IMAGE MANIPULATION

1. Upsample an image twice of the original size Help: https://www.tutorialspoint.com/upsampling-an-image-using-opencv
2. Downsample an image to a half of the image. Help: https://www.tutorialspoint.com/downsampling-an-image-using-opencv
3. Resize an image to a specific size.
4. Take an X-Ray or Satellite image and change the intensity level to 256, 128, 64, and 32. Help: https://theailearner.com/2019/01/29/intensity-level-slicing/
5. Perform basic image operation such as addition and subtraction of two images. Help: https://www.geeksforgeeks.org/arithmetic-operations-on-images-using-opencv-set-1-addition-andsubtraction/

```
import cv2
from google.colab.patches import cv2_imshow
```

```
redfruit = cv2.imread("/content/drive/MyDrive/Computer Vision And image Processing/Images/redfruits.jpg", cv2.IMREAD_COLOR)
cv2_imshow(redfruit)
print(redfruit.shape)
```

```
(426, 640, 3)
```

```
resizeimg = cv2.resize(redfruit, (500, 333))
cv2_imshow(resizeimg)
print(resizeimg.shape)
```

```
(333, 500, 3)
```

Upsample

Upsampling in CVIP involves increasing image resolution or size for various applications like image enhancement and object recognition.

Upsampling Techniques:

1. Nearest Neighbor: Simple replication of pixels, prone to aliasing.
2. Bilinear Interpolation: Interpolates between neighboring pixels for smoother results.
3. Bicubic Interpolation: Uses a cubic polynomial to estimate pixel intensities, producing high-quality results.

Applications:

1. Image Super-Resolution: Enhances low-resolution images by reconstructing fine details.
2. Semantic Segmentation: Improves spatial resolution of feature maps for accurate pixel classification.
3. Image Registration: Enhances image resolution for better alignment in registration tasks.

Conclusion: Upsampling plays a crucial role in CVIP, utilizing interpolation techniques to enhance image quality and resolution for various applications.

```
upscale = cv2.pyrUp(redfruit)
cv2_imshow(upscale)
print(upscale.shape)
```

Downsampling

Downsampling in CVIP involves reducing image resolution for various purposes like computational efficiency and compression.

Downsampling Techniques:

1. Average Pooling: Computes average intensity in non-overlapping regions.
2. Max Pooling: Selects maximum intensity from non-overlapping regions.
3. Subsampling: Discards pixels to reduce resolution drastically.

Applications:

1. CNNs: Reduces spatial dimensions between convolutional layers for computational efficiency.
2. Image Compression: Used in JPEG and other compression techniques to discard redundant information.
3. Data Reduction: Decreases dataset size for faster processing and lower memory requirements.

Conclusion: Downsampling is crucial in CVIP for reducing image resolution while preserving important features. Techniques like average pooling, max pooling, and subsampling serve specific purposes in different applications. Understanding these techniques is essential for practical CVIP implementation.

```
downscale = cv2.pyrDown(redfruit)
cv2_imshow(downscale)
print(downscale.shape)
```

```
(213, 320, 3)
```

X-ray

X-ray imaging is pivotal in medical diagnosis, industrial inspection, and security screening, involving the analysis of X-ray images for diverse applications.

Techniques:

1. Radiography: Traditional method for medical diagnosis and industrial testing.
2. Computed Tomography (CT): Produces 3D images by combining X-ray projections from multiple angles.
3. Digital Radiography (DR): Uses digital detectors for quicker image acquisition and processing.

Applications:

1. Medical Diagnosis: Identifying fractures, tumors, and internal abnormalities.
2. Industrial Inspection: Quality control in manufacturing, detecting defects and foreign objects.
3. Security Screening: Detecting weapons and contraband in luggage and cargo.

Considerations:

1. Radiation Exposure: Minimizing patient exposure in medical imaging.
2. Image Quality: Ensuring high-quality images for accurate diagnosis and inspection.
3. Data Management: Efficient handling of large volumes of X-ray data.

Conclusion: X-ray imaging is indispensable in CVIP, facilitating non-invasive examination for medical, industrial, and security purposes. Understanding its principles and applications is vital for effective utilization in various CVIP tasks.

```
Xray = cv2.resize(cv2.imread("/content/drive/MyDrive/Computer Vision And image Processing/Images/X-ray.jpg"), (350,400))
cv2_imshow(Xray)
```

```
for i in range(0,4):
  scalar_value = int(input("enter the intensity level: " ))
  intensified_img = cv2.add(Xray, scalar_value)
  cv2_imshow(intensified_img)
```

enter the intensity level: 256

enter the intensity level: 128

enter the intensity level: 64

enter the intensity level: 32

Addition and Subtraction

In CVIP, addition and subtraction are fundamental operations used for tasks like image blending, contrast adjustment, and noise reduction.

Addition:

- Involves adding corresponding pixel values of two images.
- Used for tasks like image blending to create composite images.
- Can lead to overflow if not managed properly.

Subtraction:

- Involves subtracting pixel values of one image from another.
- Used for tasks like contrast adjustment to enhance image details.
- May result in negative values, requiring clipping or scaling.

Applications:

1. Image Blending: Combines images seamlessly for panoramas and special effects.
2. Contrast Adjustment: Enhances contrast by subtracting scaled versions of the image.
3. Noise Reduction: Subtracts noise estimates from original images to improve quality.

Conclusion: Addition and subtraction are essential in CVIP for various tasks, including blending, contrast enhancement, and noise reduction, contributing to effective image processing techniques.

```
bird = cv2.resize(cv2.imread("/content/drive/MyDrive/Computer Vision And image Proc
snake = cv2.resize(cv2.imread("/content/drive/MyDrive/Computer Vision And image Pro

added_image = cv2.addWeighted(bird, 0.5, snake, 0.5, 0)

cv2_imshow(added_image)
```

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