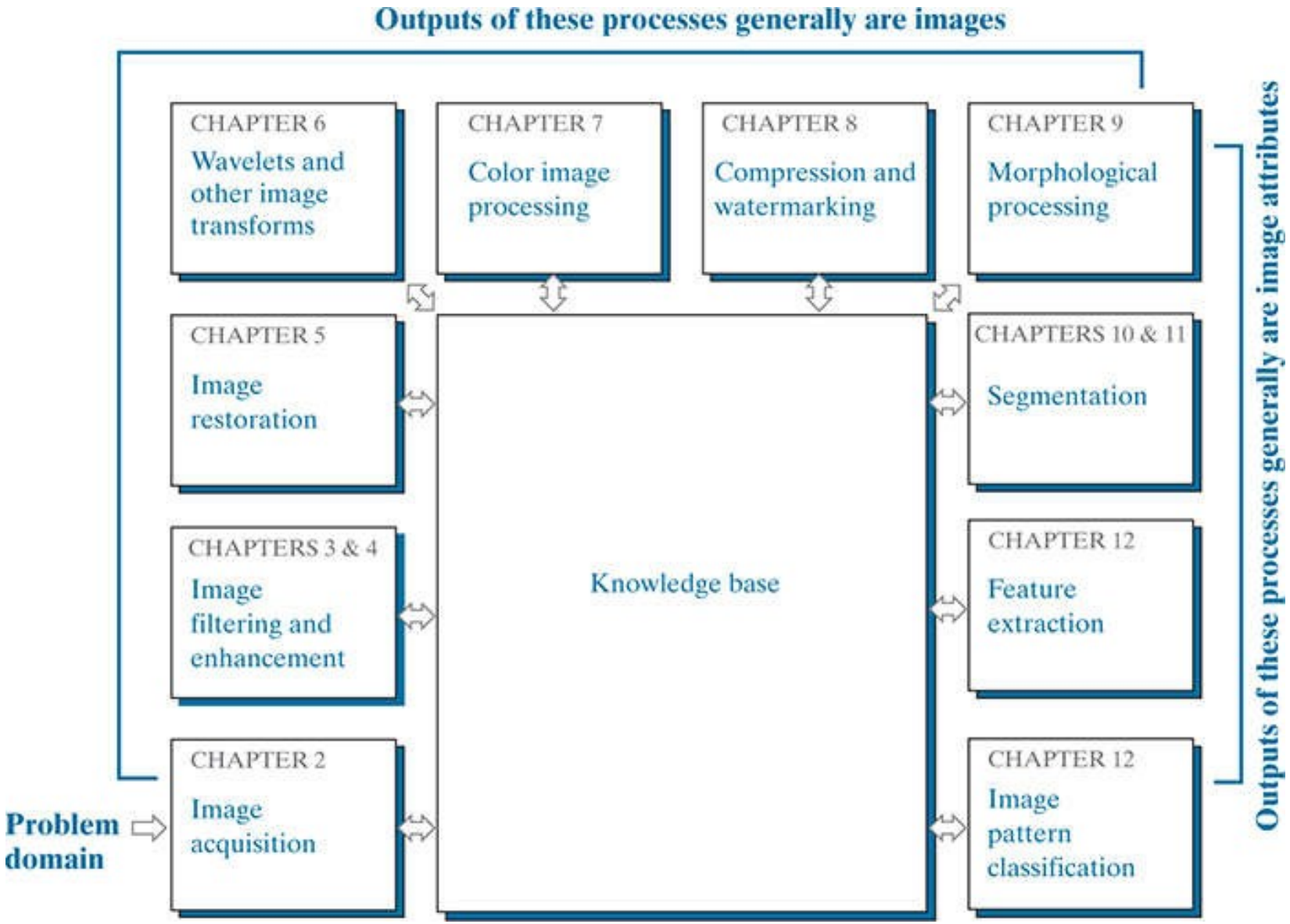
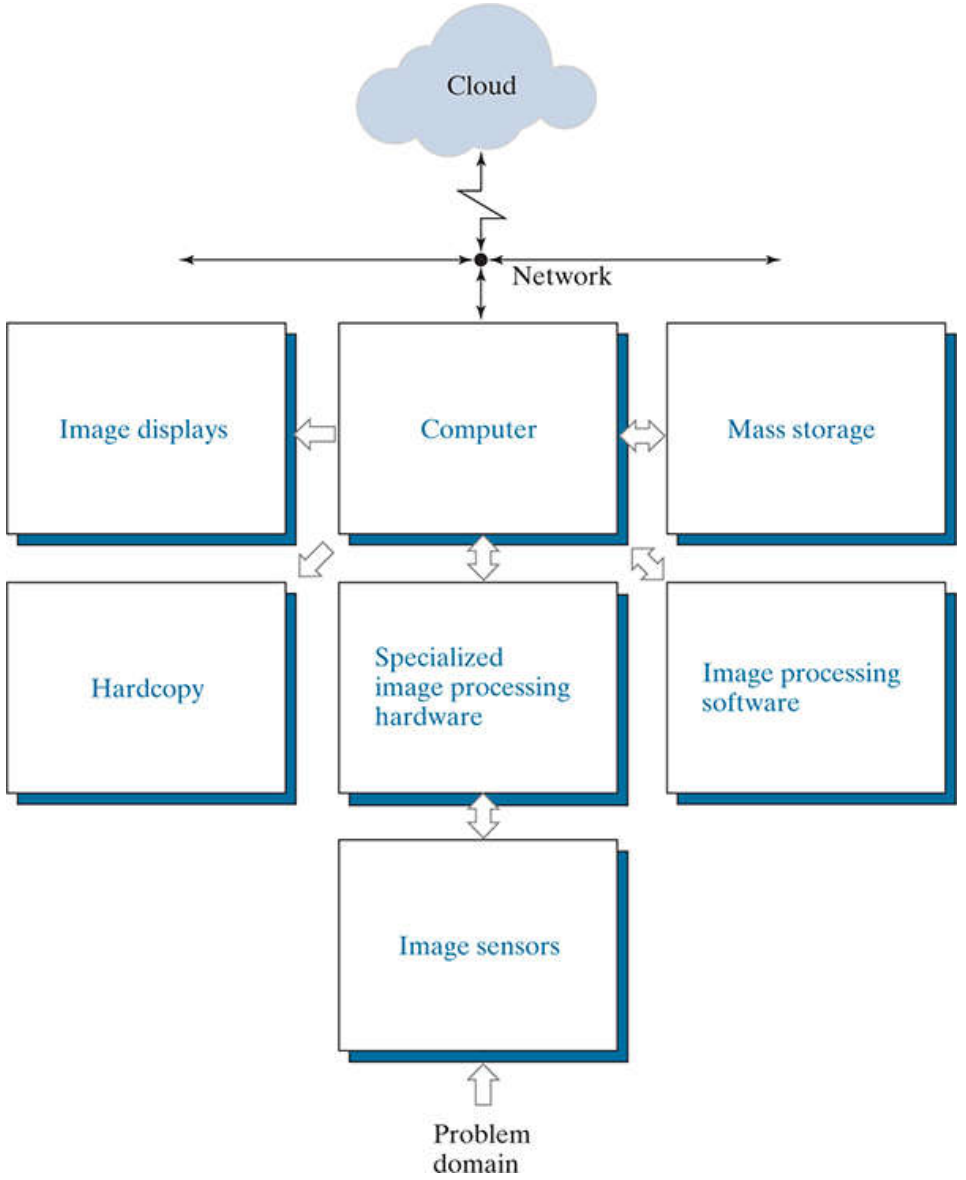
PENGANTAR

Topik Dalam Pengolahan Citra Digital

Fundamental steps in digital image processing (Gonzales & Woods, 2018).



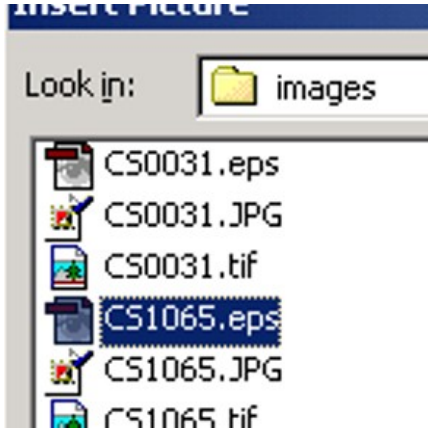
Components of a general-purpose image processing system (Gonzales & Woods, 2018).

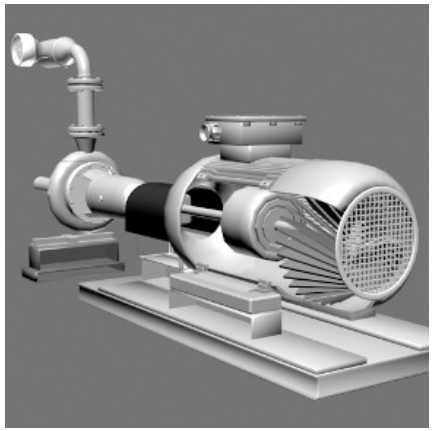


DASAR-DASAR CITRA DIGITAL

CITRA DIGITAL

Direpresentasikan dengan array 2 dimensi yang berisi elemen citra yang disebut piksel





CITRA DIGITAL

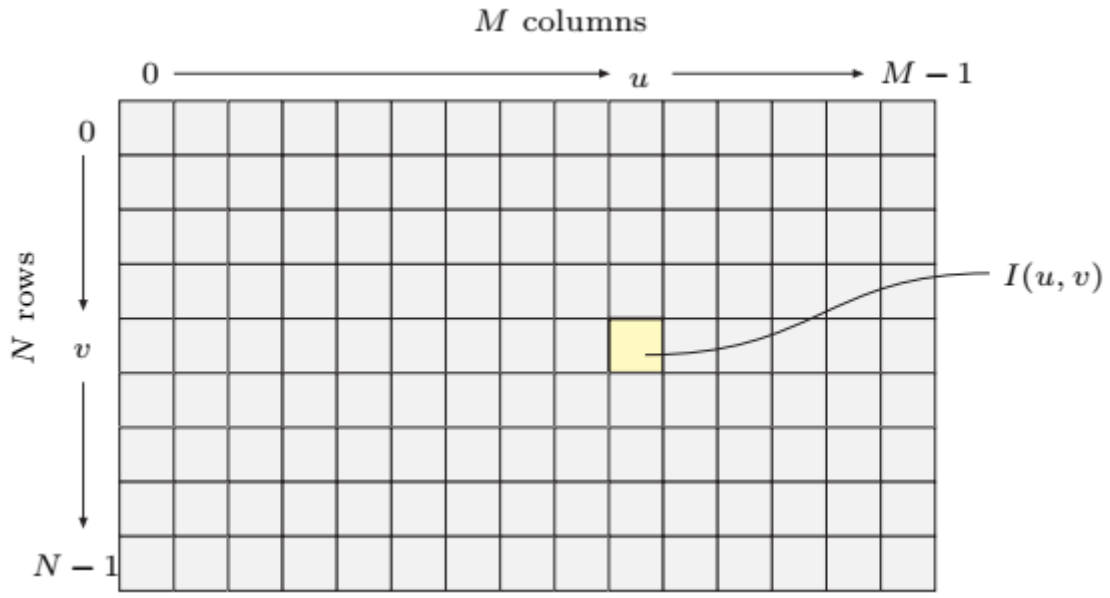
$F(x, y)$

$\rightarrow$

148	123	52	107	123	162	172	123	64	89 $\cdots$
147	130	92	95	98	130	171	155	169	163 $\cdots$
141	118	121	148	117	107	144	137	136	134 $\cdots$
82	106	93	172	149	131	138	114	113	129 $\cdots$
57	101	72	54	109	111	104	135	106	125 $\cdots$
138	135	114	82	121	110	34	76	101	111 $\cdots$
138	102	128	159	168	147	116	129	124	117 $\cdots$
113	89	89	109	106	126	114	150	164	145 $\cdots$
120	121	123	87	85	70	119	64	79	127 $\cdots$
145	141	143	134	111	124	117	113	64	112 $\cdots$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$

$I(u, v)$

KOORDINAT CITRA DIGITAL



RESOLUSI CITRA (SPASIAL DAN INTENSITAS)

- Resolusi spasial direpresentasikan dengan banyaknya titik (piksel) pada satu satuan jarak, misalnya *dots per inch* (dpi)
  - dpi digunakan di industri percetakan di US
    - Koran dicetak dengan resolusi 75 dpi
    - Majalah: 133 dpi
    - Brosur: 175 dpi
    - Buku: 2400 dpi

RESOLUSI SPASIAL

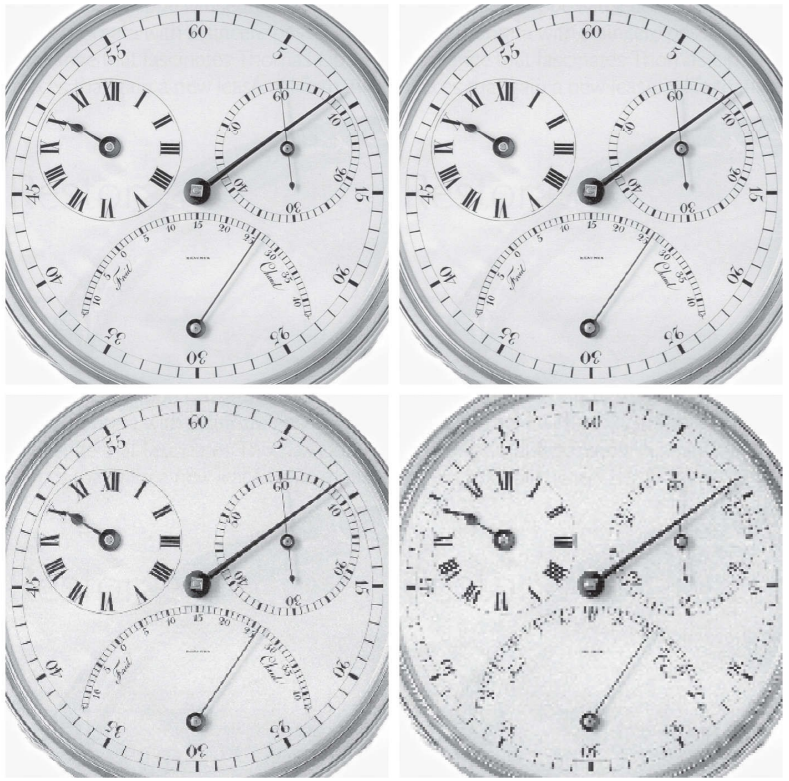
(a) 930 dpi

(b) 300 dpi

(c) 150 dpi

(d) 72 dpi

a b
c d



RESOLUSI INTENSITAS

Karena pertimbangan hardware, level intensitas umumnya bilangan pangkat 2, misalnya 8 bits

Resolusi intensitas 8 bits = 256 level intensitas

RESOLUSI INTENSITAS

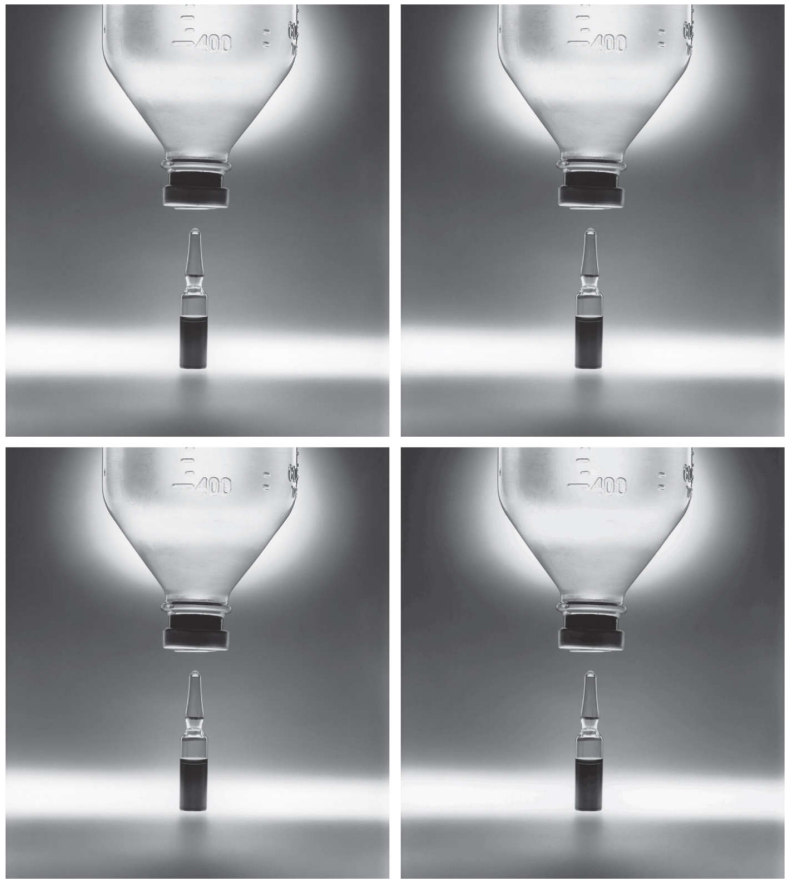
(a) 256-level image

(b) 128-level

(c) 64-level

(d) 32-level

a b
c d



RESOLUSI INTENSITAS

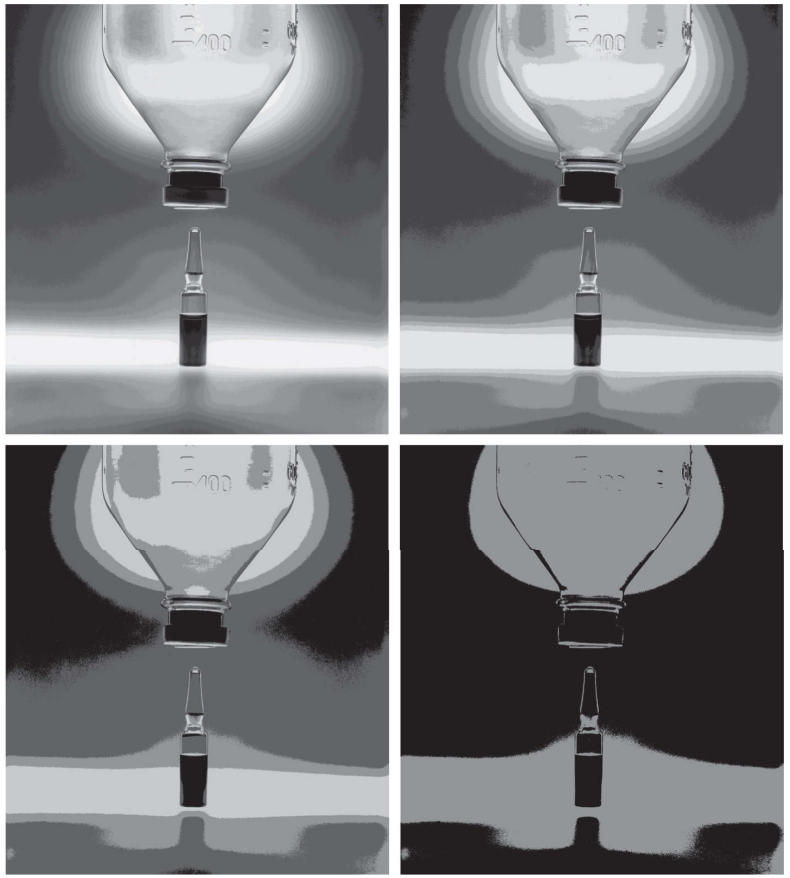
e. 16-level image

f. 8-level

g. 4-level

h. 2-level

e f
g h



BIT DEPTHS OF COMMON IMAGE TYPES AND TYPICAL APPLICATION DOMAINS

Grayscale (Intensity Images):

Chan.	*Bits/Pix.*	*Range*	*Use*
1	1	$[0, 1]$	Binary image: document, illustration, fax
1	8	$[0, 255]$	Universal: photo, scan, print
1	12	$[0, 4095]$	High quality: photo, scan, print
1	14	$[0, 16383]$	Professional: photo, scan, print
1	16	$[0, 65535]$	Highest quality: medicine, astronomy

Color Images:

Chan.	*Bits/Pix.*	*Range*	*Use*
3	24	$[0, 255]^3$	RGB, universal: photo, scan, print
3	36	$[0, 4095]^3$	RGB, high quality: photo, scan, print
3	42	$[0, 16383]^3$	RGB, professional: photo, scan, print
4	32	$[0, 255]^4$	CMYK, digital prepress

Special Images:

Chan.	*Bits/Pix.*	*Range*	*Use*
1	16	$[-32768, 32767]$	Integer values pos./neg., increased range
1	32	$\pm 3.4 \cdot 10^{38}$	Floating-point values: medicine, astronomy
1	64	$\pm 1.8 \cdot 10^{308}$	Floating-point values: internal processing

TOPIK RISET CITRA DIGITAL

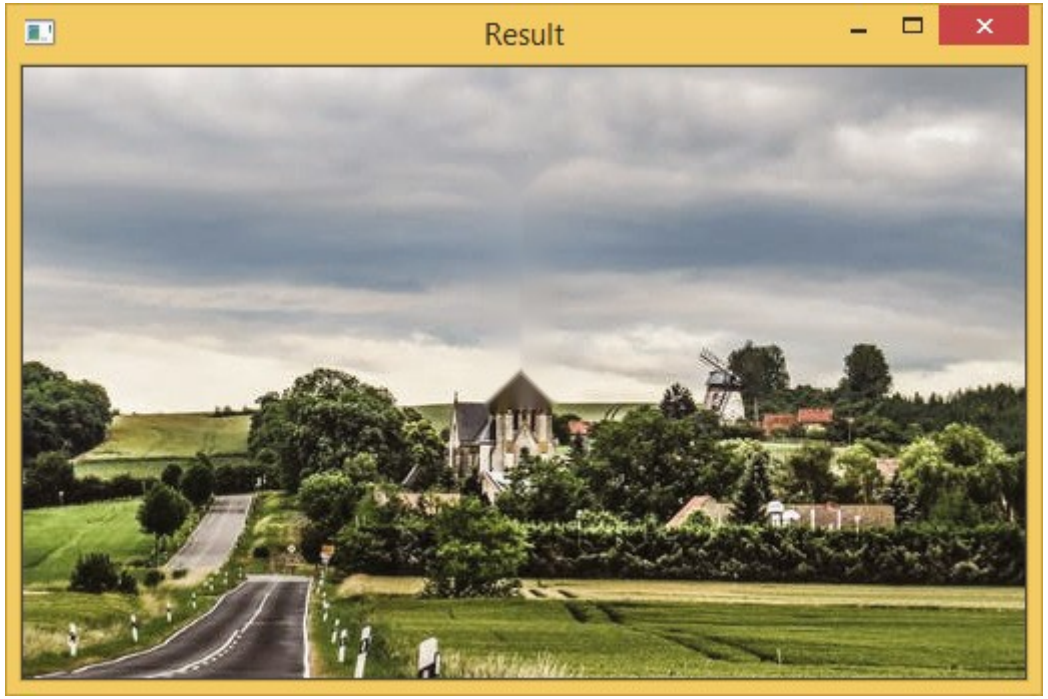
CONTOH RISET/APLIKASI TERKAIT PCD

- Image Stitching
- Image Inpainting
- Image Coloring
- Image Super Resolution
- Image Fusion
- Image Watermark
- Image Generation
- ...

IMAGE STITCHING

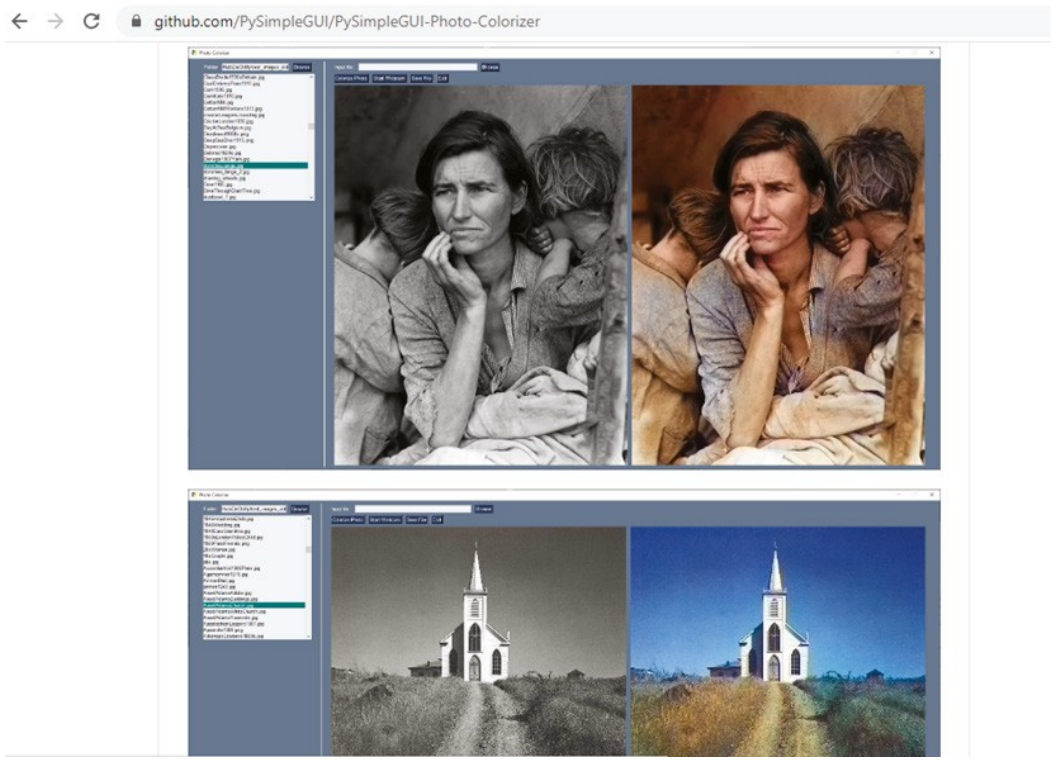
stitch multiple images into a single image

IMAGE INPAINTING



a process to repair and restore the damaged, deteriorated, or missing parts of the image

IMAGE COLORING



(Source: https://github.com/PySimpleGUI/PySimpleGUI-Photo-Colorizer

IMAGE SUPER RESOLUTION

Aims to improve the image resolution

IMAGE FUSION

IMAGE FUSION

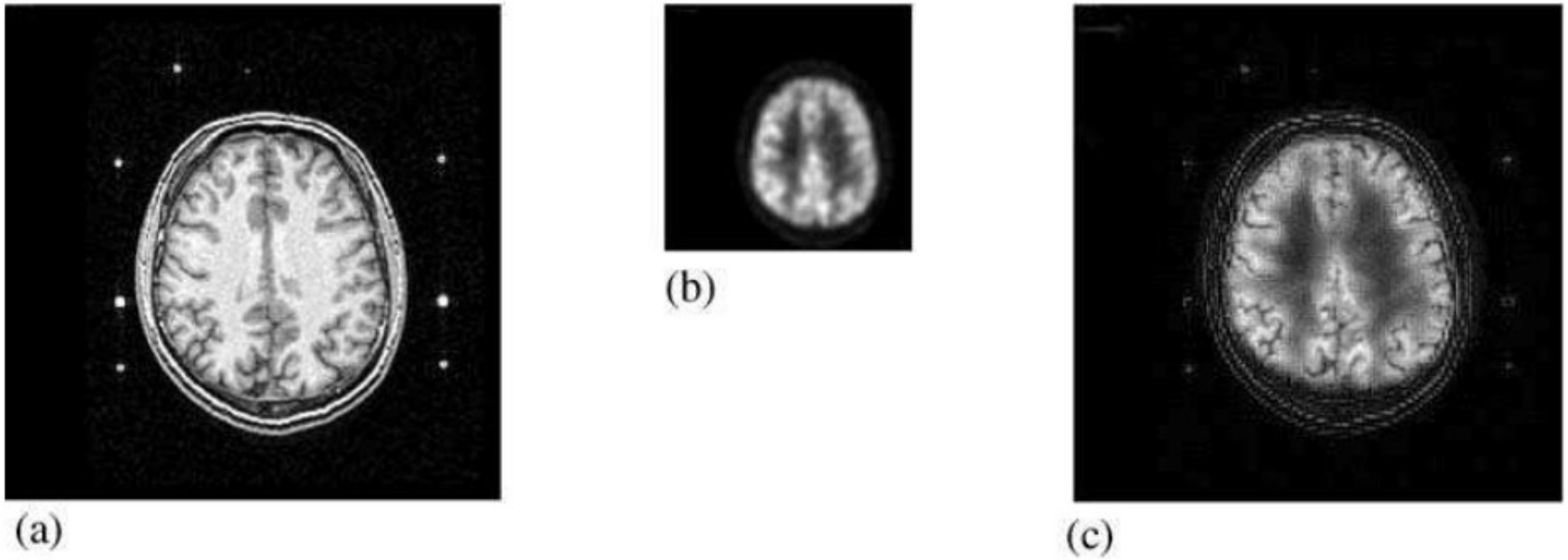
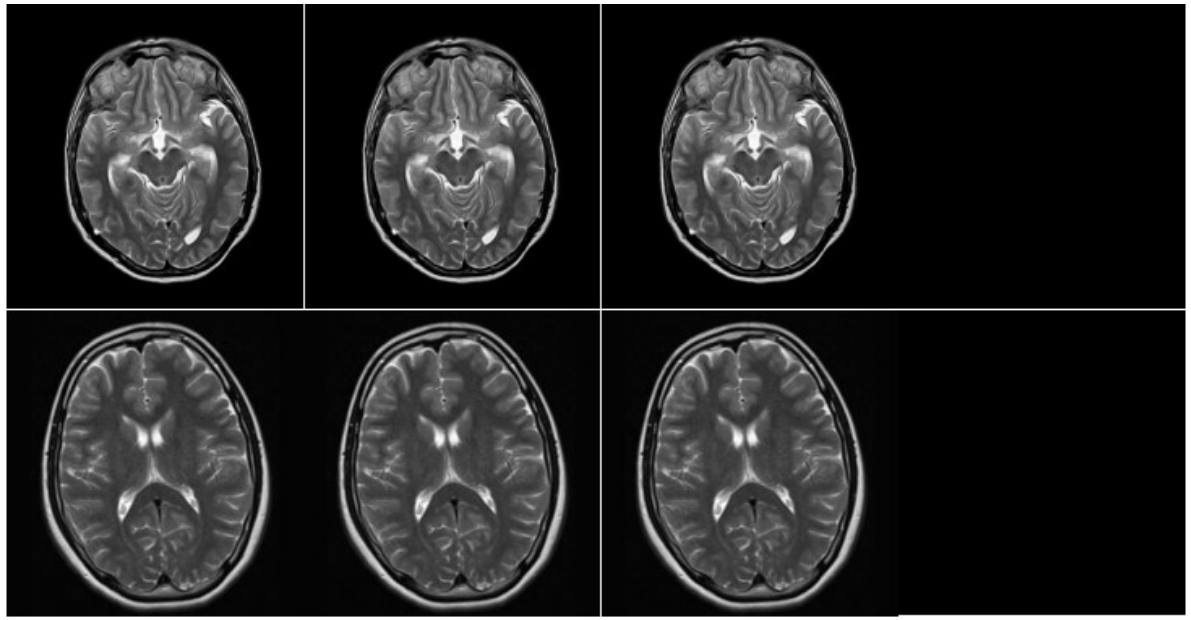


Fig. 10. (a) MRI and (b) PET images; (c) fused image from (a) and (b).

IMAGE WATERMARK



Original images (OM)	Watermarked images (WM)	Extracted images (XM)	Difference between OM and XM images

Fig. 5.7: Examples of the original DICOM images and their corresponding watermarked and extracted images after applying the proposed watermarking approach. No visual difference between the original and watermarked images can be observed which indicates that the distortion of the watermarked image is very low, and the watermark was encoded invisibly within the images. There is no numerical difference between the original and extracted which confirms the reversibility of the proposed approach.

IMAGE GENERATION

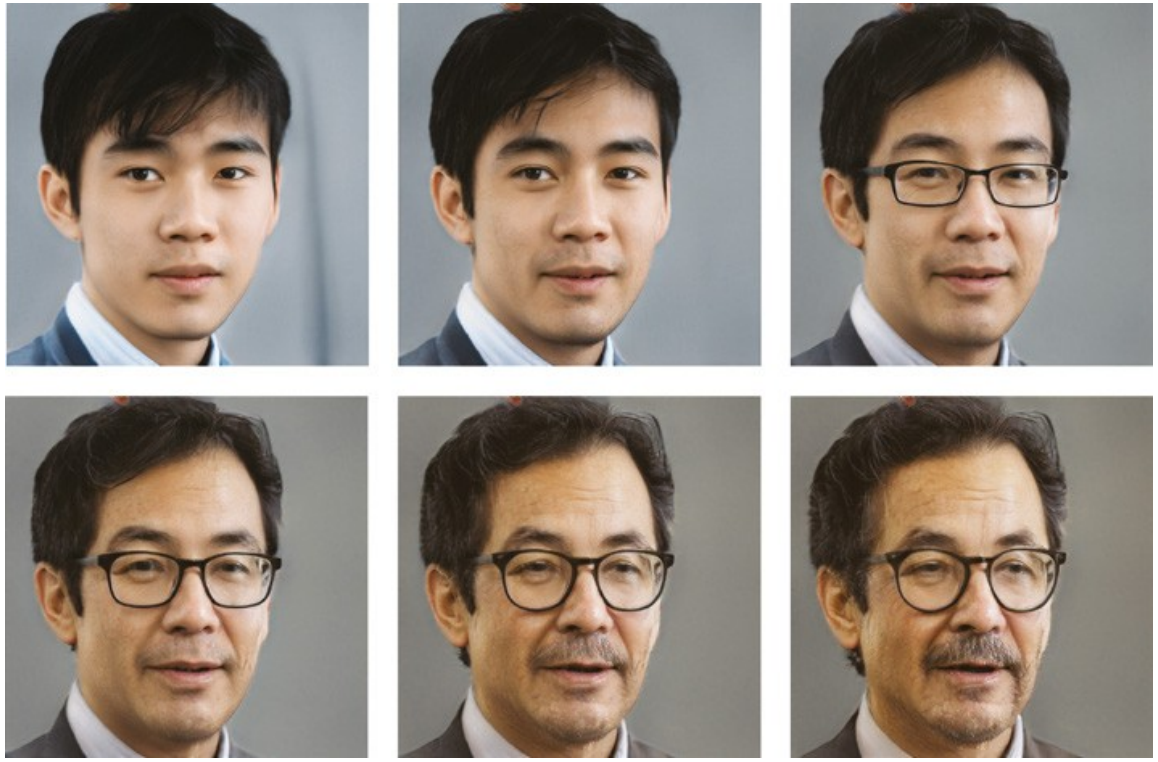


IMAGE GENERATION

STYLE TRANSFER



STYLE TRANSFER

TERIMA KASIH