Process Automation Engineering

Image Processing

Laboratory Work 3

Image Enhancement

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Task 1: Image Enhancement with PIL

Task 1.1: Read and Display the Original Image

Code:

```python
from PIL import Image, ImageEnhance

# Task 1: Read and Display the Original Image
original_image = Image.open("flame_towers.png")
original_image.show(title="Original Image")
original_image.save("flame_towers_original.png")
```

Result:

Original Flame Towers Image

Task 1.2: Increase Brightness

Code:

```python
# Task 2: Increase Brightness
bright_image = ImageEnhance.Brightness(original_image).enhance
    (1.5)
bright_image.show(title="Brightness Increased")
bright_image.save("flame_towers_brightness.png")
```

Result:

Brightness Enhanced (Factor: 1.5)

Task 1.3: Increase Contrast

Code:

```
# Task 3: Increase Contrast
contrast_image = ImageEnhance.Contrast(original_image).enhance
    (2.0)
contrast_image.show(title="Contrast Increased")
contrast_image.save("flame_towers_contrast.png")
```

Result:

Contrast Enhanced (Factor: 2.0)

Task 1.4: Increase Sharpness

Code:

```
# Task 4: Increase Sharpness
sharp_image = ImageEnhance.Sharpness(original_image).enhance(4.0)
sharp_image.show(title="Sharpness Increased")
sharp_image.save("flame_towers_sharpness.png")
```

Result:

Sharpness Enhanced (Factor: 4.0)

Task 2: Arithmetic Operations with OpenCV

Task 2.1: Read and Resize Images

Code:

```python
import cv2 as cv
import matplotlib.pyplot as plt

# Read images
ronaldo_img = cv.imread("ronaldo.png")
messi_img = cv.imread("messi.png")

# Resize images to the same size
target_size = (1200, 740)
ronaldo_resized = cv.resize(ronaldo_img, target_size)
messi_resized = cv.resize(messi_img, target_size)

# Convert BGR to RGB for Matplotlib
ronaldo_rgb = cv.cvtColor(ronaldo_resized, cv.COLOR_BGR2RGB)
messi_rgb = cv.cvtColor(messi_resized, cv.COLOR_BGR2RGB)
```

Result:

Ronaldo (Original)

Messi (Original)

Task 2.2: Addition Operation

Code:

```python
# Addition
added_img = cv.add(ronaldo_resized, messi_resized)
cv.imwrite("ronaldo_messi_addition.png", added_img)
added_rgb = cv.cvtColor(added_img, cv.COLOR_BGR2RGB)
```

Result:

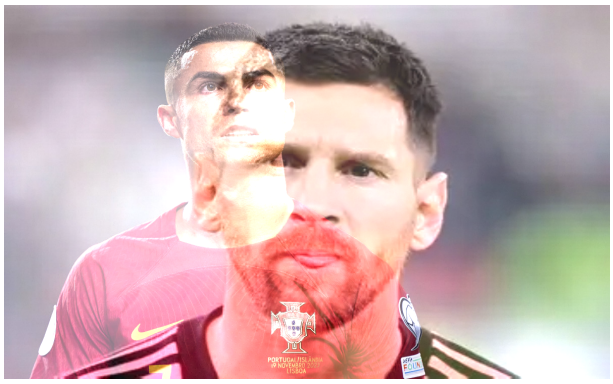


Image Addition: Ronaldo + Messi

Task 2.3: Subtraction Operation

Code:

```
# Subtraction
subtracted_img = cv.subtract(ronaldo_resized, messi_resized)
cv.imwrite("ronaldo_messi_subtraction.png", subtracted_img)
subtracted_rgb = cv.cvtColor(subtracted_img, cv.COLOR_BGR2RGB)
```

Result:

Image Subtraction: Ronaldo - Messi

Task 2.4: Multiplication Operation

Code:

```
# Multiplication with scalar
scalar_mult = 1.5
multiplied_img = cv.convertScaleAbs(ronaldo_resized * scalar_mult
    )
cv.imwrite("ronaldo_multiplication.png", multiplied_img)
multiplied_rgb = cv.cvtColor(multiplied_img, cv.COLOR_BGR2RGB)
```

Result:

Image Multiplication: Ronaldo × 1.5

Task 2.5: Division Operation

Code:

```
# Division with scalar
scalar_div = 2.0
divided_img = cv.convertScaleAbs(ronaldo_resized / scalar_div)
cv.imwrite("ronaldo_division.png", divided_img)
divided_rgb = cv.cvtColor(divided_img, cv.COLOR_BGR2RGB)
```

Result:

Image Division: Ronaldo ÷ 2.0

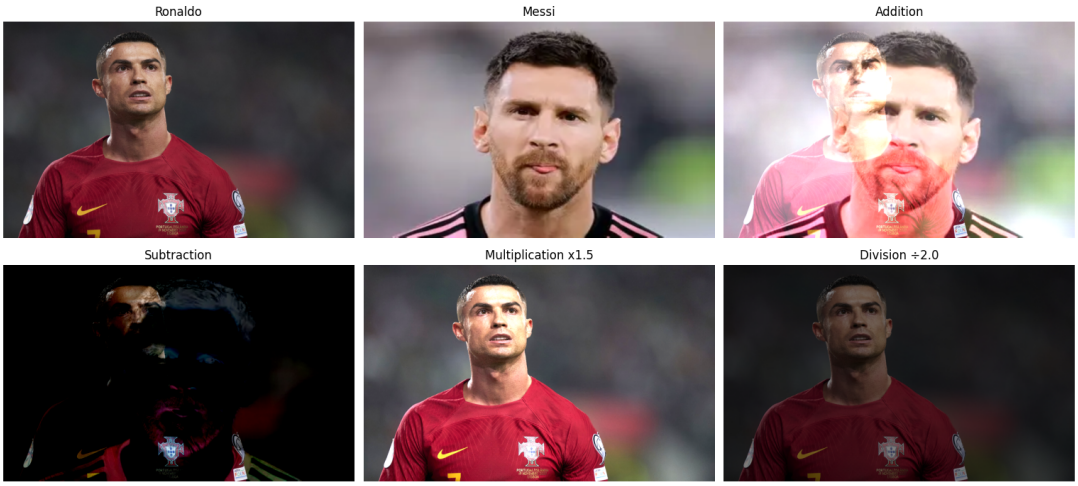
Task 2.6: Display All Operations

Code:

```
fig, axes = plt.subplots(2, 3, figsize=(18, 10))

axes[0, 0].imshow(ronaldo_rgb)
axes[0, 0].set_title("Ronaldo")
axes[0, 0].axis("off")

axes[0, 1].imshow(messi_rgb)
```

```
axes[0, 1].set_title("Messi")
axes[0, 1].axis("off")

axes[0, 2].imshow(added_rgb)
axes[0, 2].set_title("Addition")
axes[0, 2].axis("off")

axes[1, 0].imshow(subtracted_rgb)
axes[1, 0].set_title("Subtraction")
axes[1, 0].axis("off")

axes[1, 1].imshow(multiplied_rgb)
axes[1, 1].set_title(f"Multiplication x{scalar_mult}")
axes[1, 1].axis("off")

axes[1, 2].imshow(divided_rgb)
axes[1, 2].set_title(f"Division / {scalar_div}")
axes[1, 2].axis("off")

plt.tight_layout()
plt.show()
```

Result:



All Arithmetic Operations Combined