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**DJSCE SYNAPSE CO-COMM ML TASK**

**Task 3 – Research Task**

Option 2:

What are some Image processing techniques? How can I achieve effects like blur and sharpening of an image? How does image compression and image format conversion work (JPG to PNG, HEIC to PNG etc)?

Answer:

\* Image processing is a technique in which an image is filtered, edited or customized according to the needs of the users. It can be performed using various methods, such as adjusting color and contrast, converting images to RGB or black & white, based on the desired output. Another approach is by applying filters to change the appearance of an image; many camera apps and dedicated applications like Snapchat and Canva provide such filters. This can also be achieved on various mobile phones by using their inbuilt AI Photo Editors. One more technique is geometric transformations of the image, such as resizing, rotating, flipping or cropping, as needed. These techniques can be implemented programmatically by using Python and its libraries such as computer vision (OpenCV) and many machine learning models for advanced image processing. These techniques are often used as pre-processing steps when training a machine learning model to improve its accuracy. Furthermore, advanced image processing includes tasks like object detection, segmentation and recognition, etc, where models analyze or modify images intelligently.

\* Effects like blur and sharpening of an image are common effects in image processing used to modify the appearance of an image. Blurring softens the image by reducing fine details and noise, which can be achieved through techniques like Gaussian blur or median filtering. Sharpening emphasizes edges and important features, making objects in the image more distinct and is done using convolution filters. These effects can be easily implemented in Python by using libraries like OpenCV, PIL. In machine learning applications, blurring can be used to reduce overfitting by smoothing irrelevant details in an image while sharpening can help models to fine tune an image. Moreover, these techniques are applied in computer vision tasks such as medical imaging, face recognition, and object detection, where quality plays an important role.

\* Image compression and format conversion are important techniques in image processing that deal with reducing storage size and changing how image data is represented. Compression works by reducing redundant information in an image. For example, JPEG uses lossy compression, where some details are discarded to achieve smaller file sizes, while formats like PNG uses lossless compression, which preserves every pixel in the exact same manner. In contrast, HEIC (High Efficiency Image Coding) is a newer format that provides even higher compression efficiency with better quality retention as compared to JPEG.

\* Image format conversion (e.g., JPG to PNG or HEIC to PNG) essentially involves decoding the image from its original format and re-encoding it into the new one. Lossy to lossless conversions (JPEG -> PNG) do not recover lost data, but they preserve whatever information exists going forward. In machine learning, image compression and conversion are often used during data preprocessing to standardize datasets into a common format (e.g., converting all the images to PNG or JPG before training) and to reduce the storage requirements without significantly losing important data.