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1. Installation

```
pip install pillow
```

Verify Installation:

```
from PIL import Image
print(Image.__version__)
```

2. Import Pillow

```
from PIL import Image, ImageDraw, ImageFont, ImageFilter
```

3. Opening and Displaying an Image

```
img = Image.open('image.jpg')  
img.show()
```

4. Saving an Image

```
img.save('output.jpg')
```

5. Image Properties

```
print(img.format)      # Image format (JPEG, PNG)  
print(img.size)        # (width, height)  
print(img.mode)        # Color mode (RGB, L)
```

6. Resizing an Image

```
resized = img.resize((300, 200))  
resized.show()
```

7. Cropping an Image

```
cropped = img.crop((50, 50, 200, 200)) # (left, top, right, bottom)
cropped.show()
```

8. Rotating and Flipping

```
rotated = img.rotate(45)
flipped = img.transpose(Image.FLIP_LEFT_RIGHT)
rotated.show()
flipped.show()
```

9. Converting to Grayscale

```
gray = img.convert('L')
gray.show()
```

10. Drawing on Images

```
draw = ImageDraw.Draw(img)
draw.rectangle([50, 50, 150, 150], outline='red', width=5)
draw.text((10, 10), "Hello!", fill='white')
img.show()
```

11. Adding Filters

```
blurred = img.filter(ImageFilter.BLUR)
sharpened = img.filter(ImageFilter.SHARPEN)
blurred.show()
```

```
sharpened.show()
```

12. Adding Text (Custom Fonts)

```
font = ImageFont.truetype("arial.ttf", 40)
draw = ImageDraw.Draw(img)
draw.text((50, 50), "Hello World!", font=font, fill='blue')
img.show()
```

13. Creating a New Image

```
new_img = Image.new('RGB', (400, 300), color='green')
new_img.show()
```

14. Merging Images (Pasting)

```
background = Image.new('RGB', (500, 500), color='white')
foreground = img.resize((200, 200))
background.paste(foreground, (150, 150))
background.show()
```

15. Applying Transparency (Alpha Channel)

```
img = img.convert("RGBA")
pixels = img.load()

for y in range(img.height):
    for x in range(img.width):
        r, g, b, a = pixels[x, y]
        if r > 200 and g > 200:
```

```
pixels[x, y] = (r, g, b, 0) # Set transparent  
  
img.show()
```

16. Thumbnail Generation

```
img.thumbnail((150, 150))  
img.show()
```

17. Drawing Shapes

```
draw = ImageDraw.Draw(img)  
draw.ellipse([100, 100, 200, 200], outline='yellow', width=4)  
draw.line((0, 0, img.width, img.height), fill='blue', width=3)  
img.show()
```

18. Image Blending

```
img1 = Image.open('image1.jpg')  
img2 = Image.open('image2.jpg')  
blended = Image.blend(img1, img2, alpha=0.5)  
blended.show()
```

19. Image Masking

```
mask = Image.new("L", img.size, 128) # 128 is 50% opacity  
img.putalpha(mask)  
img.show()
```

20. Combining Multiple Images (Grid Layout)

```
images = [Image.open('image1.jpg'), Image.open('image2.jpg')]
widths, heights = zip(*(i.size for i in images))

total_width = sum(widths)
max_height = max(heights)

combined = Image.new('RGB', (total_width, max_height))
x_offset = 0

for img in images:
    combined.paste(img, (x_offset, 0))
    x_offset += img.width

combined.show()
```

21. Image Metadata (EXIF)

```
exif_data = img._getexif()
for tag, value in exif_data.items():
    print(tag, value)
```

22. Key Pillow Functions

Function	Description
Image.open()	Opens an image file
Image.save()	Saves an image
resize()	Resizes an image
rotate()	Rotates an image

Function	Description
crop()	Crops an image
convert()	Converts image mode
filter()	Applies filters (BLUR, SHARPEN, etc.)
transpose()	Flips or rotates image
draw.rectangle()	Draws a rectangle
putalpha()	Adds transparency
thumbnail()	Creates a thumbnail
paste()	Pastes one image over another

Example: Simple Image Pipeline (Resize, Filter, Text)

```
img = Image.open('image.jpg')
img = img.resize((300, 300))
img = img.filter(ImageFilter.CONTOUR)

draw = ImageDraw.Draw(img)
draw.text((20, 20), 'OpenCV Rocks!', fill='blue')
img.show()
```