Image and Video Processing: Suggested Fields and Applications

1. Image Enhancement & Restoration

Areas

- Noise reduction
- Deblurring
- Contrast enhancement
- Image sharpening
- Color correction

Applications

- Improving low-light images
- Removing motion blur
- Enhancing old/damaged photographs
- Medical image enhancement (X-ray, MRI)

2. Image Filtering & Transform-Based Methods

Areas

- Spatial domain filtering
- Frequency domain filtering
- Edge-preserving filters

Applications

- Edge detection
- Texture enhancement
- Removing specific types of noise (salt & pepper, Gaussian)
- High-pass and low-pass filtering

3. Image Segmentation

Areas

- Thresholding (global, adaptive, Otsu)
- Region growing
- Split-and-merge
- Clustering-based segmentation

Applications

- Tumor or organ segmentation
- Road lane segmentation
- Object region extraction
- Background removal in images

4. Feature Detection & Description

Areas

- Edges (Sobel, Canny)
- Corners (Harris)
- Interest points (FAST, ORB, SIFT-like descriptors)

Applications

- Matching similar images
- Detecting shapes (circles, lines using Hough Transform)
- Recognizing logos or landmarks

5. Object Detection & Recognition (Classical Approaches)

Areas

- Template matching
- Color-based detection
- Haar-cascade detection

Applications

- Face and eye detection
- License plate detection (traditional features)
- Hand gesture detection
- Logo detection

6. Texture Analysis

Areas

- GLCM (Gray-Level Co-occurrence Matrix)
- LBP (Local Binary Patterns)
- Wavelet-based texture analysis

Applications

- Soil texture classification
- Fabric defect detection
- Identifying surface roughness
- Classifying materials (wood, metal, fabric)

7. Morphological Image Processing

Areas

- Erosion, dilation
- Opening, closing
- Morphological gradients

Applications

- Counting objects (cells, shapes, seeds)
- Removing small objects
- Extracting boundaries
- Shape analysis

8. Video Processing & Motion Analysis

Areas

- Background subtraction
- Optical flow
- Motion estimation
- Frame differencing

Applications

- Moving object detection in surveillance
- Traffic monitoring
- People counting
- Detecting abnormal movement patterns

9. Object Tracking

Areas

- Centroid tracking
- KLT (Kanade–Lucas–Tomasi tracker)
- CamShift/MeanShift

Applications

- Tracking cars or pedestrians
- Tracking a moving ball in sports videos
- Tracking hands for gesture recognition
- Tracking animals in agriculture videos

10. Image Compression

Areas

- DCT-based compressions
- Wavelet compression
- Predictive coding

Applications

- Basic JPEG simulation
- Reducing image size for transmission
- Lossless compression of documents

11. Image Registration & Alignment

Areas

- Geometric transformations
- Homography estimation
- Feature-based alignment

Applications

- Panorama stitching
- Aligning satellite images
- Registering before/after medical scans

12. Advanced/Creative Applications

Areas

- Image stylization
- Color quantization
- Image mosaicing
- Video stabilization

Applications

- Creating artistic effects
- Cartoonizing an image (classical methods)
- Removing camera shake from video
- Building a small mosaic from image tiles