Lab- 9

CSET340- Advanced Computer Vision and Video analytics

Task-1:- Image Stitching, Panorama stitching, Structure from motion, Image Inpainting.

Image Inpainting:- Image inpainting is a computer vision technique that reconstructs or fills in missing or damaged regions of an image by analyzing the surrounding pixels and using that information to predict the missing data.

Task:- Take an image with visible noise and remove the noise from the image.

Image Stitching & Panorama stitching:-

IS:- Is a general technique used to combine multiple images to create a larger, single image.

Can be used for various purposes, including creating mosaics, high-resolution images, or even stitching together multiple images of a document.

PS:- A specific type of image stitching that focuses on creating wide-angle or panoramic images.

Involves capturing multiple images of the same scene, ensuring that there is overlap between the images.

Structure from motion:- The first step in implementing an SfM system is finding the motion between the cameras. OpenCV may help us in a number of ways to obtain this motion, specifically using the findFundamentalMat and findEssentialMat functions.

Task-2:-

Image Restoration using Autoencoder Model :-

Step 1: Load & Preprocess Data

- Load dataset (e.g., MNIST, CIFAR-10).
- Normalize pixel values between [0,1].
- Resize images if necessary.
- Convert to grayscale (if required).

Step 2: Simulate Degradation

- Introduce noise (Gaussian noise, salt & pepper noise).
- Apply blur (motion blur, Gaussian blur).
- Add compression artifacts if needed.

Step 3: Build the Autoencoder Model

- Encoder: Uses convolutional layers to extract features and compress image representation.
- Decoder: Reconstructs the image from the compressed representation using up-sampling and convolutional layers.

Step 4: Train the Model

- Train autoencoder using degraded images as input and original images as target output.
- Use Mean Squared Error (MSE) as the loss function.
- Optimize with Adam optimizer.
- Validate on test data.

Step 5: Image Restoration & Evaluation

- Predict restored images using the trained model.
- Compare original, degraded, and restored images.
- Evaluate performance using PSNR (Peak Signal-to-Noise Ratio)

Generative adversarial networks on MNIST and Cifar-10 datasets

Take any GAN variant and generate 10 different digits of MNIST dataset and 10 different classes of cifar-10 dataset and plot the discriminator vs adversarial loss for both.

Min epoch – 50

Mobilenet based image classification:-

Apply Mobilenet on dogs-breed dataset as part of image classification task.

Compare the three Versions V1,V2 and V3 performance under same hyperparameter setting .

Dataset link: https://www.kaggle.com/datasets/gauravduttakiit/mobilenet-v2-dog-classification/code. https://www.kaggle.com/code/gauravduttakiit/dog-classification-mobilenet-v2

Helping links:- https://builtin.com/machine-learning/mobilenet

Unet for image segmentation:-

Task is to first train the U-Net model on the **Oxford-IIIT Pet Dataset** or the **brain tumor T1-Lighted CE-MRI image dataset** to perform foreground-background segmentation and evaluate the segmentation performance using **IoU** (Intersection over Union) and **Dice Coefficient**.

Link to dataset:- https://www.robots.ox.ac.uk/~vgg/data/pets/
https://www.kaggle.com/datasets/devdgohil/the-oxfordiiit-pet-dataset

https://www.kaggle.com/datasets/masoudnickparvar/brain-tumor-mri-dataset

Links for help:- https://www.kaggle.com/code/bryanb/image-segmentation-u-net

https://pyimagesearch.com/2022/02/21/u-net-image-segmentation-in-keras/

https://www.digitalocean.com/community/tutorials/unet-architecture-image-segmentation

https://www.analyticsvidhya.com/blog/2022/10/image-segmentation-with-u-net/#h-application-in-medical-image-processing

Links:-

Image Inpainting:-

https://docs.opencv.org/3.4/df/d3d/tutorial_py_inpainting.html

https://www.geeksforgeeks.org/image-inpainting-using-opencv/

Image Stitching & Panorama stitching:-

https://pyimagesearch.com/2018/12/17/image-stitching-with-opencv-and-python/

https://docs.opencv.org/4.x/d1/d46/group__stitching.html

https://www.opencvhelp.org/tutorials/advanced/image-stitching/

https://pyimagesearch.com/2016/01/11/opencv-panorama-stitching/

https://github.com/sajmaru/Image-Stitching-OpenCV

SfM :- https://imkaywu.github.io/tutorials/sfm/

https://wire.insiderfinance.io/introduction-d51c1f254ad1

https://learnopencv.com/mast3r-sfm-grounding-image-matching-3d/

GAN:- https://github.com/mafda/generative_adversarial_networks_101

https://machinelearningmastery.com/how-to-develop-a-generative-adversarial-network-for-a-cifar-10-small-object-photographs-from-scratch/