Lecture 2-3 Arithmetic Operation in DIP (chapter 2.6)

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SIST Building 2 302-F

Arithmetic Operation

- **Addition**

$$s(x,y) = f(x,y) + g(x,y)$$

- **Subtraction**

$$d(x,y) = f(x,y) - g(x,y)$$

- **Multiplication**

$$p(x,y) = f(x,y) \times g(x,y)$$

- **Division**

$$v(x,y) = f(x,y) \div g(x,y)$$

Array and Matrix Operation

Consider two 2 x 2 image

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \text{ and } \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}$$

- **Array product**

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} = \begin{bmatrix} a_{11}b_{11} & a_{12}b_{11} \\ a_{21}b_{21} & a_{22}b_{22} \end{bmatrix}$$

- **Matrix product**

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} = \begin{bmatrix} a_{11}b_{11} + a_{12}b_{21} & a_{11}b_{12} + a_{12}b_{22} \\ a_{21}b_{11} + a_{22}b_{21} & a_{21}b_{12} + a_{22}b_{22} \end{bmatrix}$$

Image Addition

Task 1: Add eight images together. $s(x,y) = f(x,y) + g(x,y)$

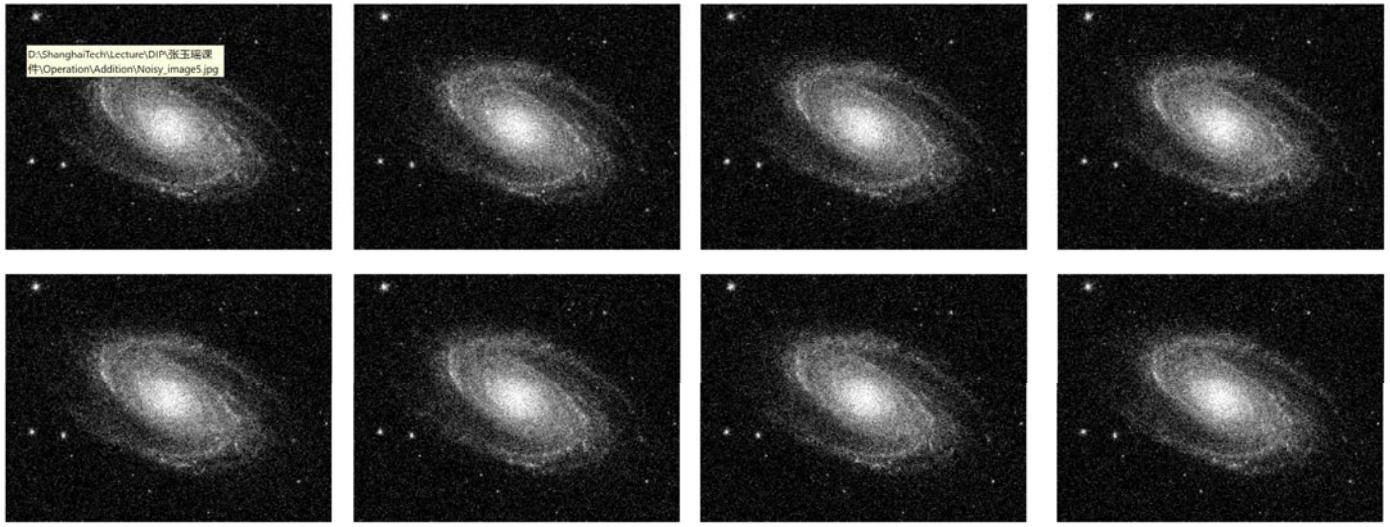
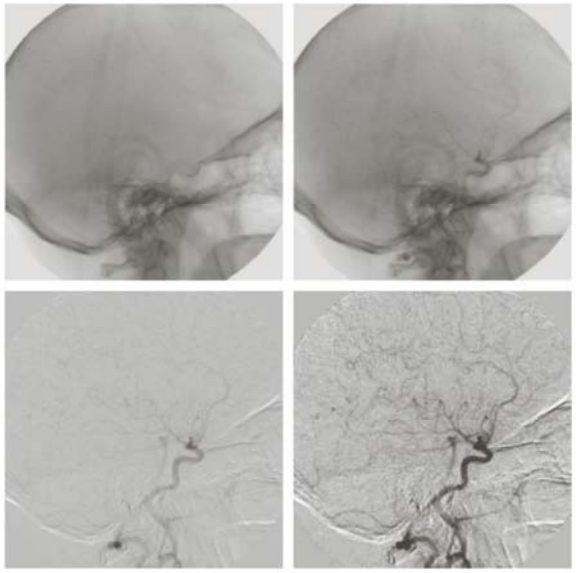


Image Subtraction



$$d(x,y) = f(x,y) - g(x,y)$$

Image Multiplication

$$p(x, y) = f(x, y) \times g(x, y)$$

Image Division

$g(x, y) = f(x, y)\, h(x, y)$

$h(x, y)$

$f(x, y)$

$$f(x, y) = g(x, y) / h(x, y)$$

Background removal

Take home message

- **The devil is in detail.**