to a particular pixel are also taken into account.

Addressing digital noise through blurring / Gaussian blurring



Case Study: On Image Classification

Context:

- We are given a dataset which contains image data.
- The data contains pixel values of the images in csv format.
- Each image represents one of the number from 0, 1, 2, ..., 8, 9. So there are 10 possible outcomes for each row of data. As the data contains the pixel values of the image in each row.
- Each image is 28 pixels in height and 28 pixels in width, for a total of 784 pixels in total.
- Each pixel has a single pixel-value associated with it, indicating the lightness or darkness of that pixel, with higher numbers meaning darker.
- This pixel-value is an integer between 0 and 255, inclusive.
- The data set has 785 columns.
- The first column, called "label", is the digit which is in the image.
- The rest of the columns contain the pixel-values of the associated image.

Steps:

- Import necessary libraries.
- Get the data.
- View the image.
- Normalization of data.
- Training the model.
- Make the classification report.
- Use of Gaussian Blurring in the pre-processing.
- Compare the results before and after using pre-processing.

Questions?

Thank You!
Happy Learning!