Deep Dive: Computer Vision

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Week-3

Now that you are comfortable with Machine Learning and Computer Vision fundamentals, let's start with the most essential functions used in Image Processing (not in any specific order). We want you to go through the theory of these functions yourself, so that you develop a knack of self-exploring concepts and gain as much information as you want.

1. **Gaussian Blur**: Reduces image noise and detail by applying a Gaussian function, used in pre-processing steps.

2. **Edge Detection**: Identifies the boundaries of objects within images, useful for object detection and segmentation.

3. **Histogram Equalization**: Enhances the contrast of an image by spreading out the most frequent intensity values.

4. **Thresholding**: Converts grayscale images to binary by separating pixels into two classes, often used for segmentation.

5. **Morphological Operations**: Refines shapes in binary images, used for removing noise, filling gaps, and separating touching objects.

6. **Image Resizing**: Changes the dimensions of an image, commonly used in preprocessing to standardize input sizes for models.

7. **Image Rotation and Translation**: Alters the orientation or position of an image, useful in data augmentation and alignment tasks.

8. **Image Sharpening**: Enhances the edges and fine details of an image, used to make images clearer and more defined.

9. **Color Space Conversion**: Transforms images into different colour representations, useful for simplifying image analysis.

10. **Affine and Perspective Transformations**: Applies geometric transformations to images, used for correcting distortions and aligning images.

These functions are fundamental tools in the image processing toolkit, widely used across various applications in computer vision. Here are some resources you can use to cover the implementation of these topics:

[Full OpenCV Tutorial in Python](#) – This is a comprehensive tutorial which contains most of the fundamental topics required in image processing. Some of those topics aren't necessary to be covered this week but you are free to do it out of interest!
[OpenCV Tutorial in Image Gradients and Edge Detection](#)
[OpenCV Tutorial in Canny Edge Detection](#)
[OpenCV Tutorial in Morphological Transformations](#)
[Affine Transformation using Python](#)

These resources should help you get a good grasp of these concepts, and also implement them using Python. As always, feel free to reach out for any doubts or additional resources!

CHECKPOINT:

- ➤ For this week, we want you to submit the codes for **implementation of <u>any 5 functions</u>** (*compulsory*).
- ➤ Please also provide short descriptions/summaries of each function to demonstrate your conceptual understanding of the same. This will ensure that your knowledge of the functions is not restricted to just their code implementation.
- ➤ You can also submit implementations of the other functions (*optional*) to get a better understanding of them.