

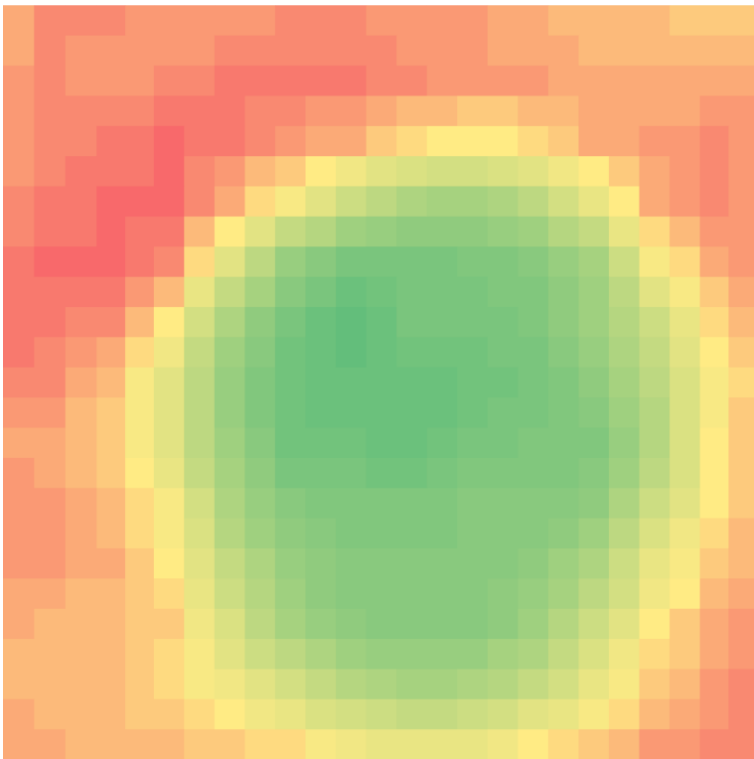
Mathematical Operations On Images

Image Processing & Analysis for Life Scientists

Olivier Burri, Romain Guiet & Arne Seitz

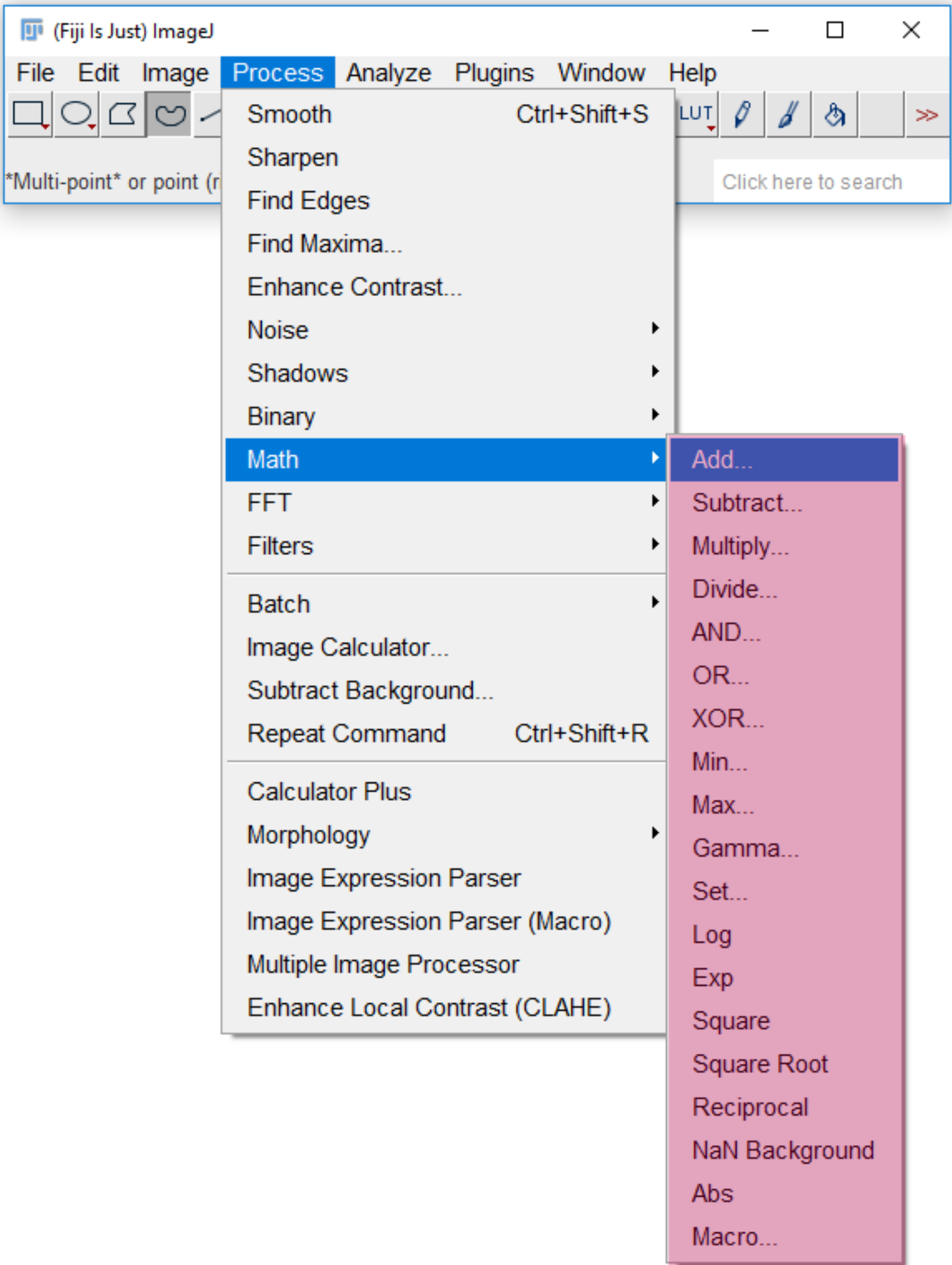
- Global Operations
- Image to Image Operations

Global Operations

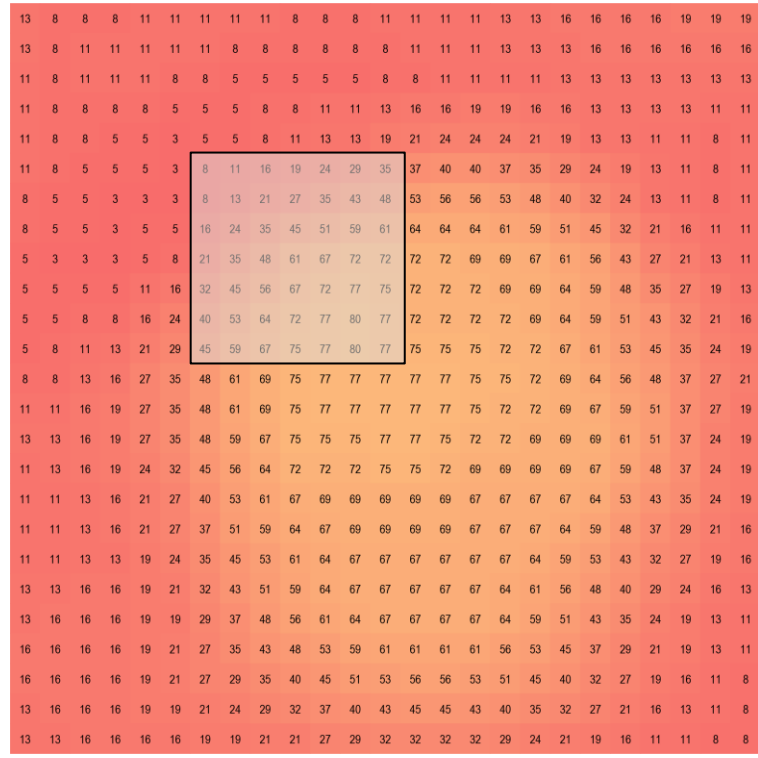
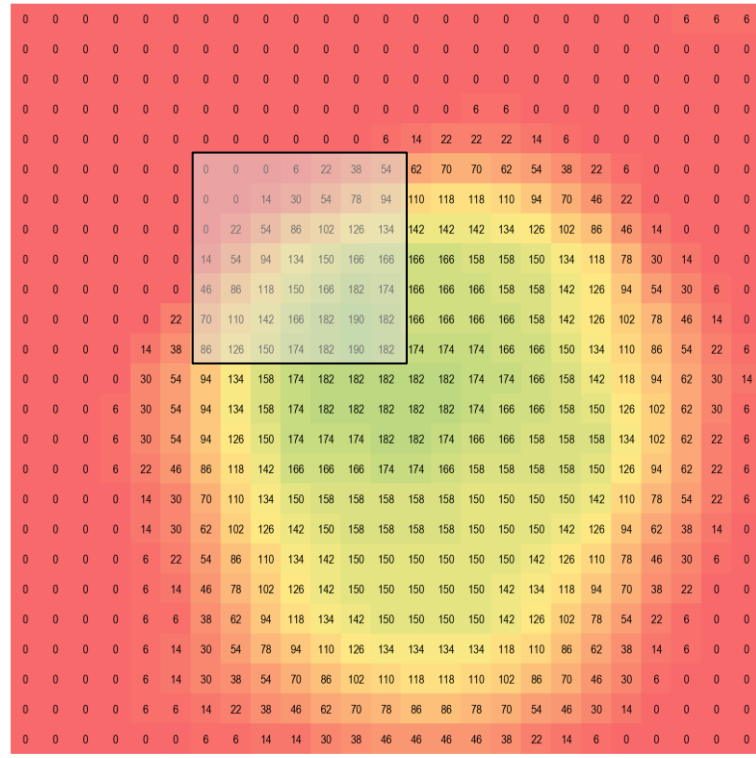
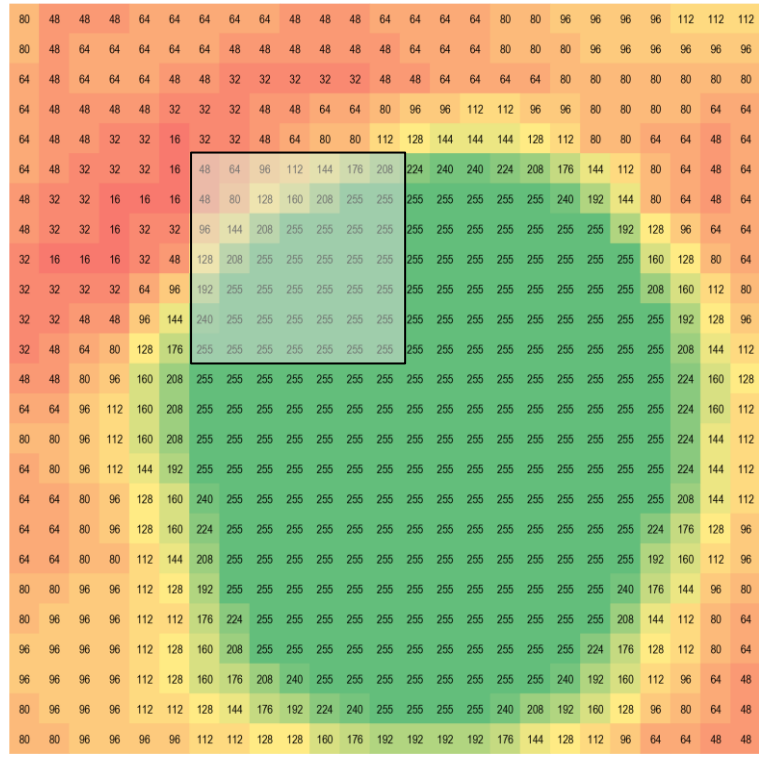
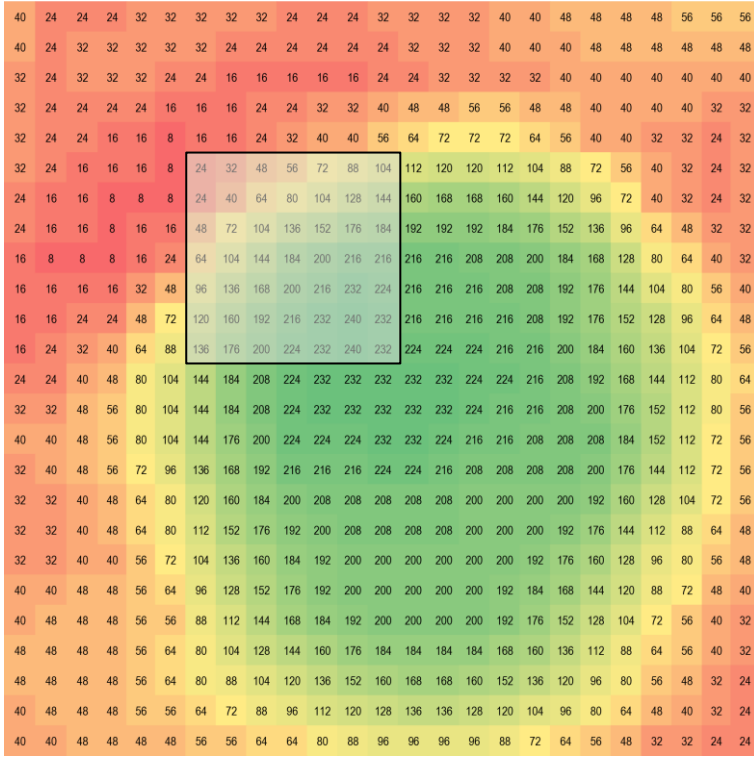


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$+$ $-$ \div \times



Global Operations

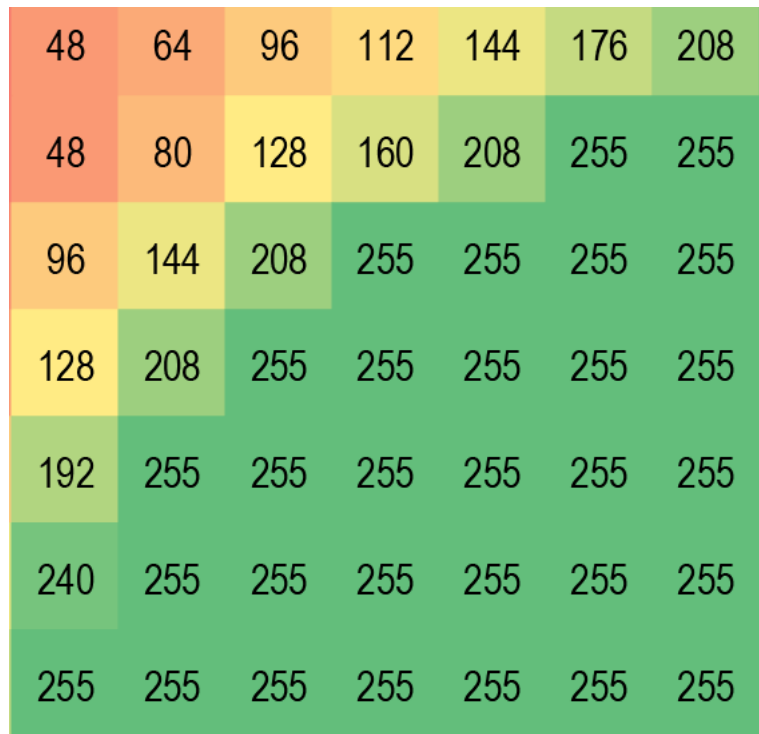
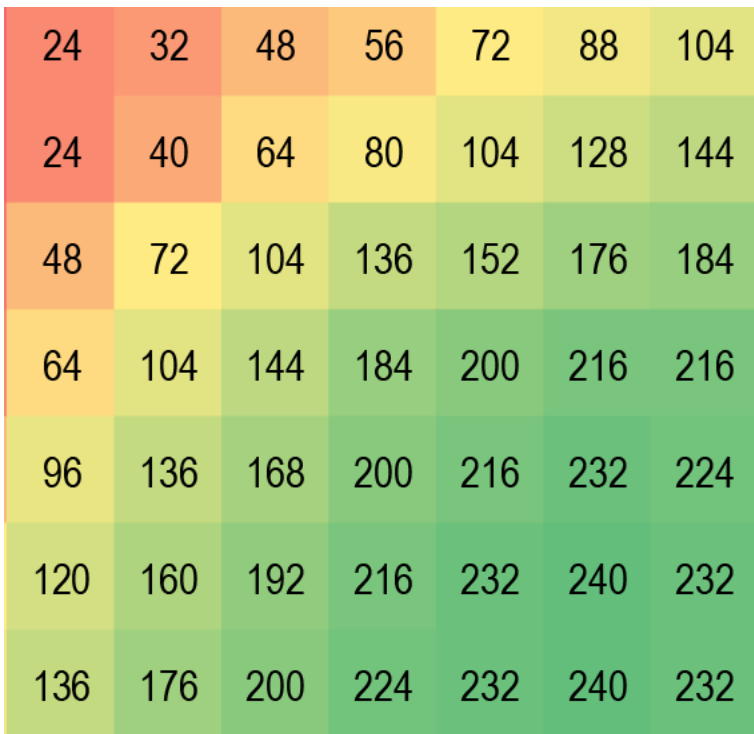


Original

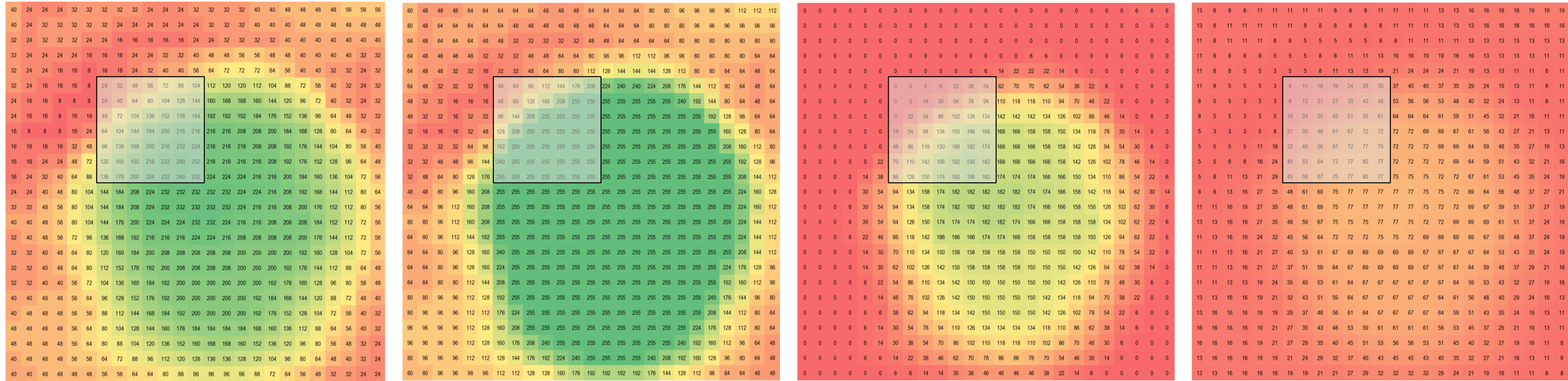
$\times 2$

- 50

$$\div 3$$



Data Clipping



Original 8-bit

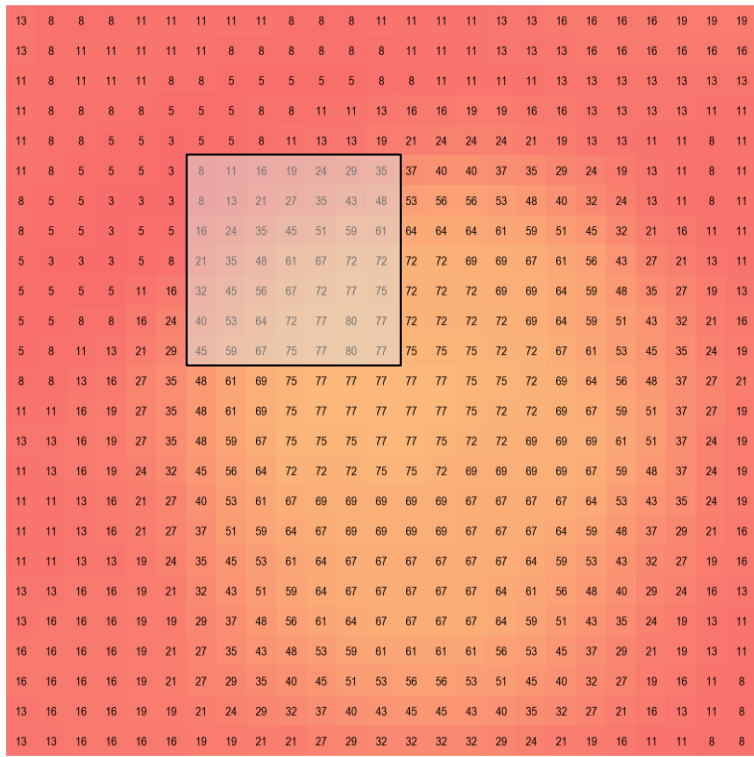
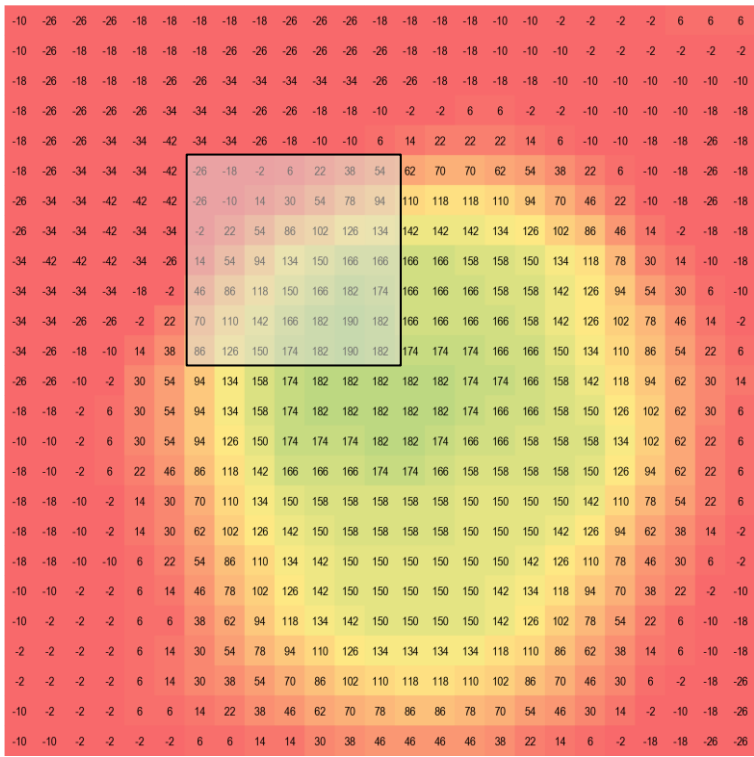
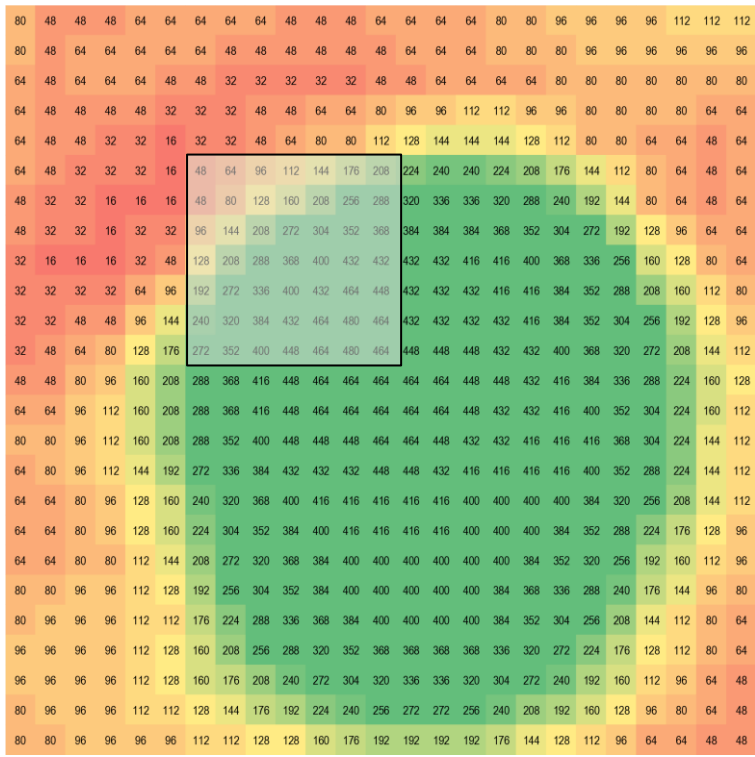
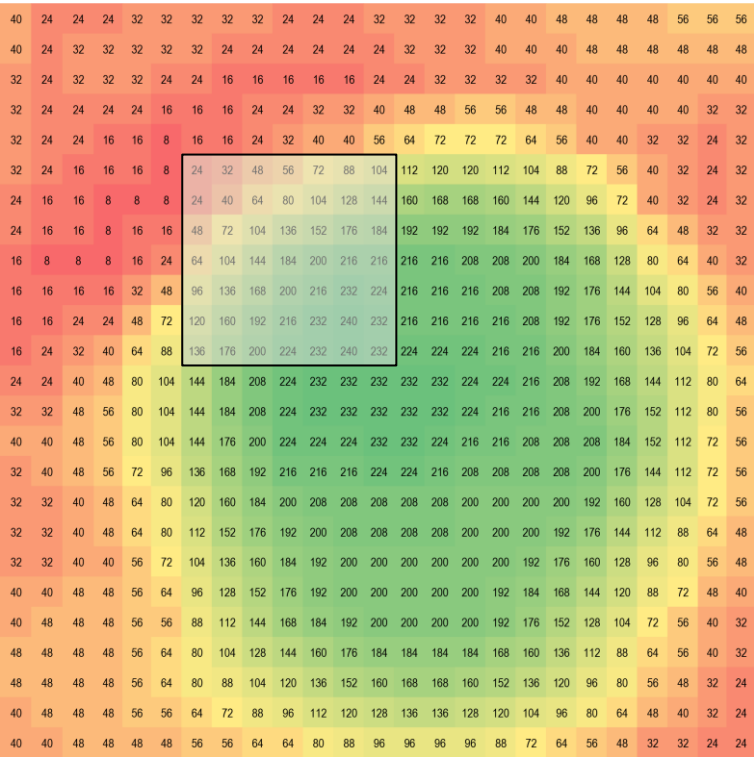
$\times 2$

- 50

$$\div 3$$



Data Clipping

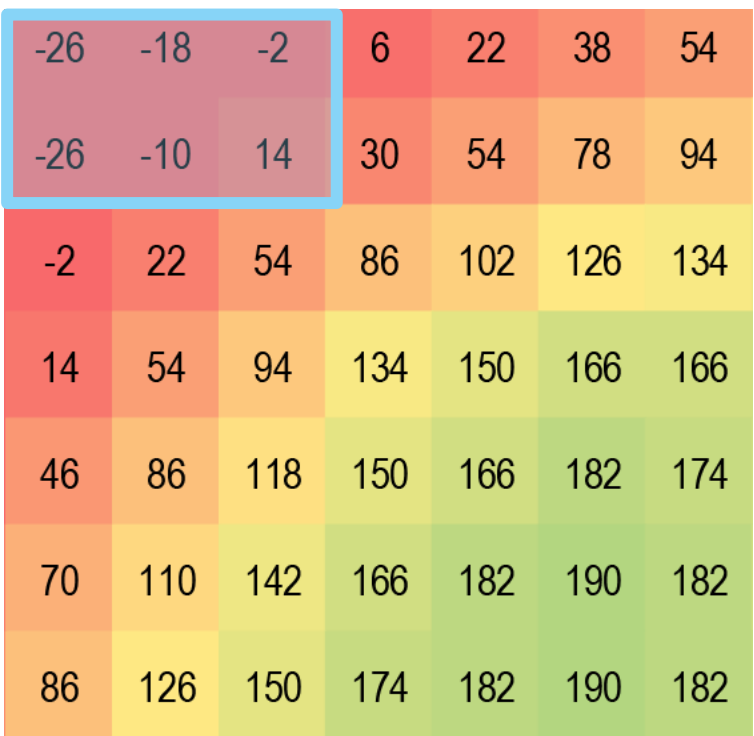
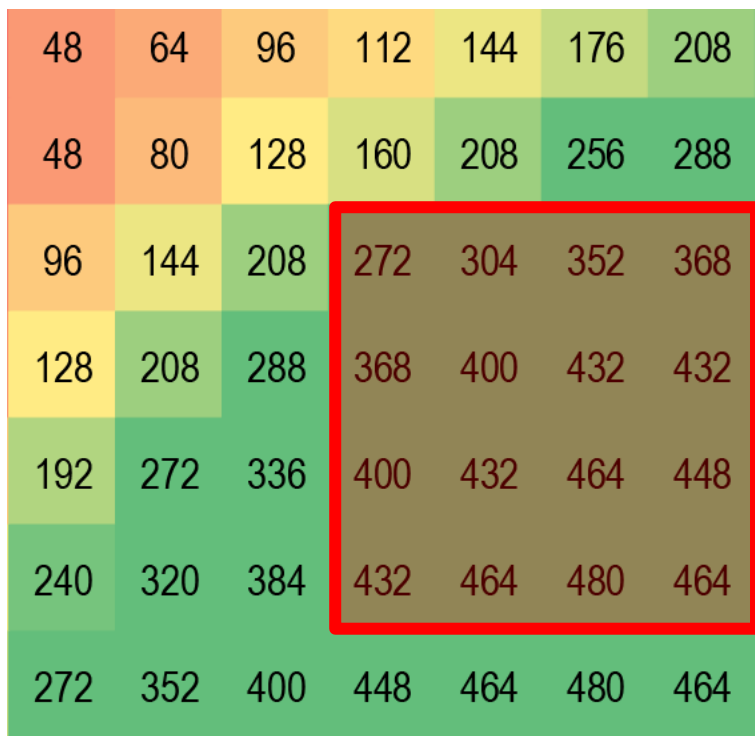
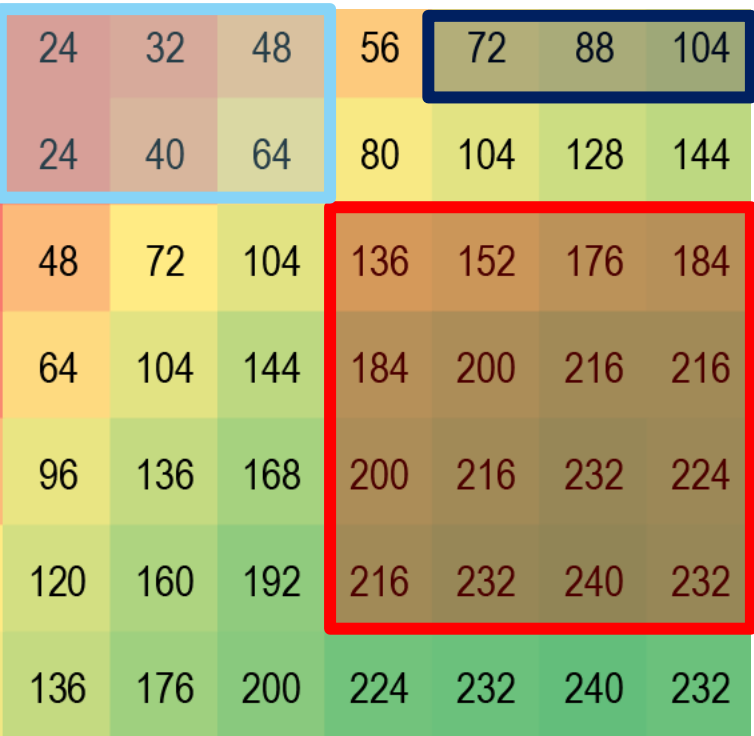


Original 32-bit

$\times 2$

$- 50$

$\div 3$



Global Operations

- Image Normalization



Simple Normalization

For each slice

1. Subtract min value
2. Divide by (max-min) value
3. Multiply by desired mean

$$I_{new} = \frac{I - I_{min}}{I_{max} - I_{min}} \times \mu_{new}$$

- Image Normalization



Simple Normalization

For each slice

1. Subtract min value
2. Divide by (max-min) value
3. Multiply by desired mean

$$I_{new} = \frac{I - I_{min}}{I_{max} - I_{min}} \times \mu_{new}$$

- Image Normalization
- Intensity Flattening

Reduce Large Contributions

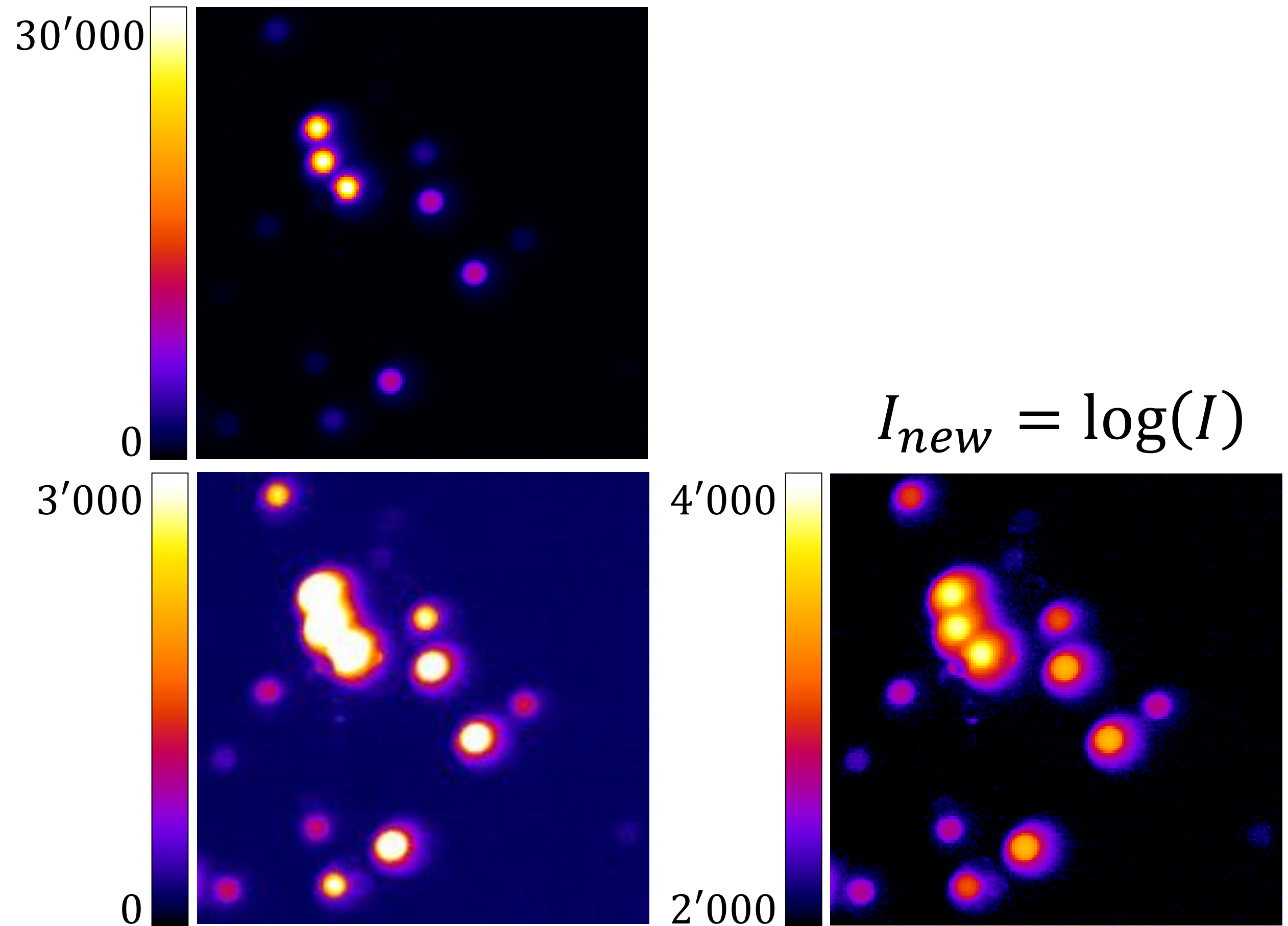


Image to Image Operations

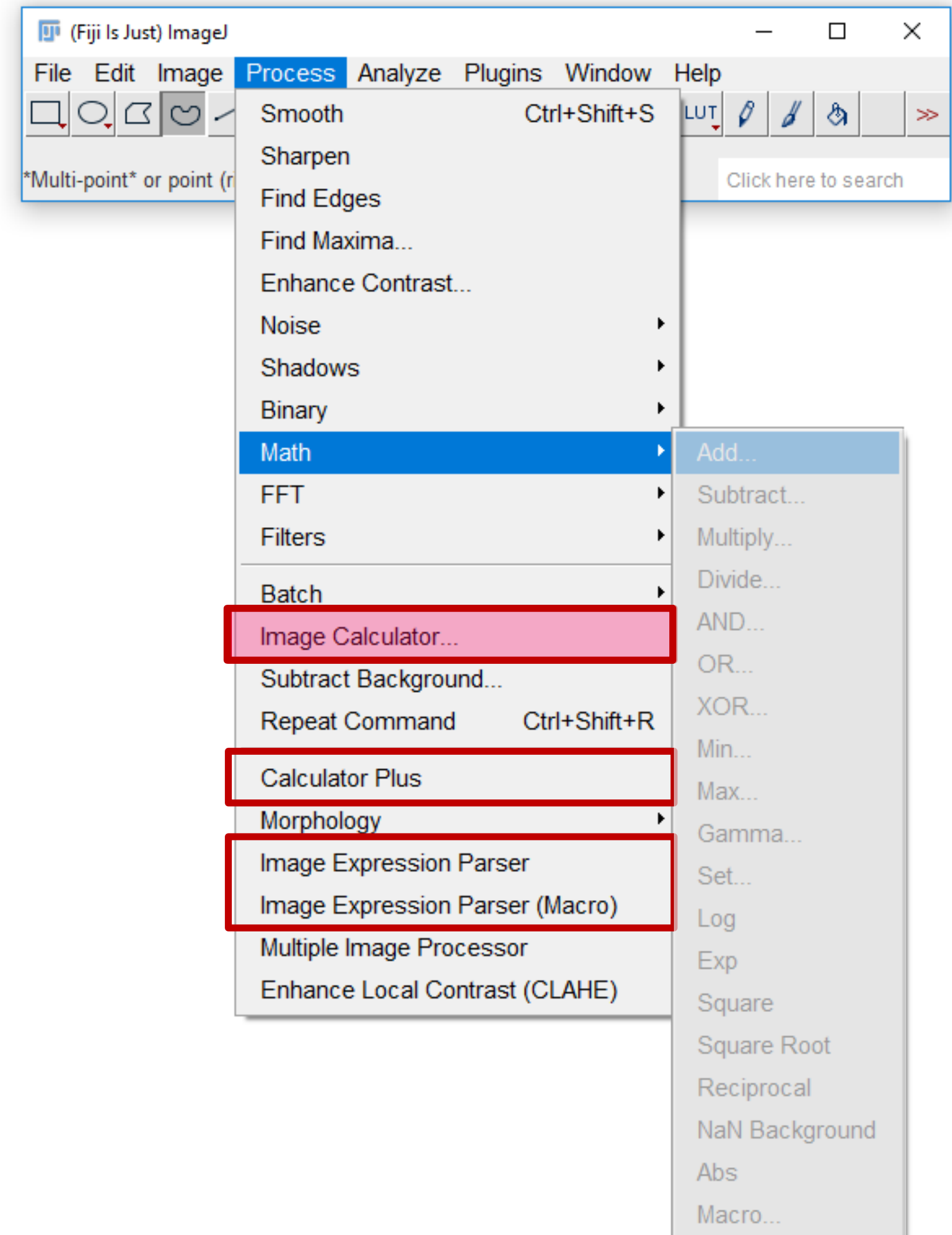


Image to Image Operations

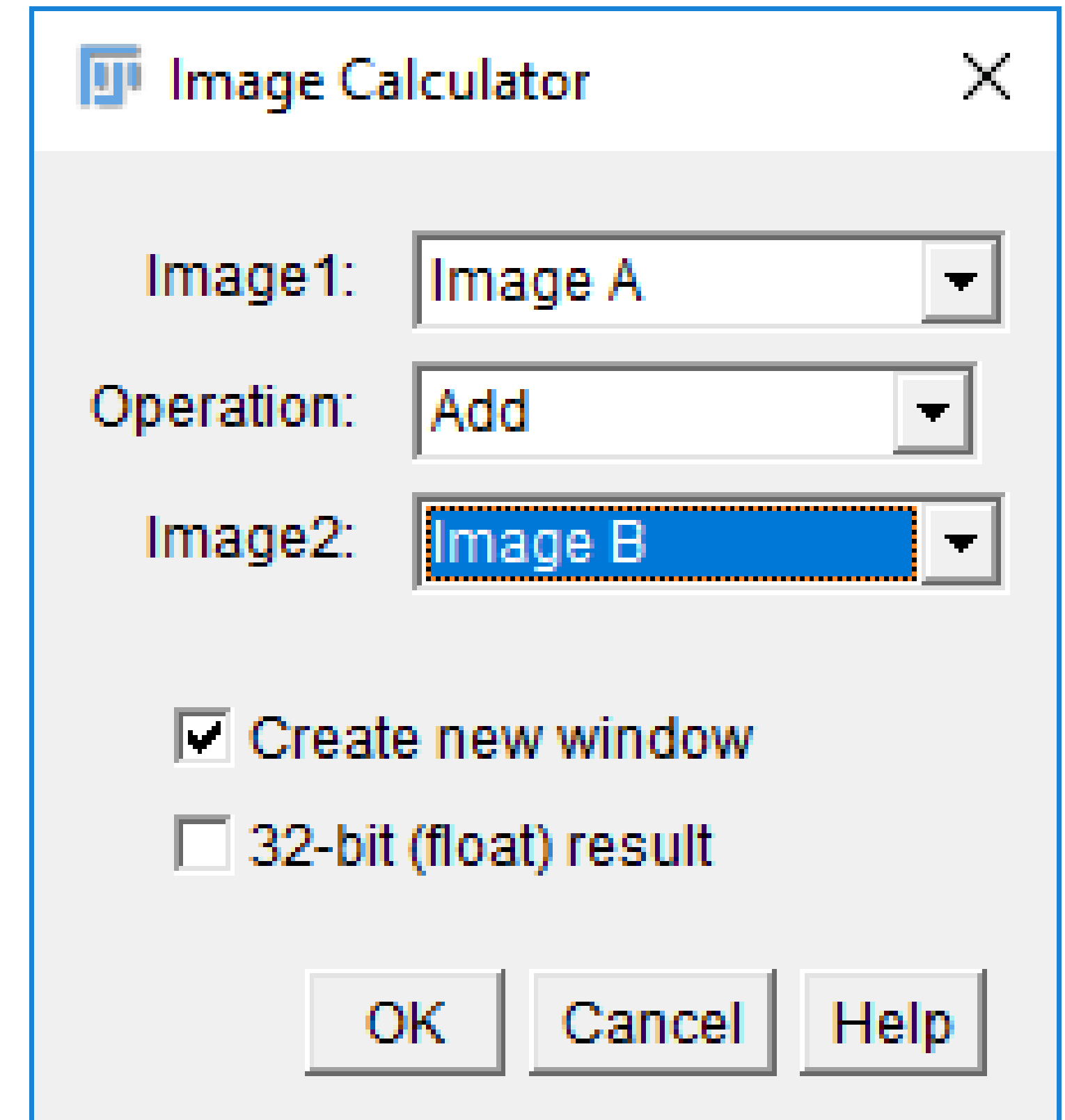
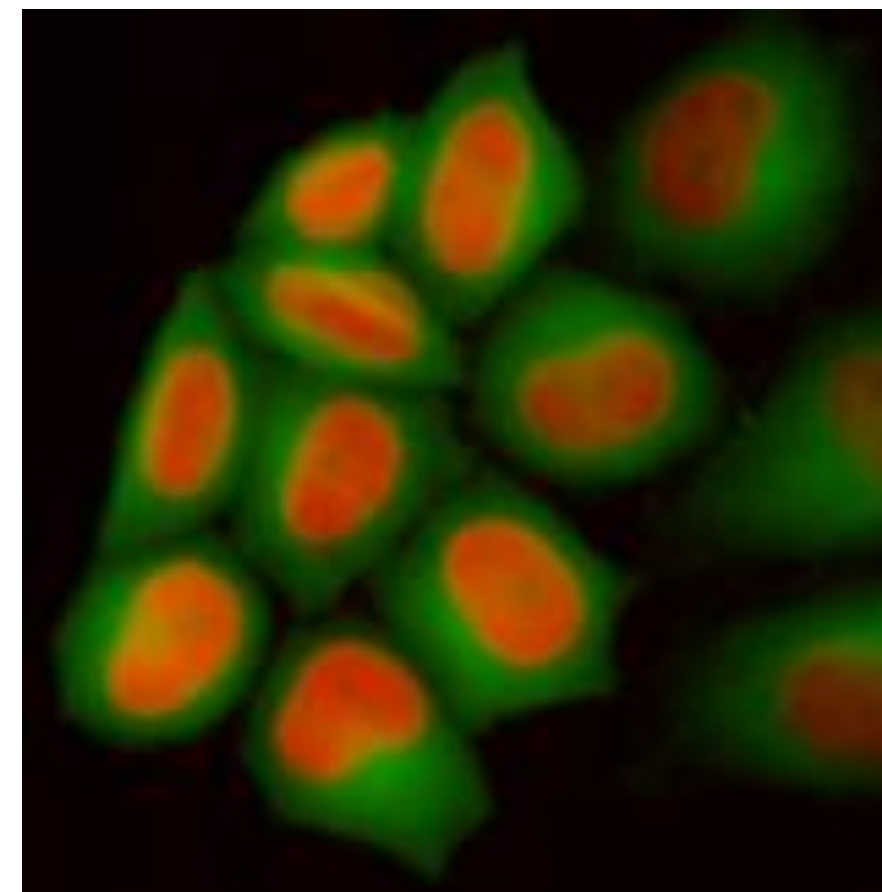


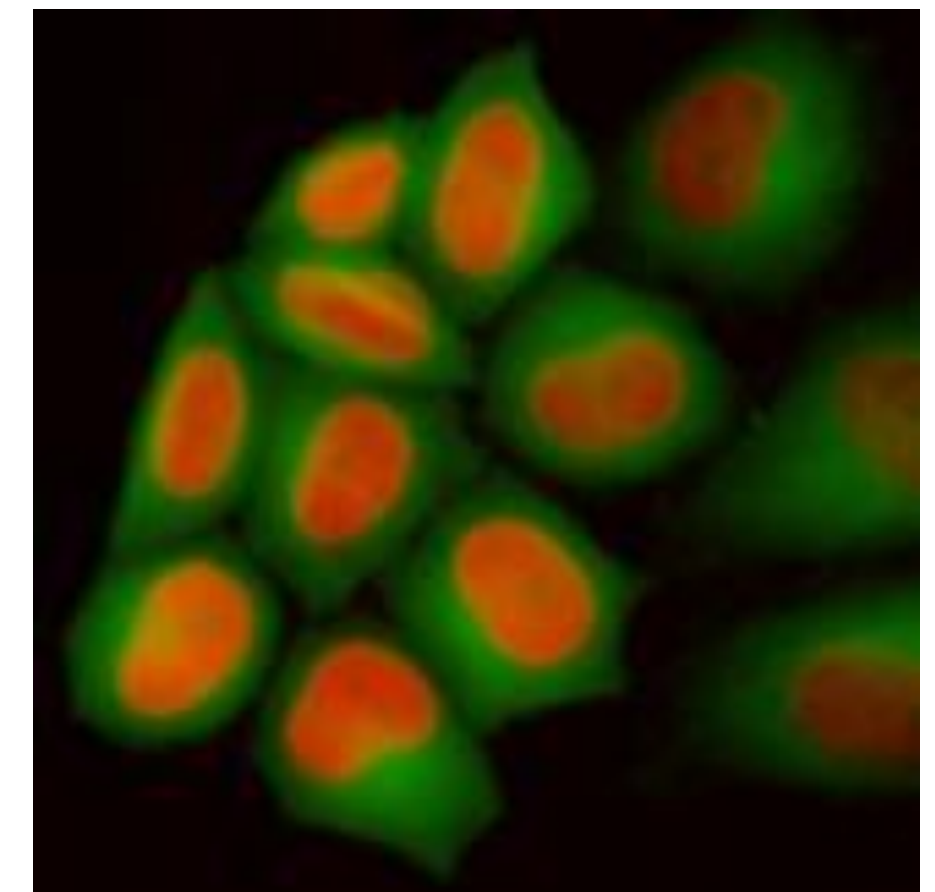
Image To Image Operations

- Checking Image Artifacts

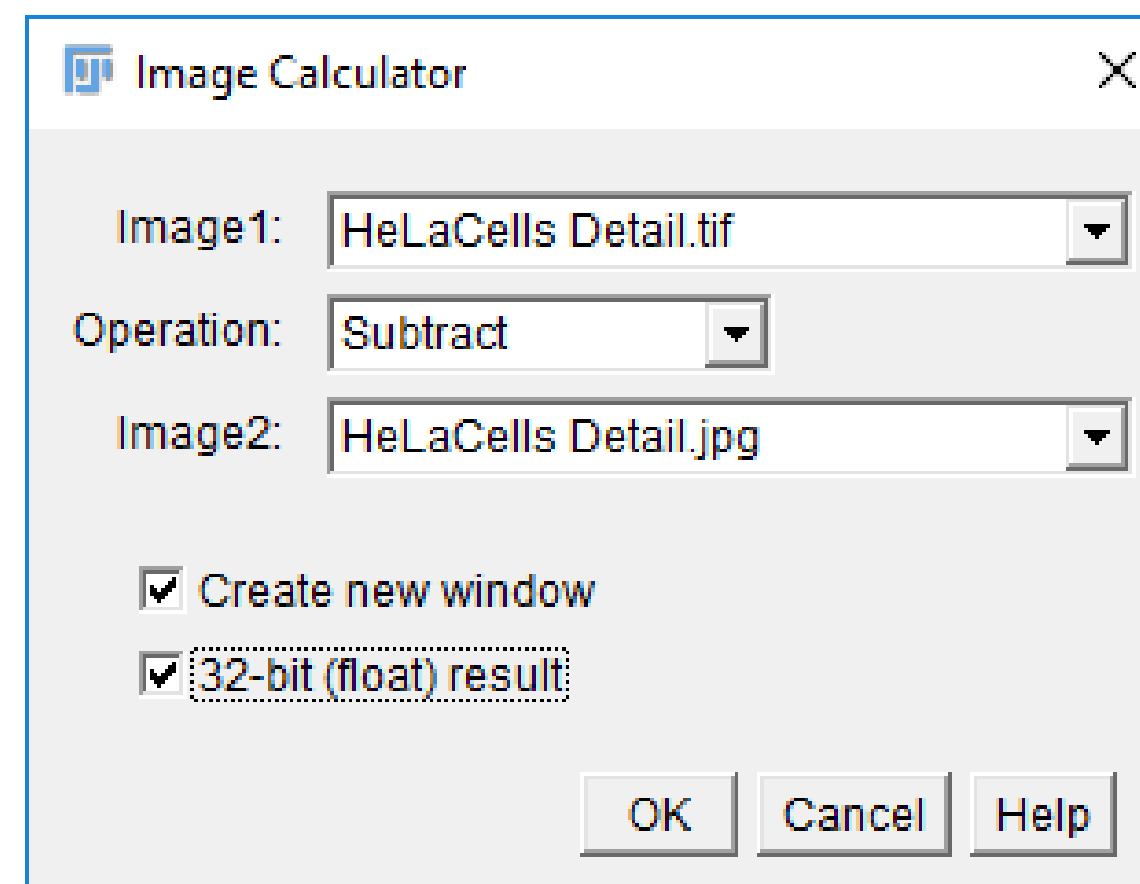
Raw



JPEG



—



7.0

-10.0

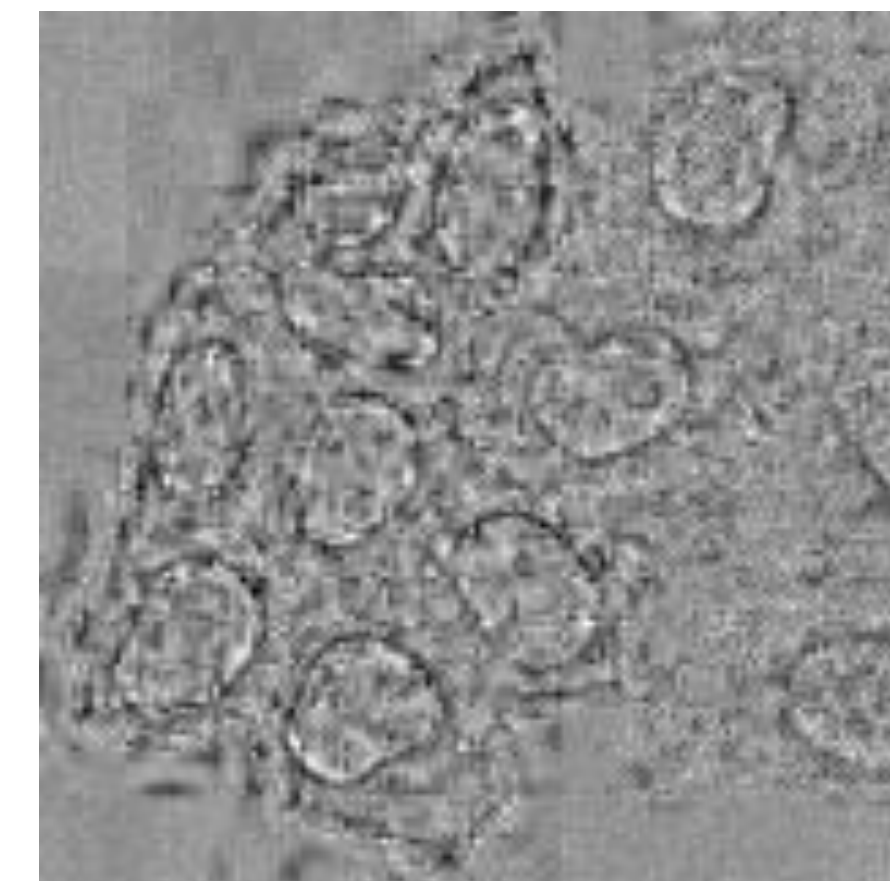


Image To Image Operations

- Checking Image Artifacts
- Ratio Imaging

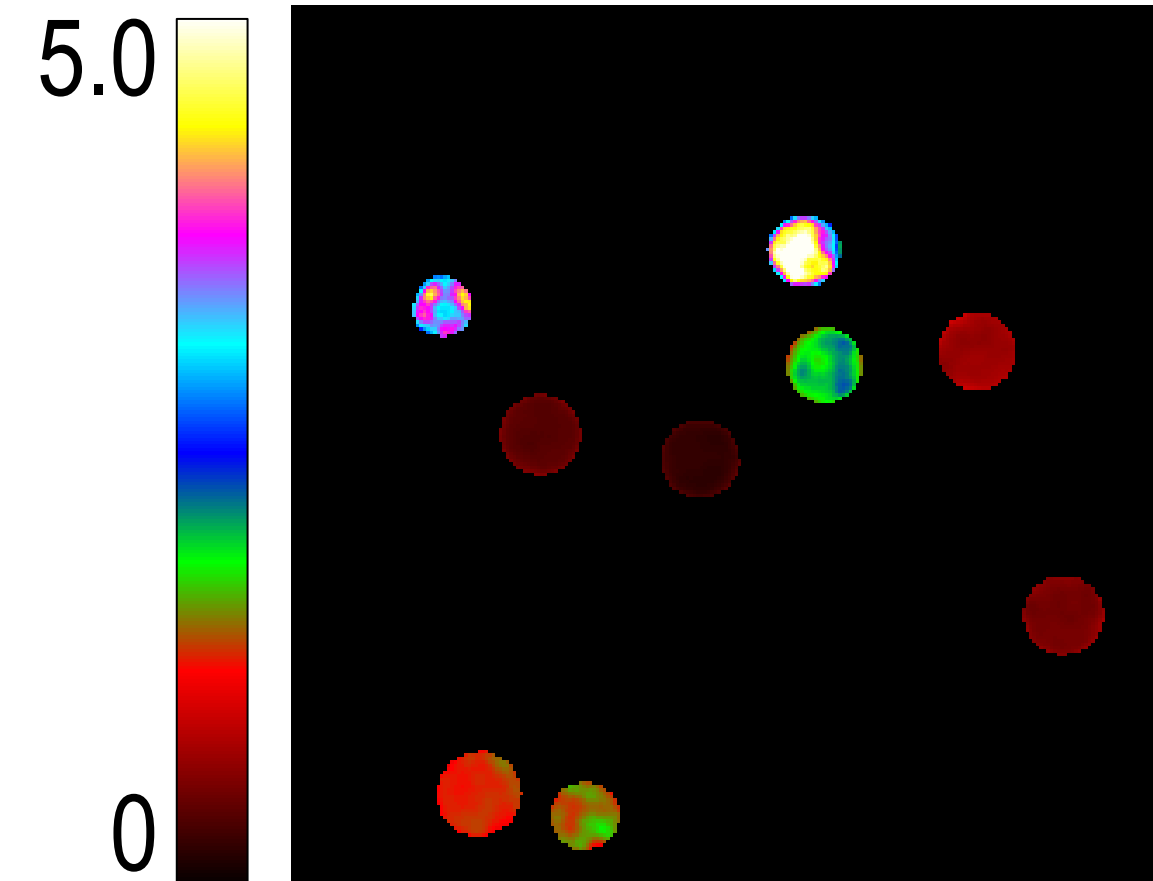
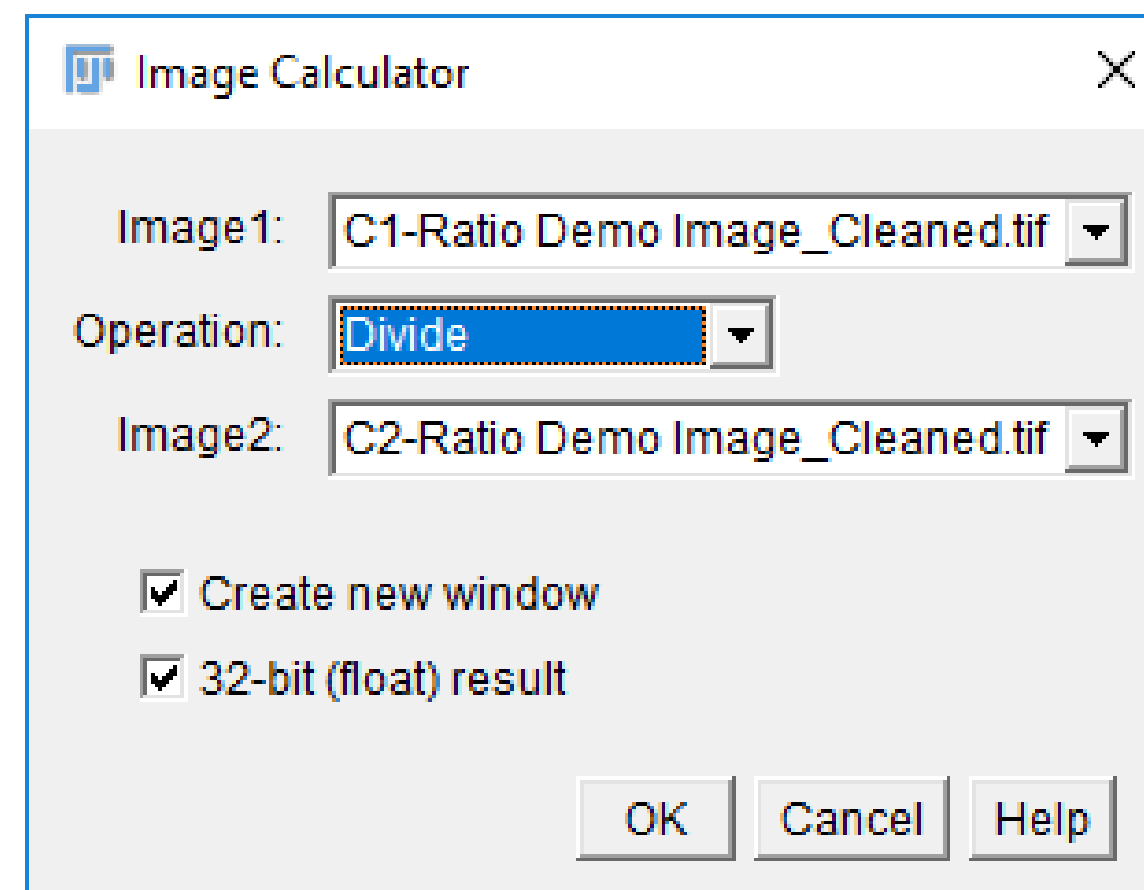
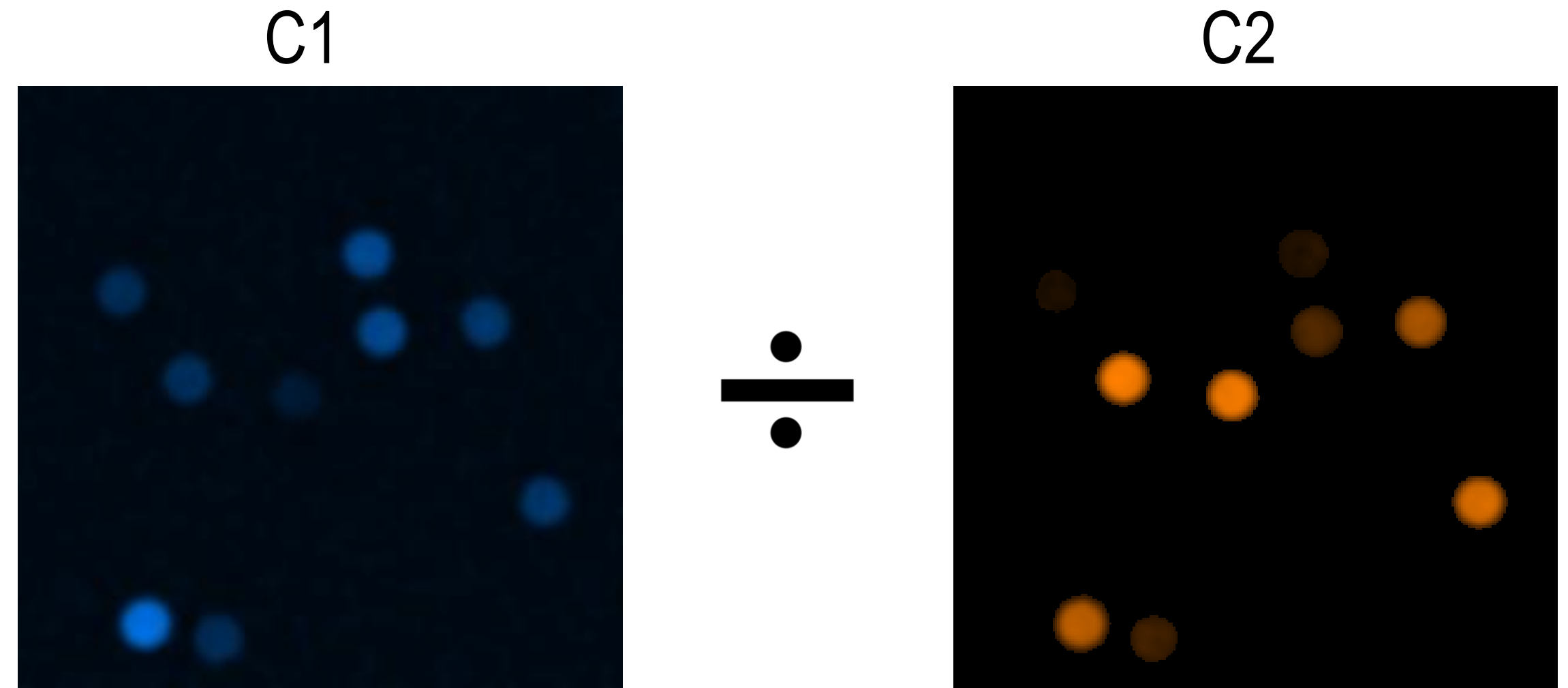
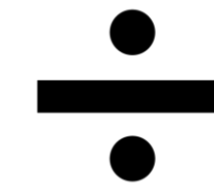
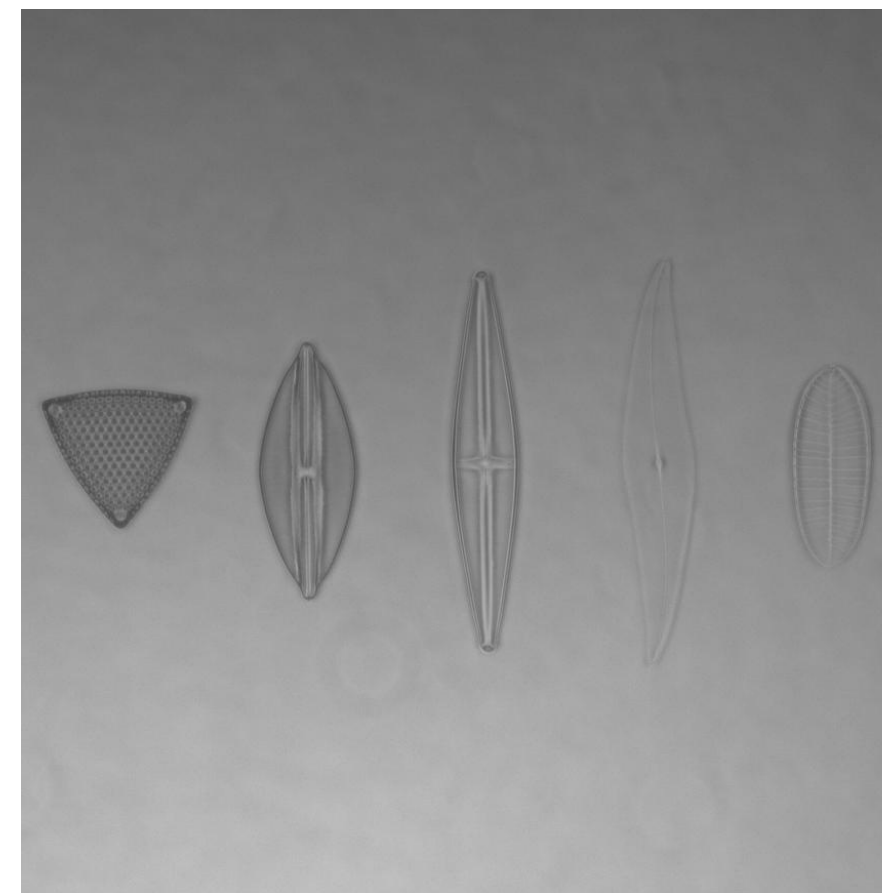


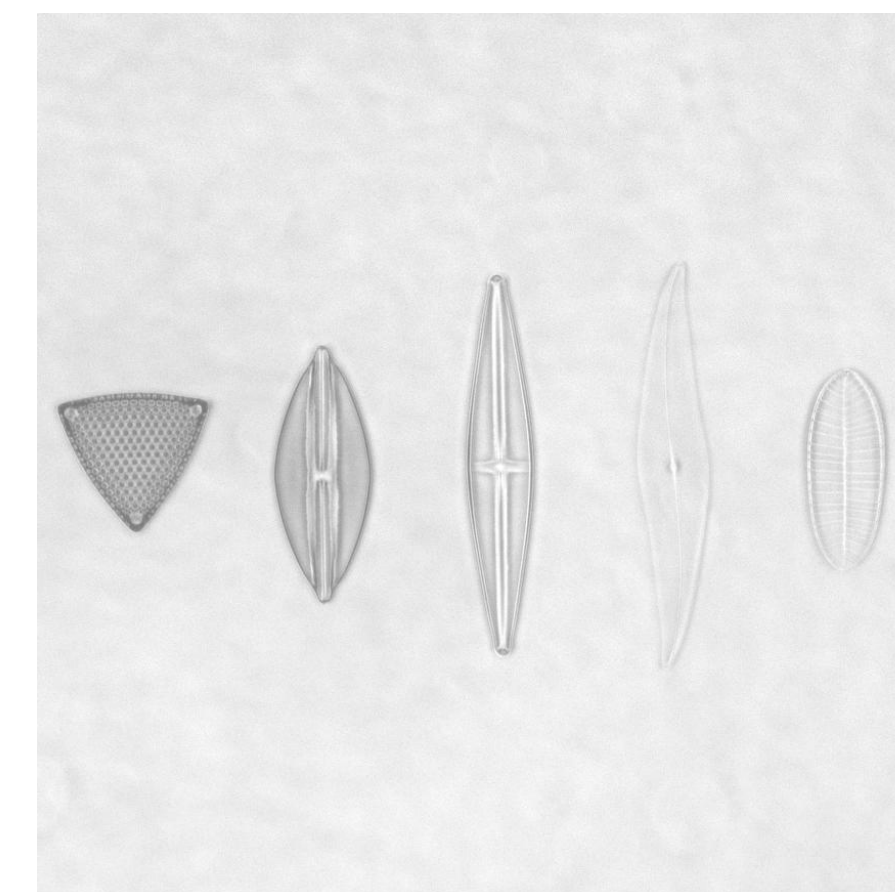
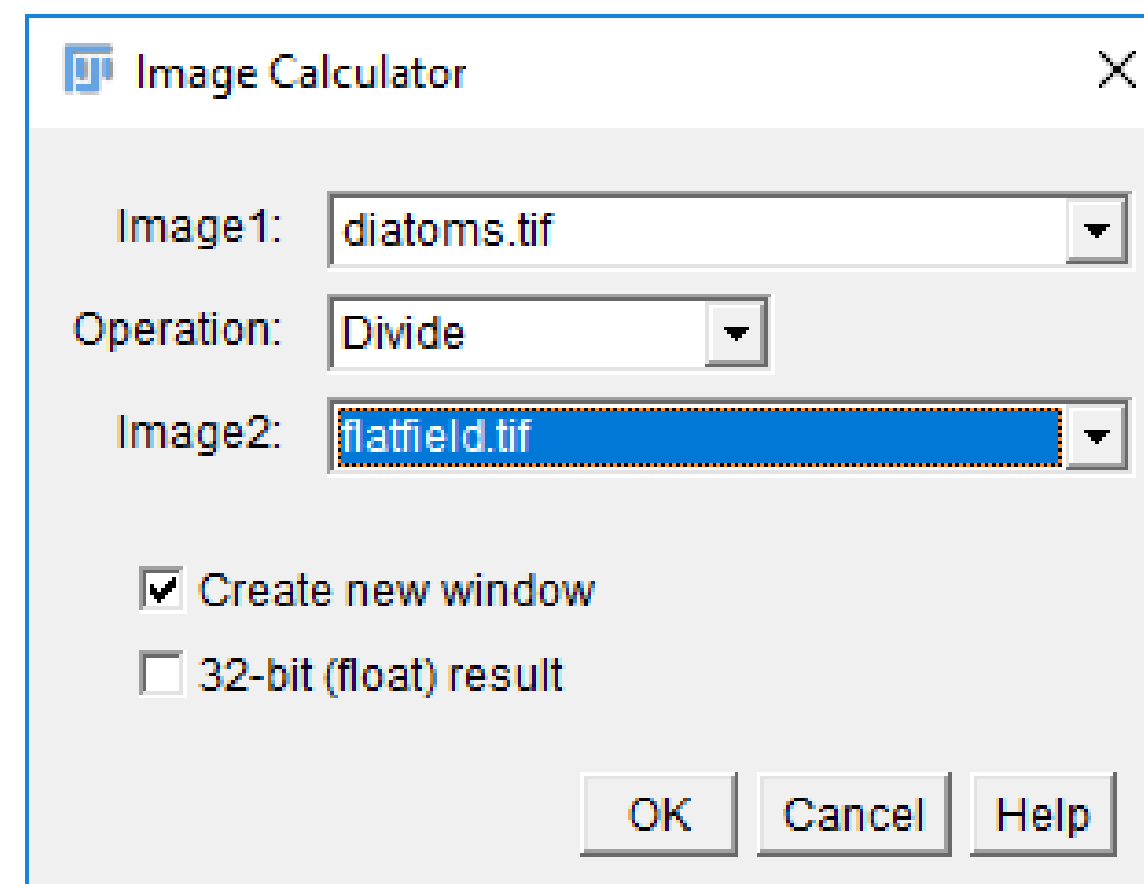
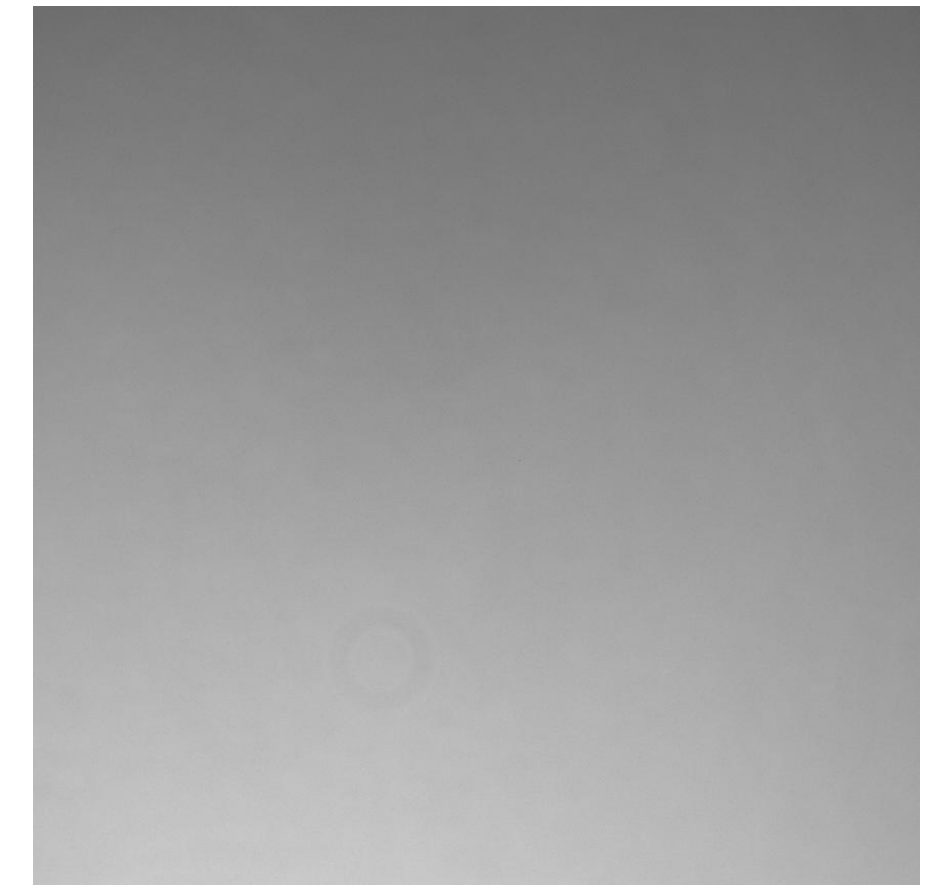
Image To Image Operations

- Checking Image Artifacts
- Ratio Imaging
- Flatfield Correction

Sample

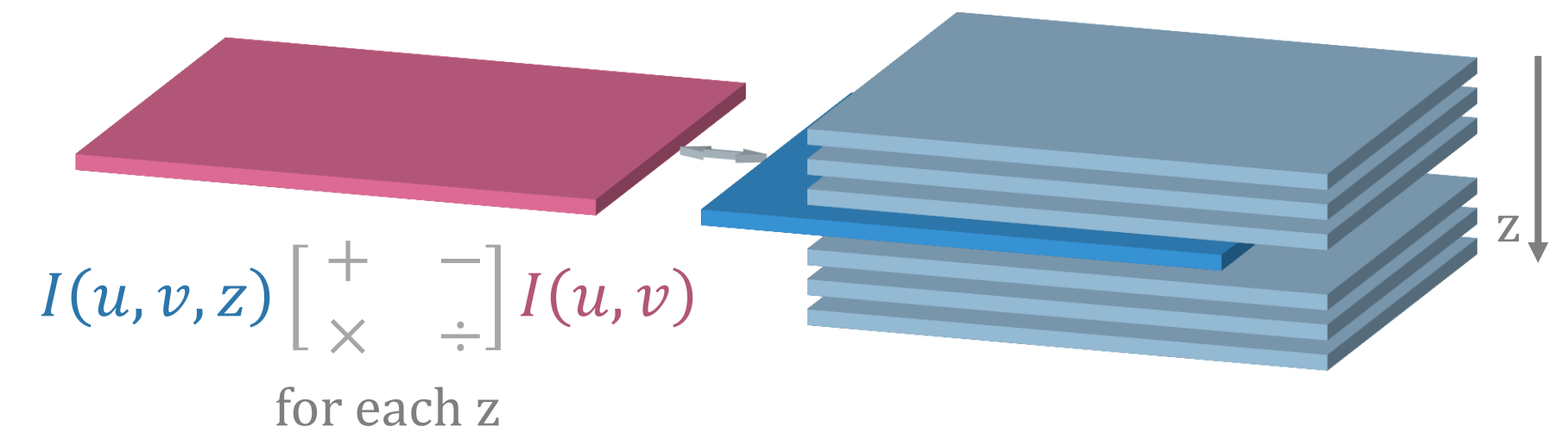


Empty



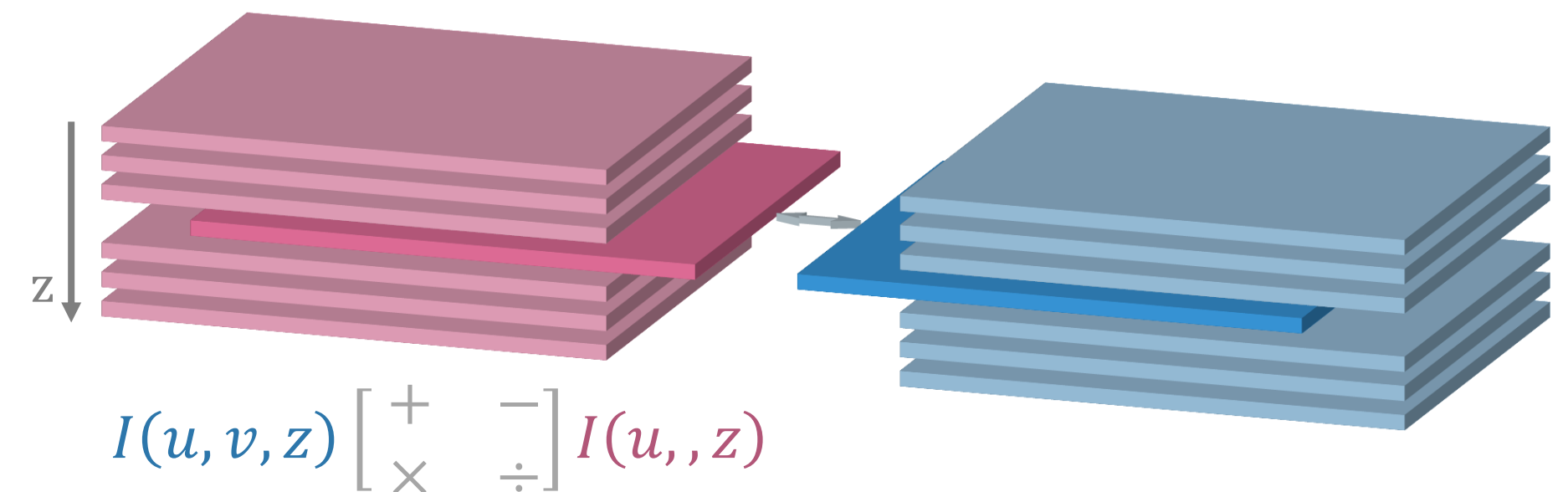
- Single Image on Stacks

- Will apply the **image** to each image of the **stack**



- Stack on Stack

- Will apply the **nth slice** on the **nth slice**
- Stacks must be the same size



- Outline of Basic Image Math
- Image Math in Fiji
 - Clipping when not using the proper bit-depth
- Simple Examples
- Stack Operations