

影像處理技術原理與應用



黃騰任 老師提供



前言

影像處理過程

數位影像的內容

數位影像的處理方式

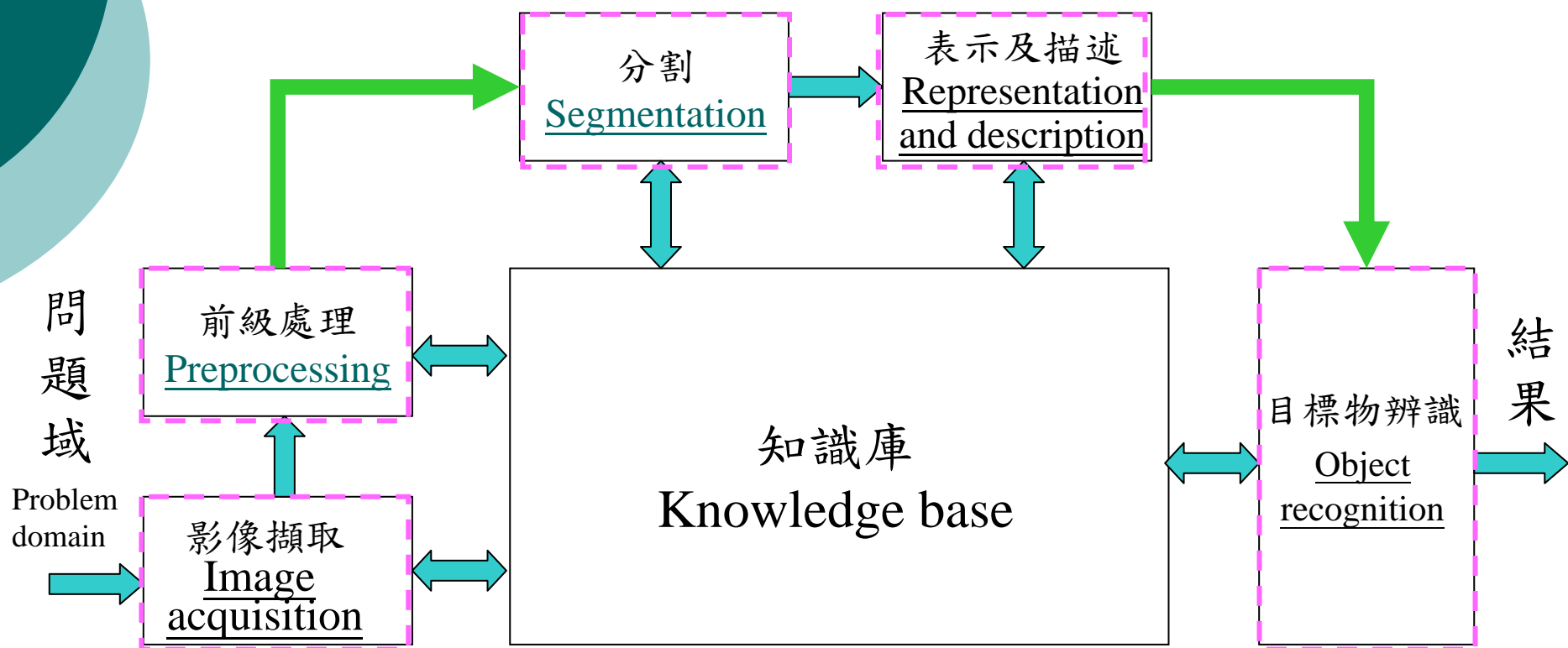
影像處理在生物產品的應用



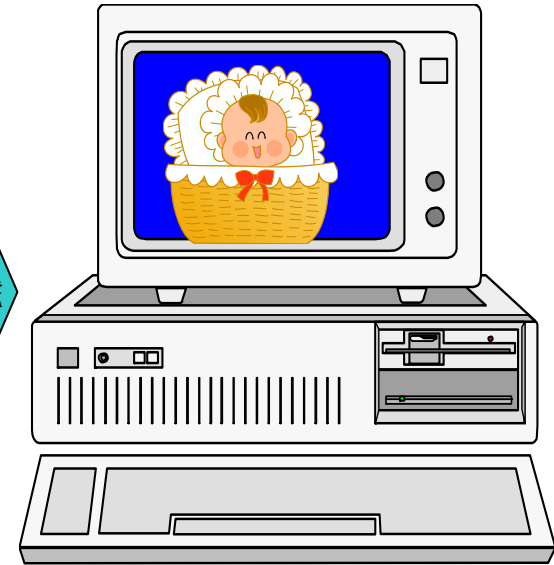
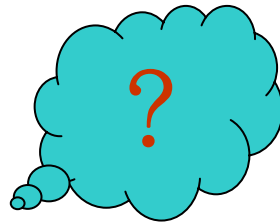
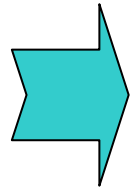
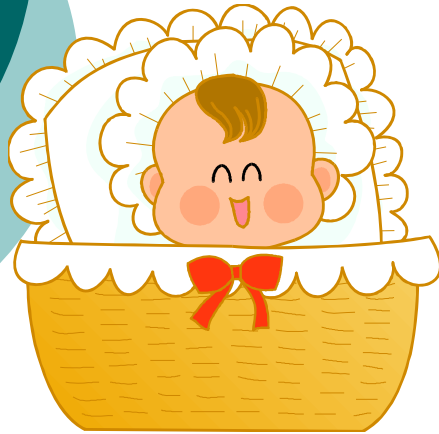
影像處理的目的

- 由實體擷取影像，從而由影像中進行處理、分析、量測與解譯出有關該實體有用之資訊

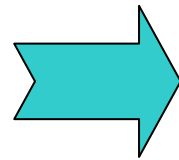
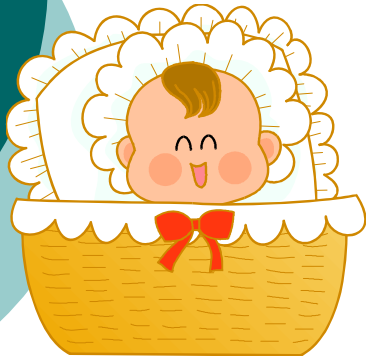
影像處理過程



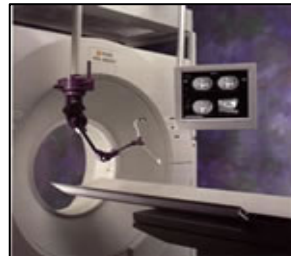
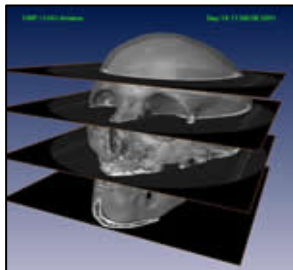
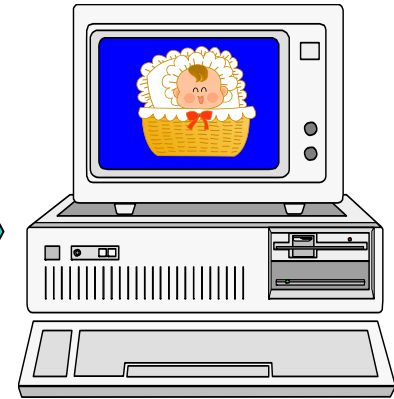
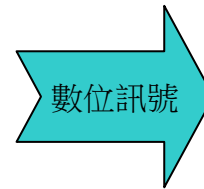
數位影像如何取得？



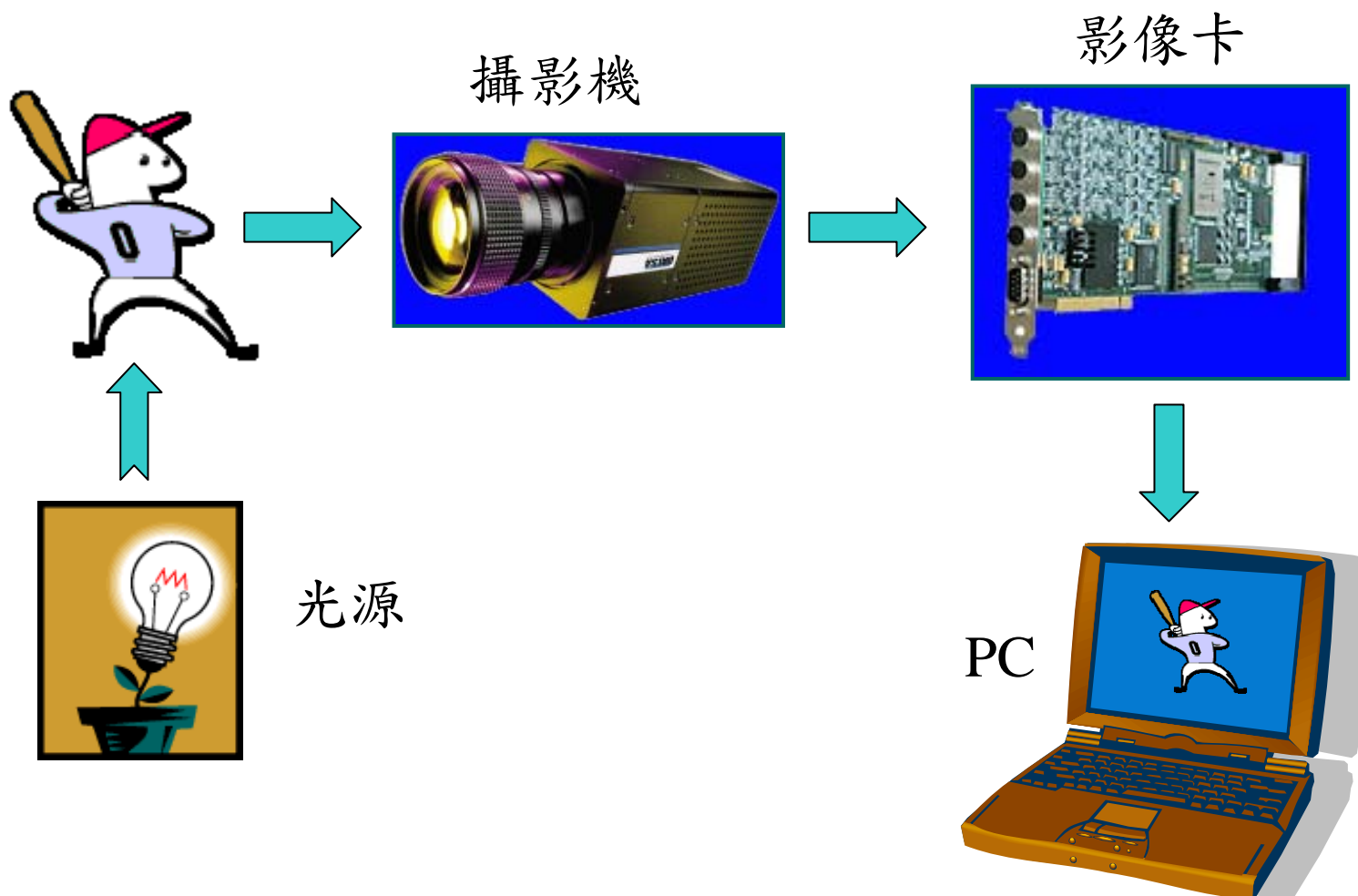
數位影像擷取設備



數位相機、類比攝影機、數位攝影機、掃描器、紅外線熱像儀、X光掃描、CT、雷達、MRI、PET、超音波：



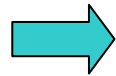
典型基本的影像擷取設備



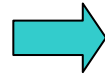
機器視覺



攝影機



影像卡



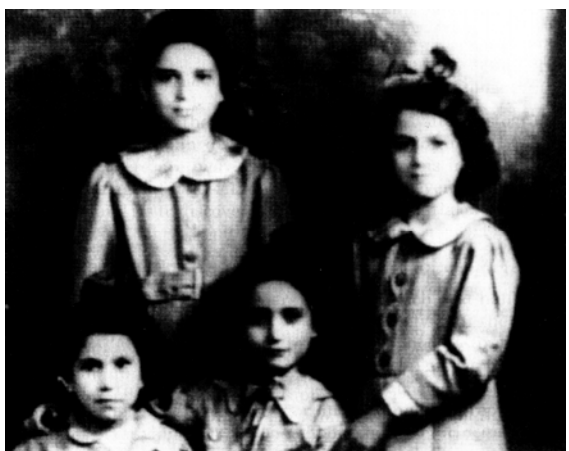
電腦



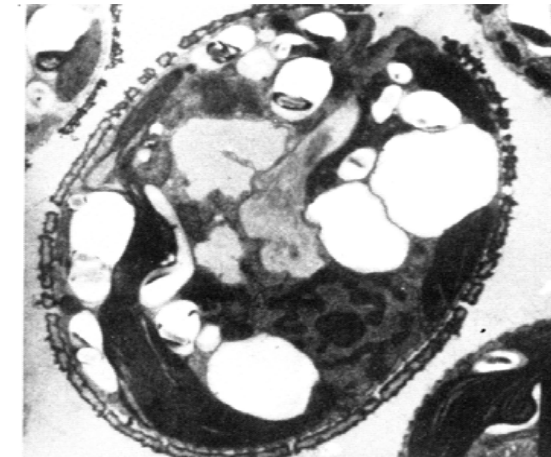
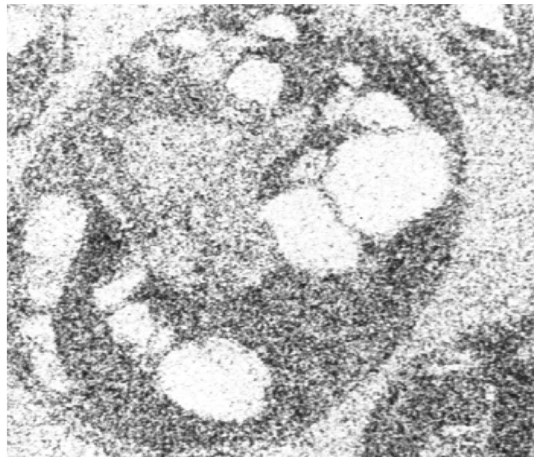
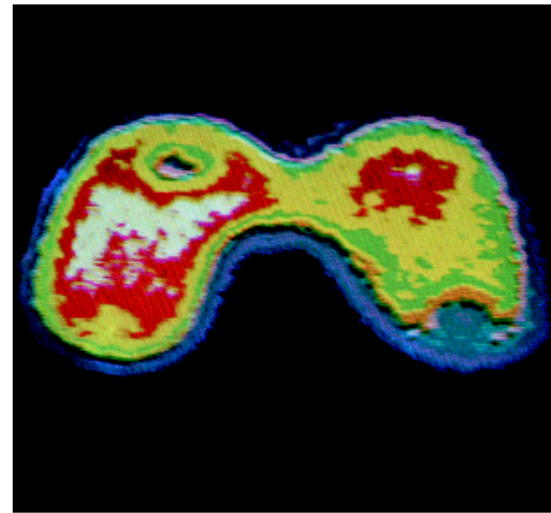
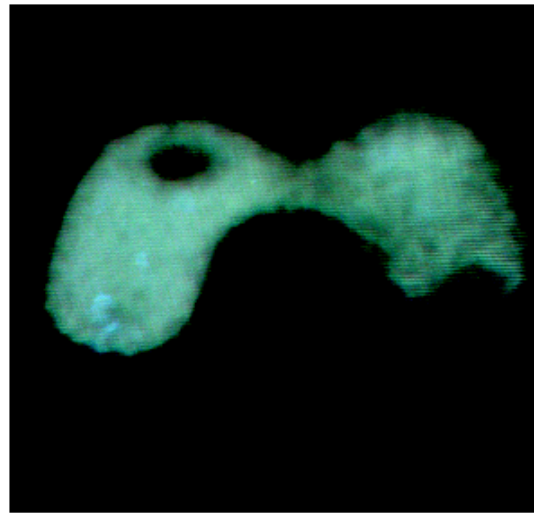
影像處理

前級處理主要目的

- 改善影像品質，使影像更適合後序的處理



前級處理

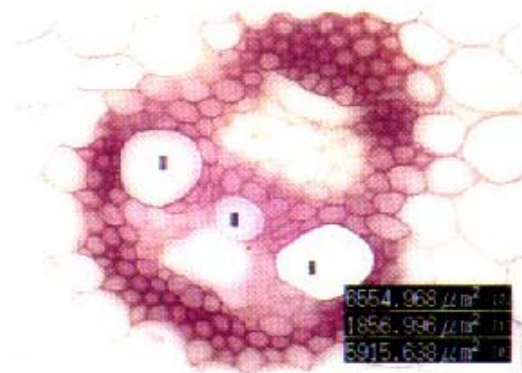
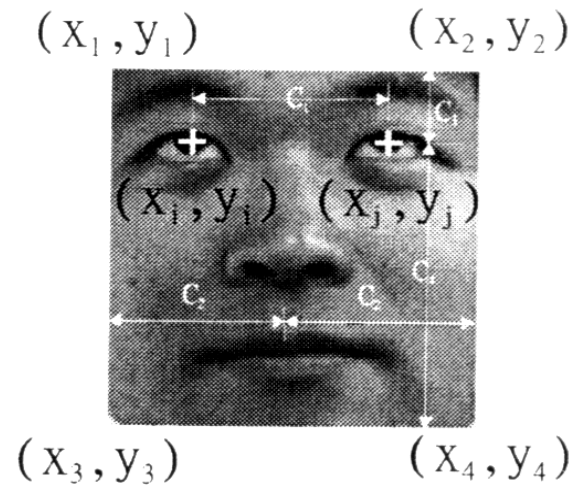
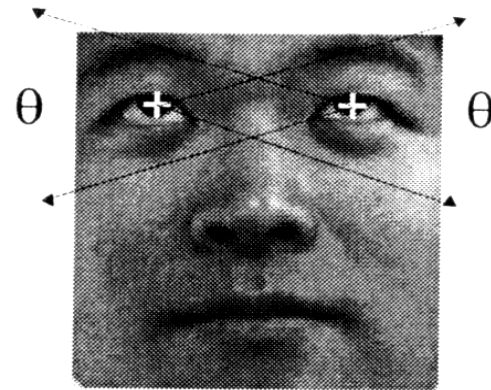


影像分割的目的

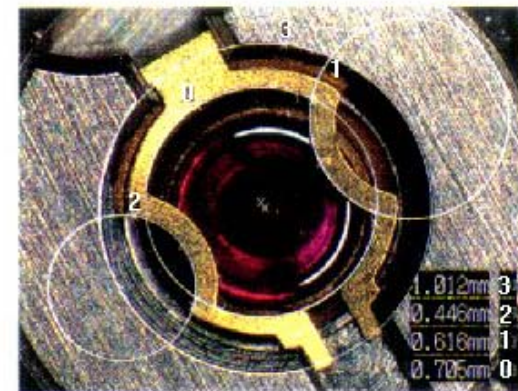
- 把影像中的目標物從原影像中獨立出來



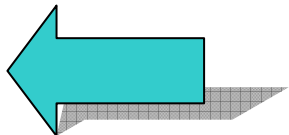
表示及描述



植物細胞



時鐘零件




Representation: internal
Description: color

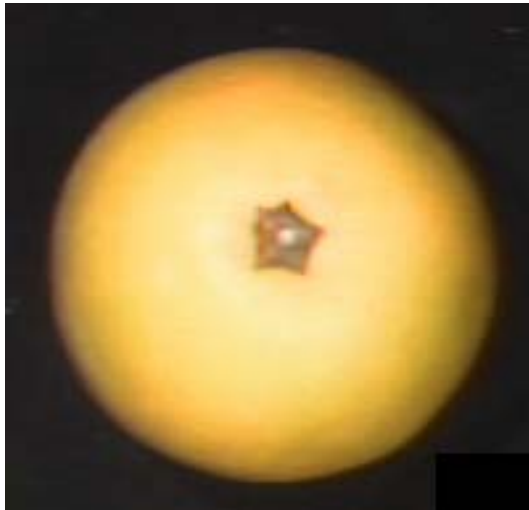


Representation: internal + external
Description: texture(紋理) + shape

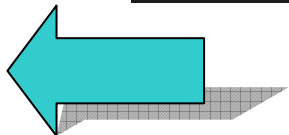
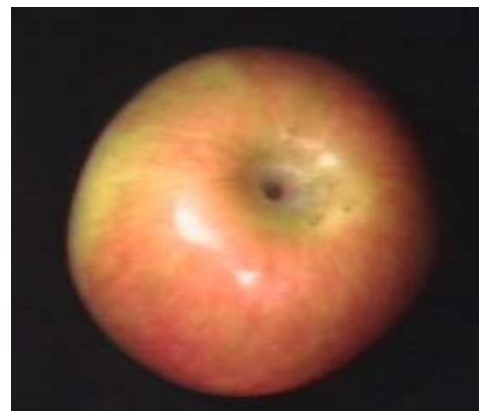
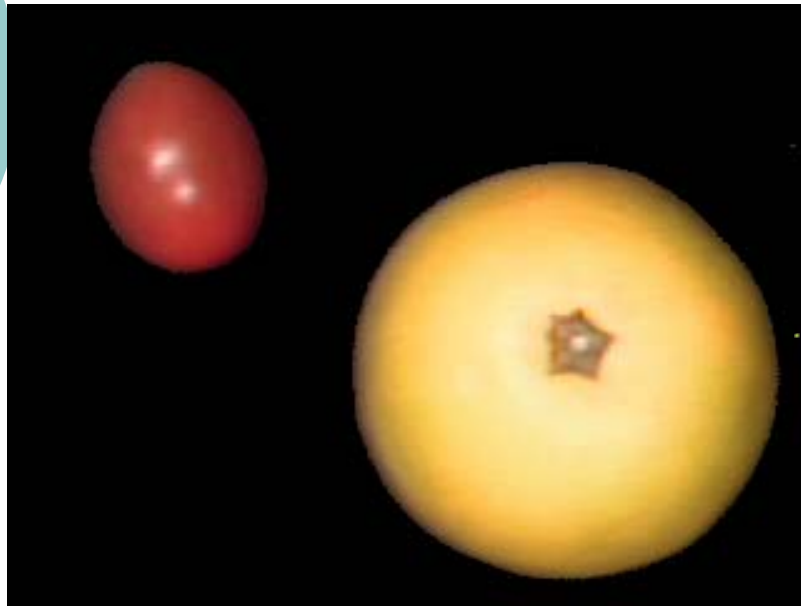




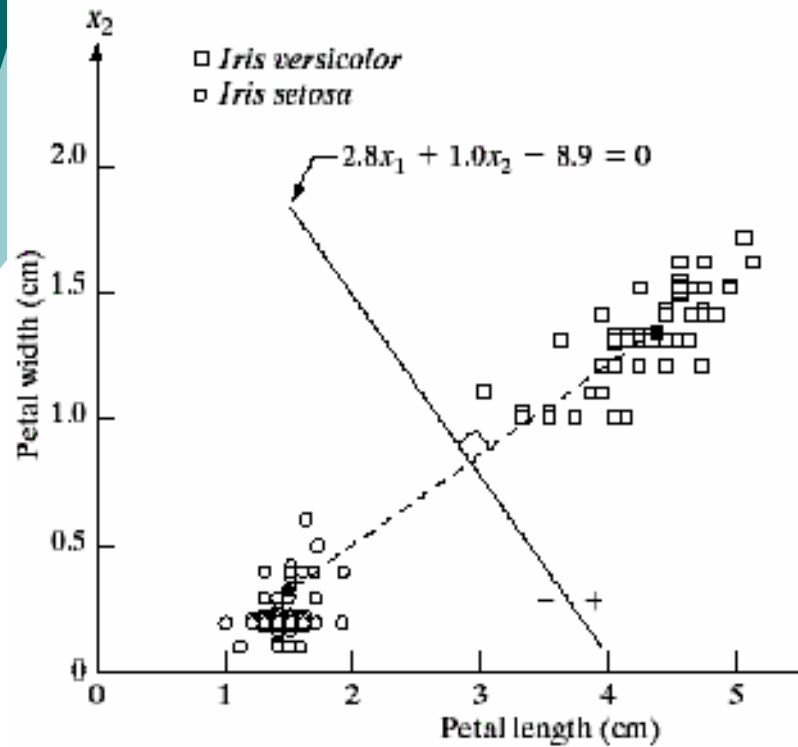
Representation: internal + external
Description: Area + color + shape



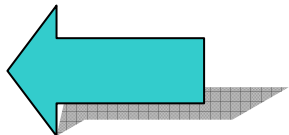
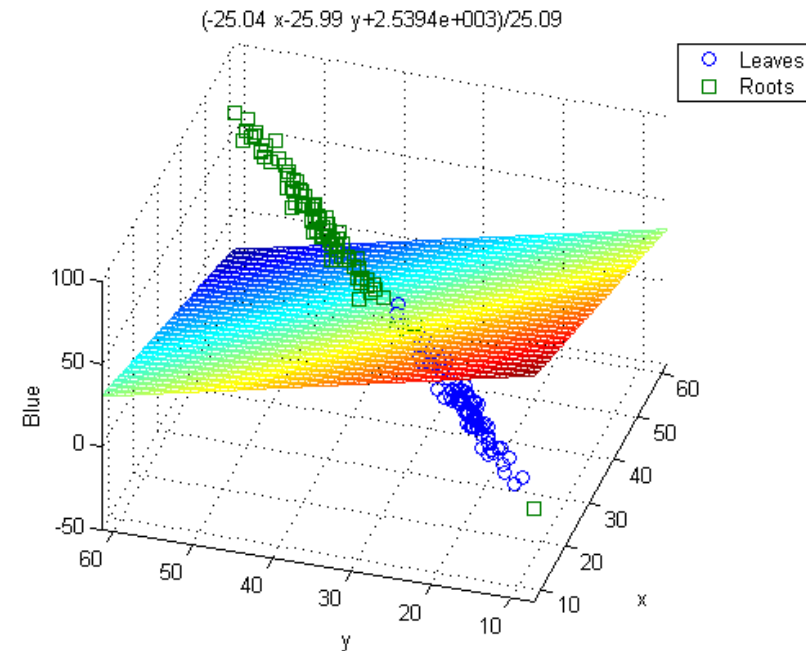
Representation: internal + external
Description: Area + color + shape + texture



目標物辨識 (Pattern recognition)



- Neural
- Fuzzy
- Genic algorithm

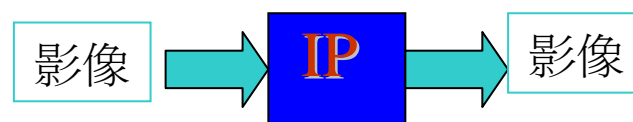


依影像處理的應用目的區分

Three levels of digital image processing:

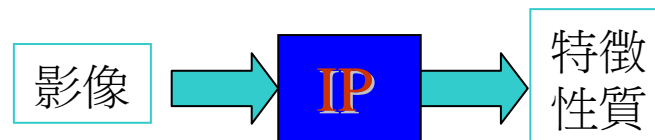
- Low-level IP

- Image preprocessing to reduce noise, contrast enhancement, image sharpening



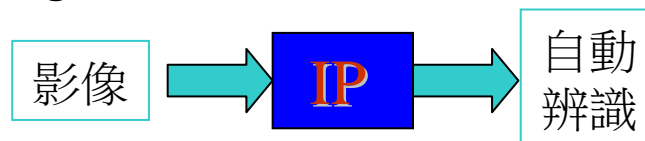
- Mid-level IP (*Image analysis*)

- Segmentation and description



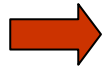
- High-level IP (*Computer vision*)

- Object recognition



數位影像的內容

影像基本元件
(image element)



Pixel
像素

描述每個像素的性質

(1)座標(x,y)

(2)顏色值f(x,y)

單色影像:

亮度值(Intensity)

8 bit: 0~255



彩色影像:

(R,G,B) 8 3 bit

每種顏色各有 0~255



origin

x

y



假如一幅影像:

•在x方向長度有640個pixel

•在y方向長度有480個pixel

則這幅影像空間解析度共有480x648 (=307200)個pixel

影像格式

○ 空間解析度:

- 描述影像的大小(pixel數)
- 一幅影像在「垂直方向的pixel數」 「水平方向的pixel數」
例: 480×640 , 768×1024 ...

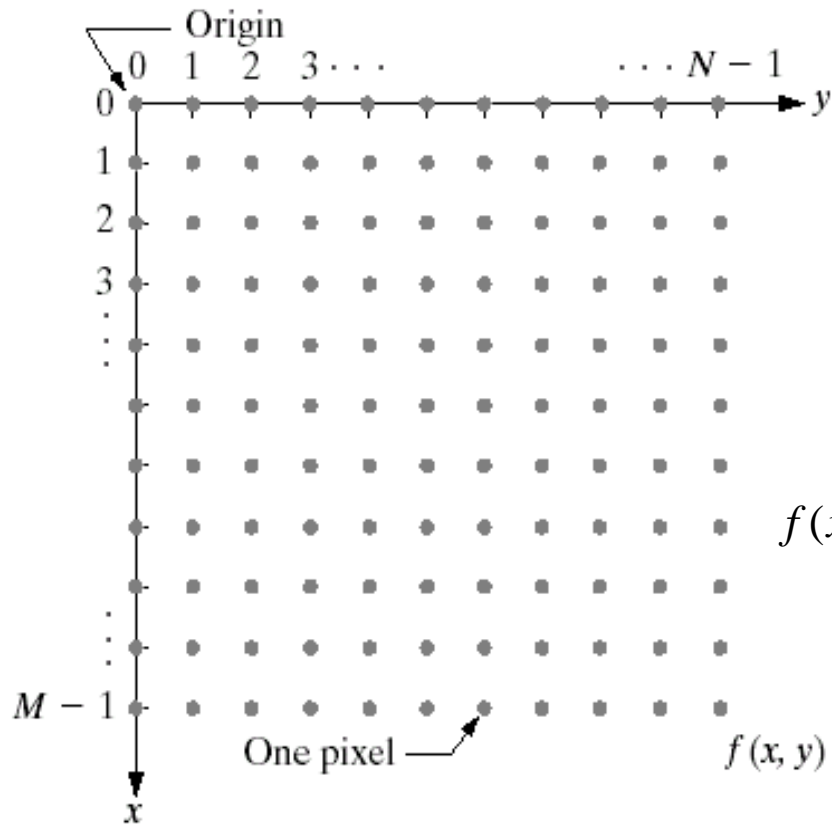
○ 色彩解析度:

- 描述每個pixel色彩變化量
例: 8 bit = $2^8 = 256$ 種變化

○ 影像格式

- 可同時描述影像的空間解析度及色彩解析度
例: 480×640×8 , 480×640×24, 768×1024×24

數位影像中可應用的資源



每個像素的

■ 座標

■ 顏色值

$$f(x, y) = \begin{bmatrix} f(0,0) & f(0,1) & \cdots & f(0,N-1) \\ f(1,0) & f(1,1) & \cdots & f(1,N-1) \\ \vdots & \vdots & \vdots & \vdots \\ f(M-1,0) & f(M-1,1) & \cdots & f(M-1,N-1) \end{bmatrix}$$

影像處理方式



MichelinBaby.bmp



影像讀取



處理結果

$$f = \begin{bmatrix} a_{1,1} & a_{1,2} & \cdots & a_{1,N} \\ a_{2,1} & a_{2,1} & \cdots & a_{2,N2} \\ \vdots & \vdots & \vdots & \vdots \\ a_{M,1} & a_{M,2} & \cdots & a_{M,N} \end{bmatrix}$$

```
f=imread('MichelinBaby.bmp');  
New_f=255-double(f);  
image(New_f);
```

程式運算

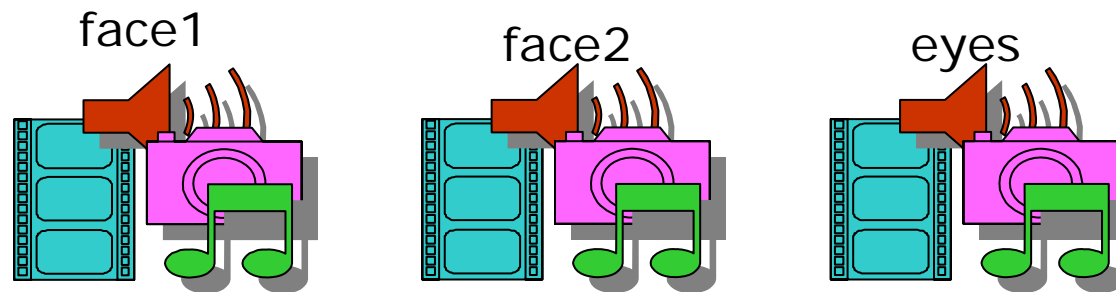


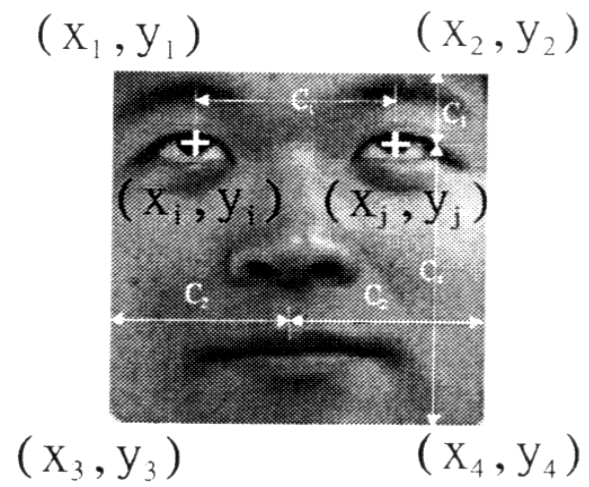
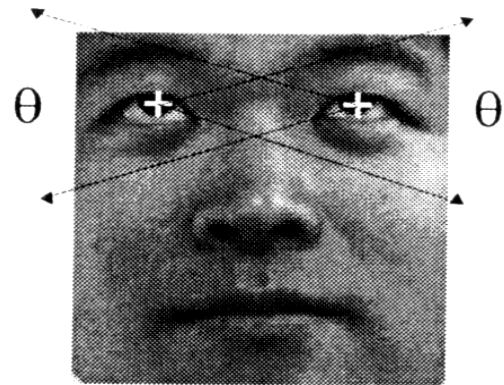
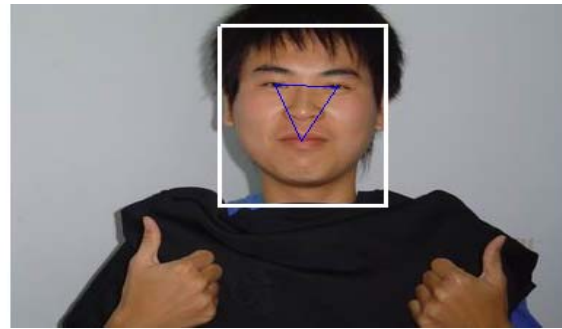
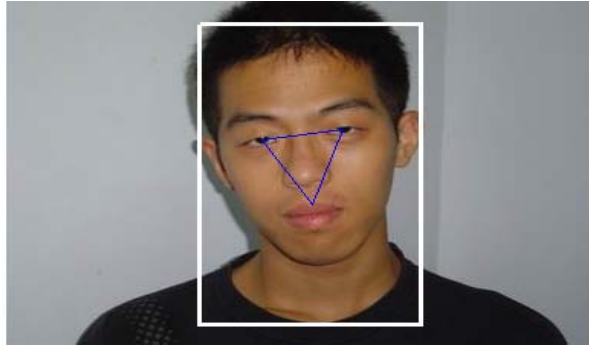
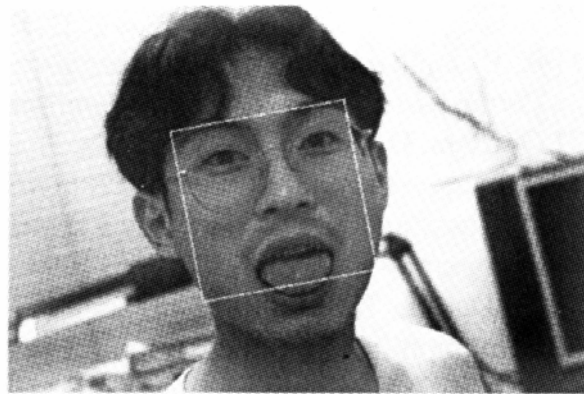
影像處理的應用

- 改善影像品質,使人更容易理解
 - 衛星影像、醫學影像、舊照片重建、....
- 美工應用:
 - 海報設計、動畫製作、電影特效、...
- 量測尺寸
 - 長、寬、直徑、面積、體積、形狀、元件間的距離、...
- 計數
 - 數錢、體細胞計數、微生物計數、魚苗計數....
- 自動辨識,檢測
 - 產品分級、瑕疵檢測、微生物鑑定、指紋比對、人臉辨識、動態物體追蹤、...
- 定位
 - 目標物之2D或3D座標位置計算
- 影像重建、虛擬實境、.....

Biometric identification

- Biometric identification is based on features of human body, such as fingerprint, face and iris.









Filter operation done !
time = 00:00:09
Press P to print out
Press T to continue

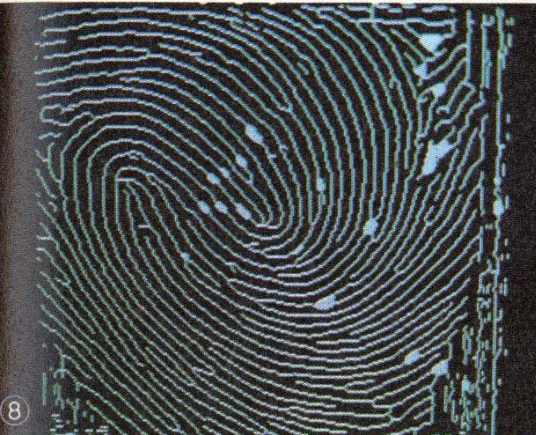
5



6



7



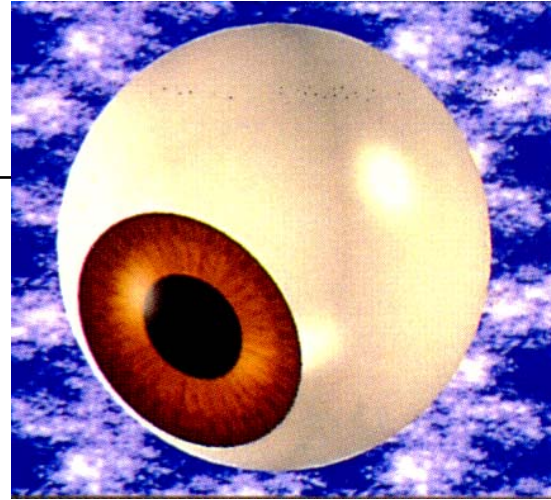
8



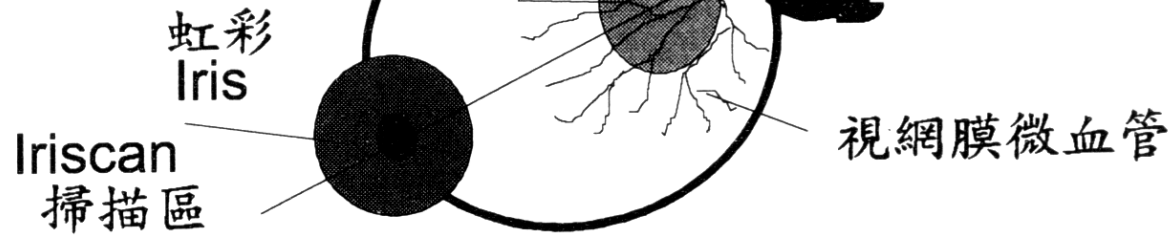
9



10

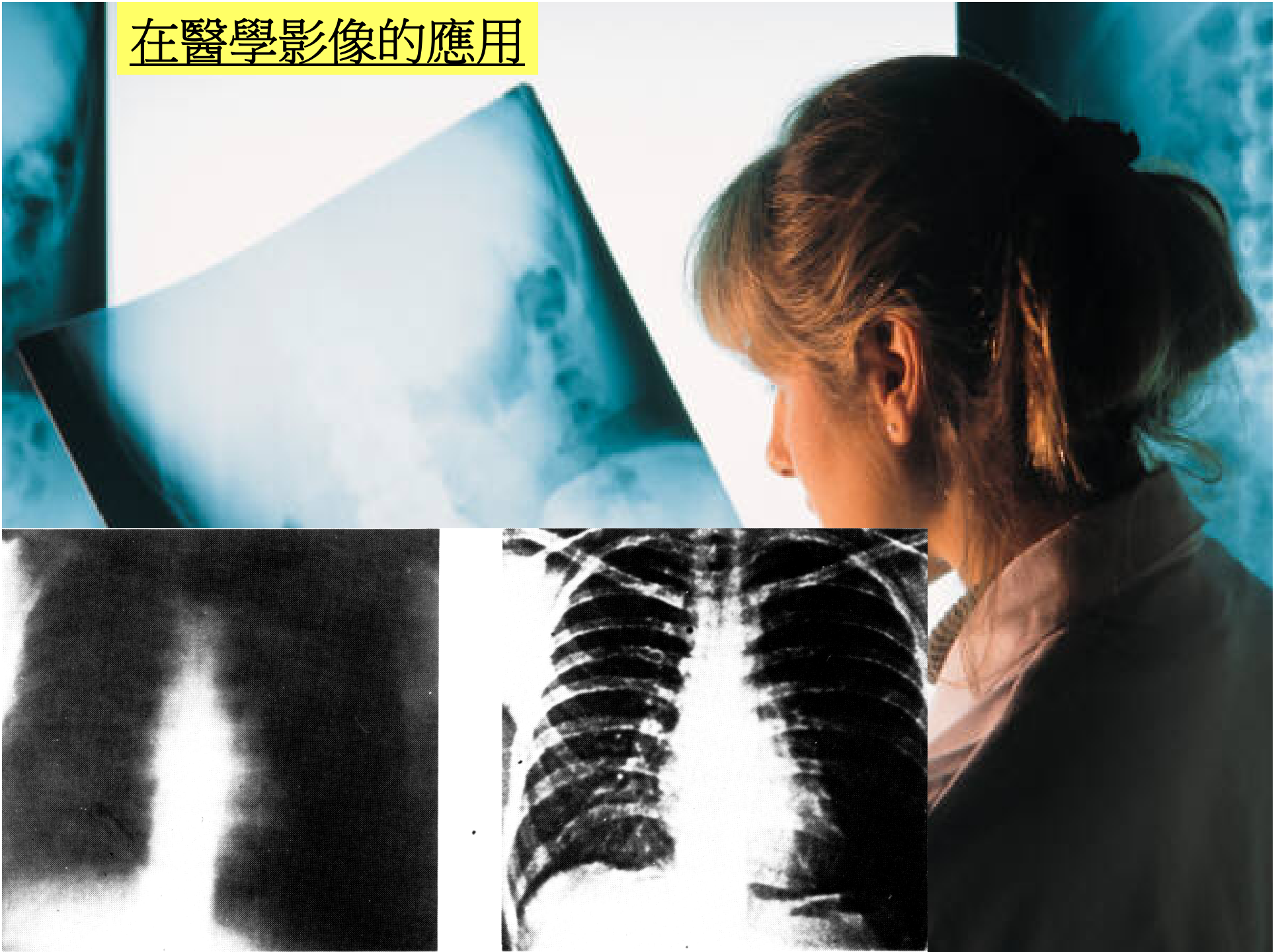


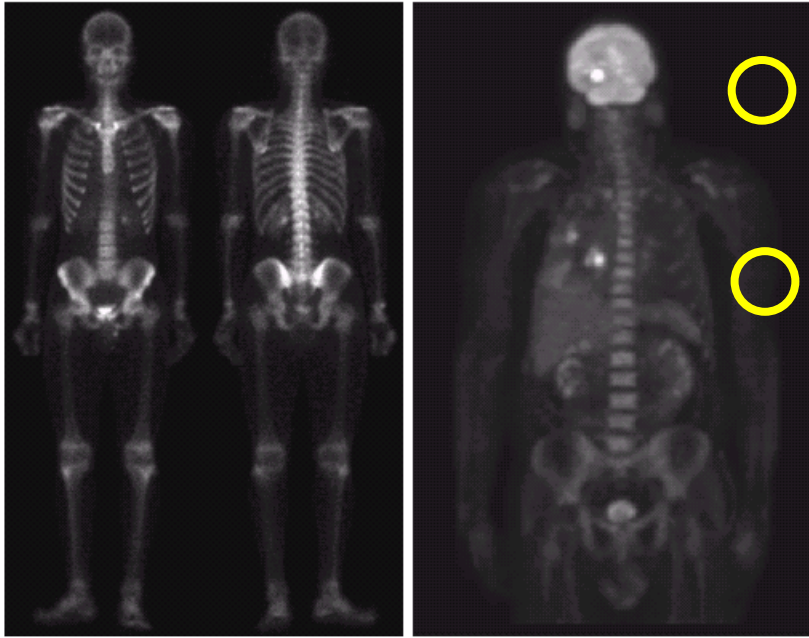
Eyedentify 掃描區



可用來辨認身份的人眼特徵

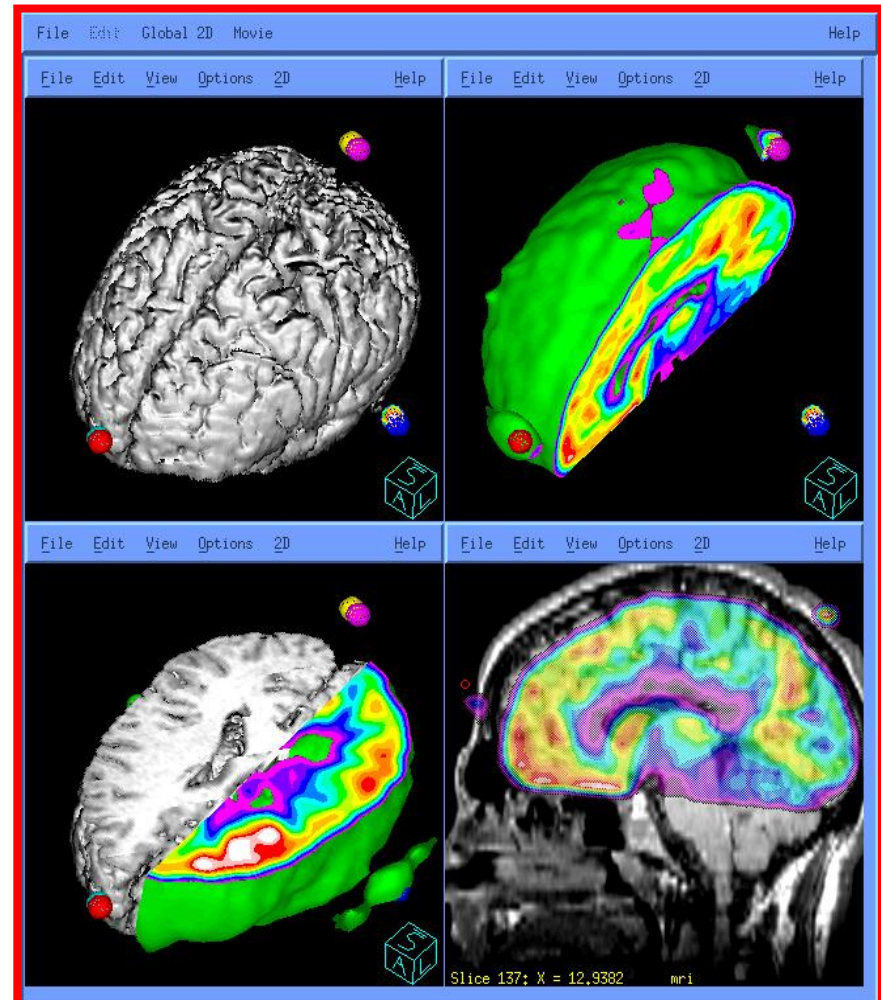
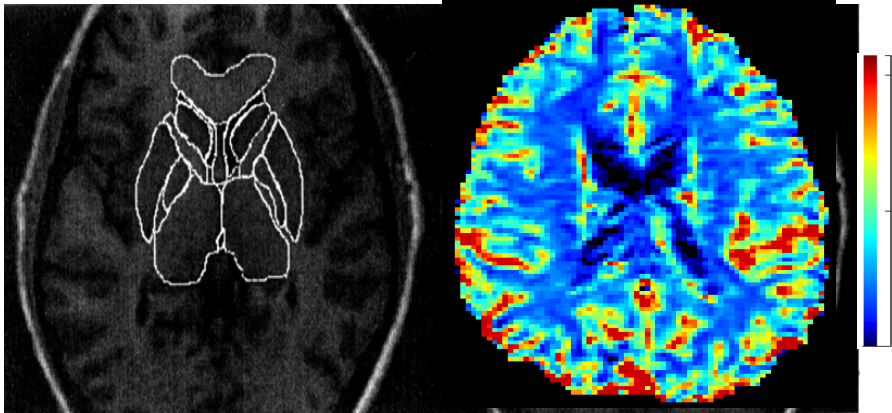
在醫學影像的應用



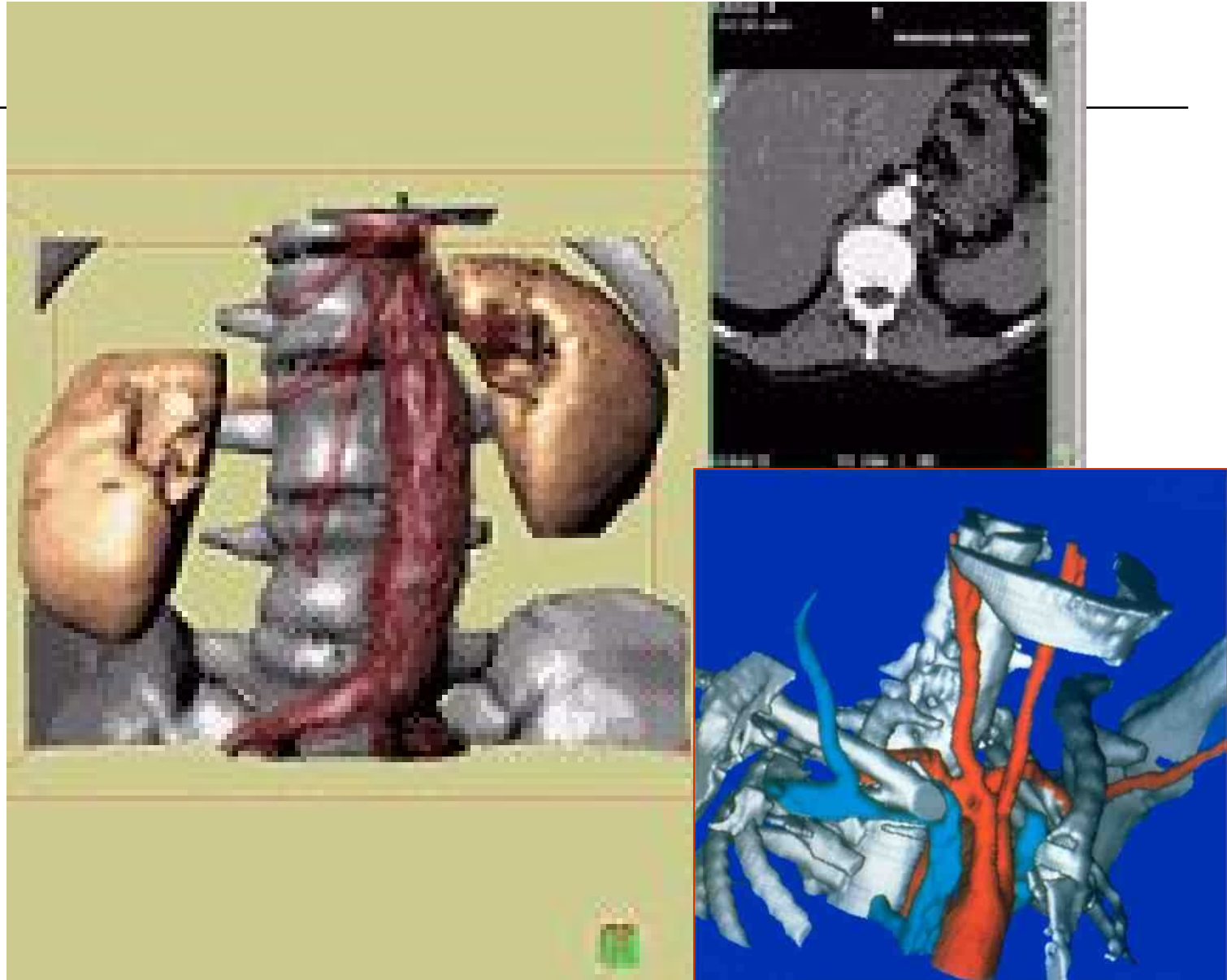


PET image
(Positron Emission Tomography)

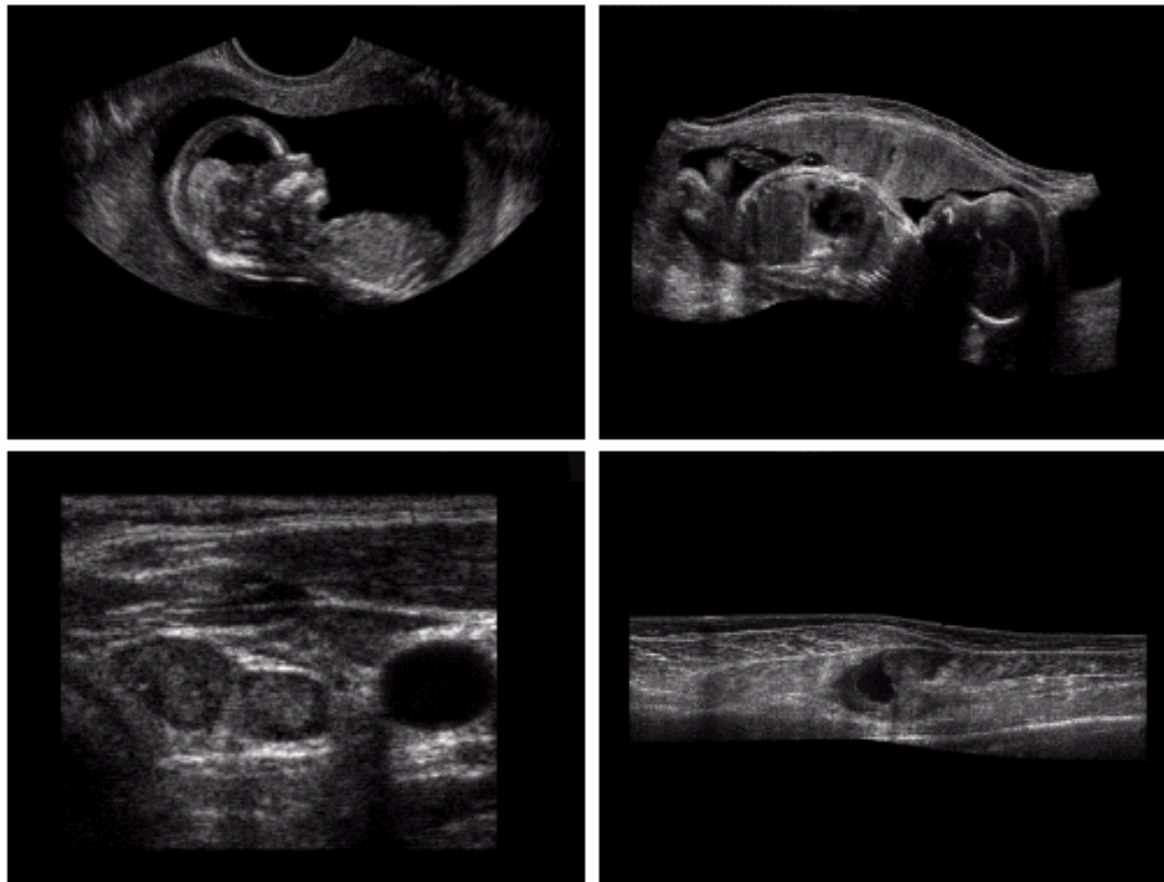
tumor



Computed Tomography (CT)



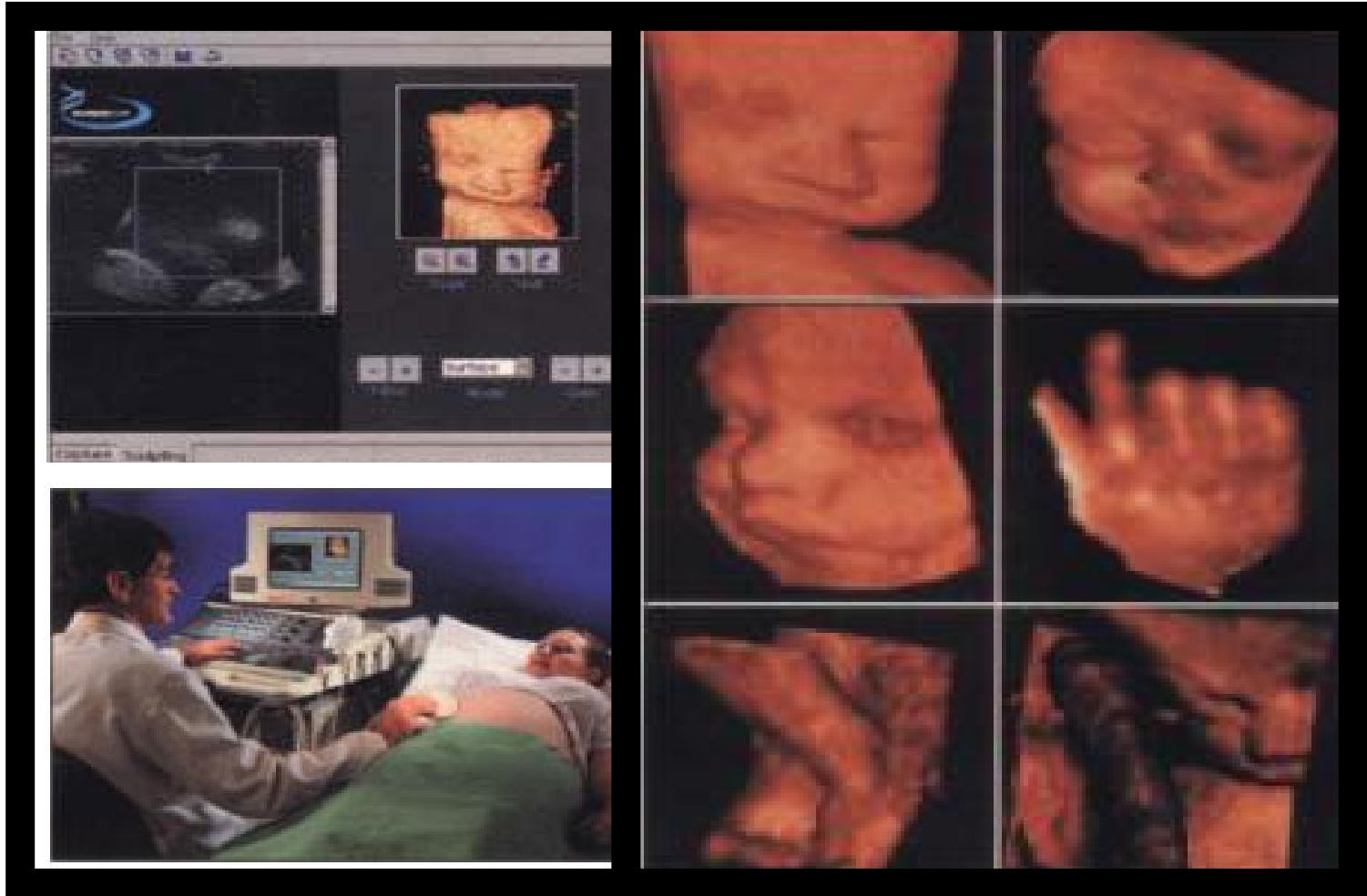
Ultrasound (millions of Hertz)



a b
c d

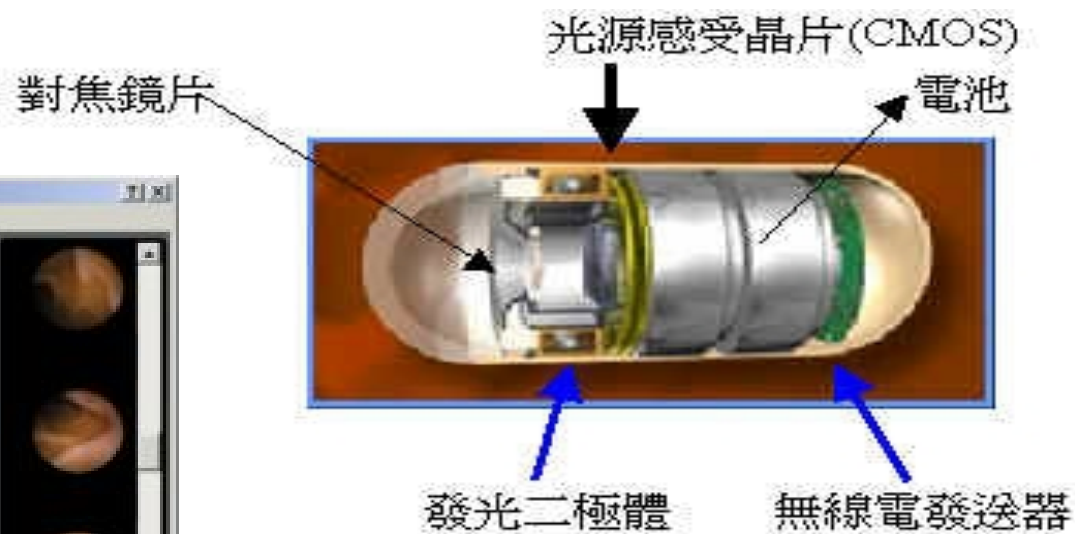
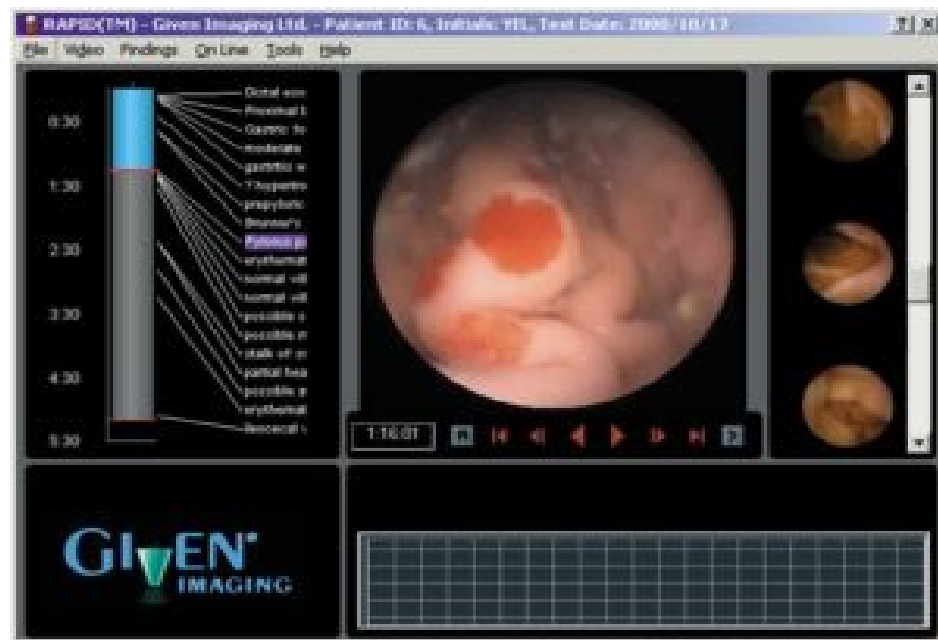
FIGURE 1.20
Examples of
ultrasound
imaging. (a) Baby.
(2) Another view
of baby.
(c) Thyroids.
(d) Muscle layers
showing lesion.
(Courtesy of
Siemens Medical
Systems, Inc.,
Ultrasound
Group.)

3D超音波影像



無線膠囊內視鏡

- 微型膠囊利用Video Camera 擷取影像後，經影像處理晶片（CMOS、CCD晶片）將影像轉成數位格式，利用天線將資料以微波方式傳出



螢光影像診斷口腔病變



醫師所勾勒的病變區域

螢光檢測反應的區域

原始螢光影像

中醫舌診 ~ 舌影像處理程式

File Edit Image-Grab Preprocessing Processing Identification Stereo_image Help

校正後舌影像

結果 個別結果

舌質

舌色	淡紅色	45.38%
50.503%	紅色	4.390%
苔色	暗紅色	0.722%
49.496%		
	白苔	34.48%
	黃苔	14.46%
	error	0.549%

舌形

舌寬	4.69808	cm
舌長	6.14226	cm
舌面積	23.6787	cm ²

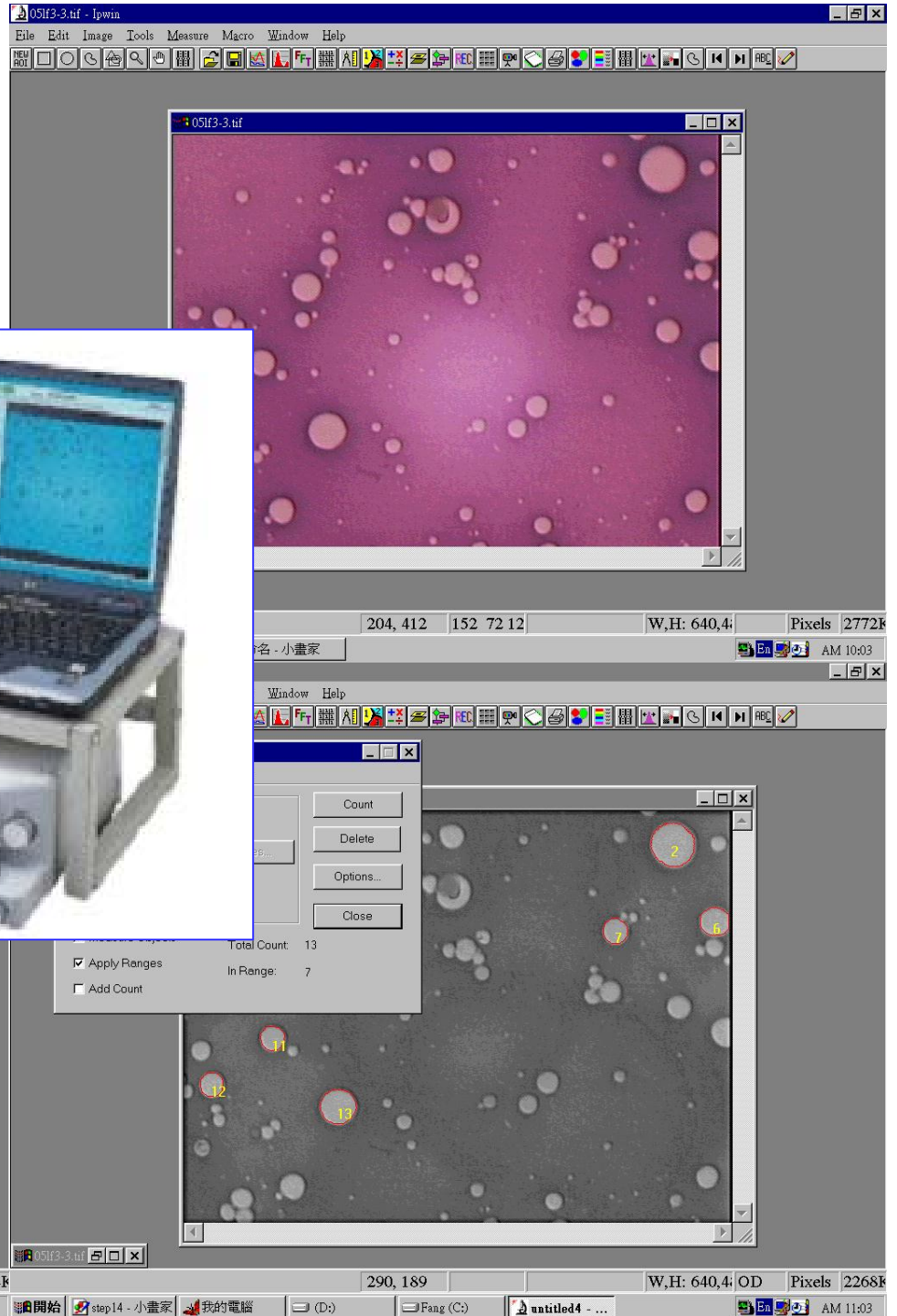
中醫舌診影像處理程式 劉致華 1997/7/29 12:45:15 AM



計數應用:



植物細胞

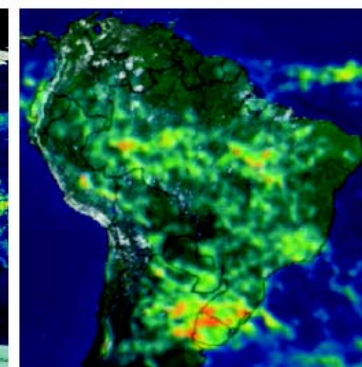
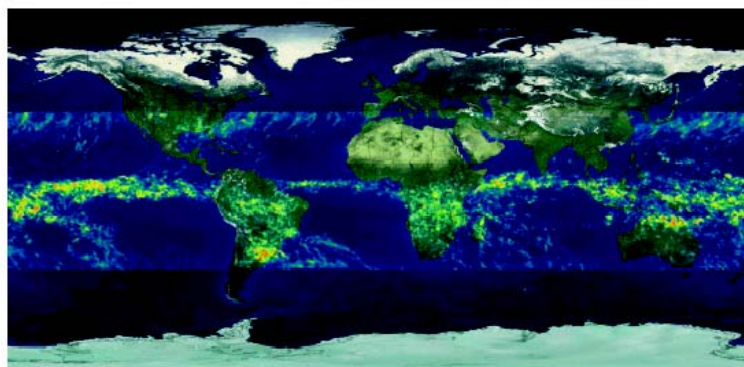
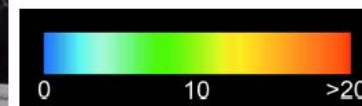
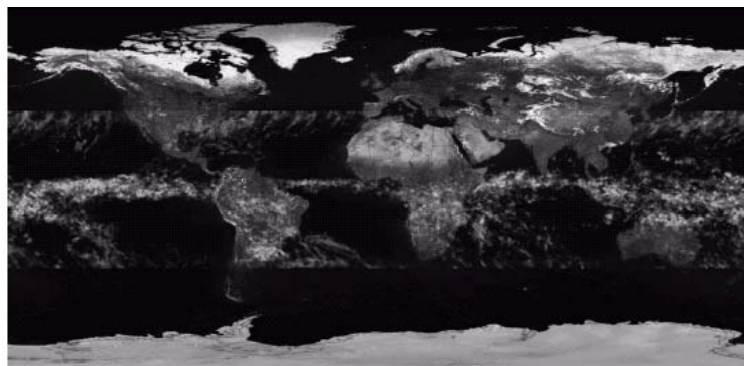
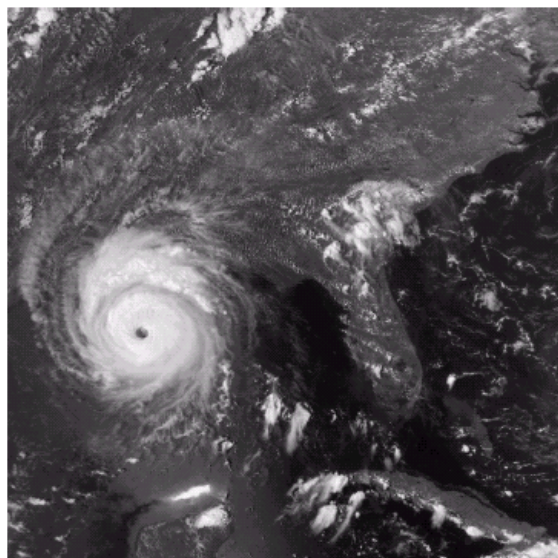




Medical image

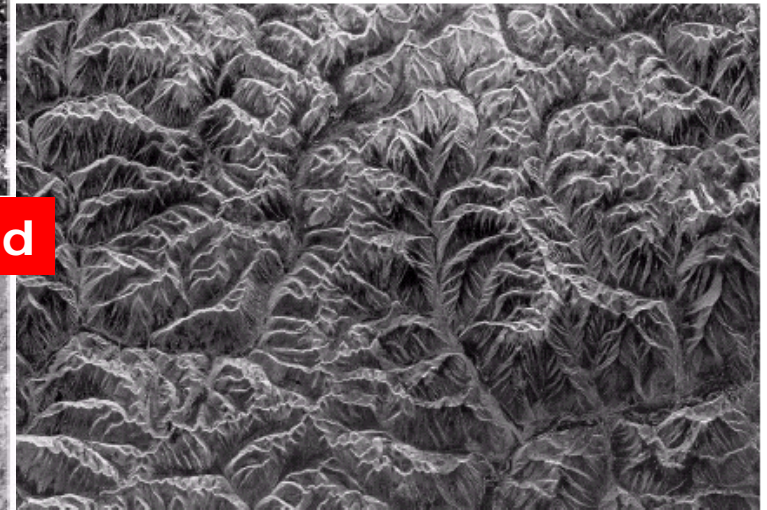
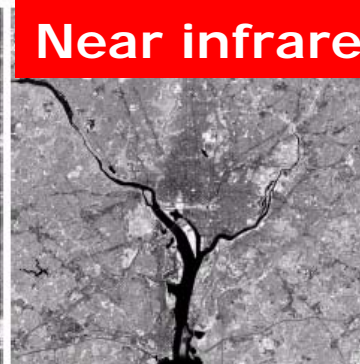
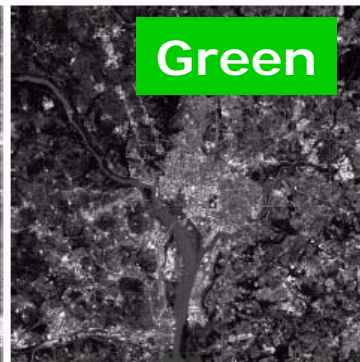
- 更清楚：改善影像品質
- 更快速：儲存空間降低(壓縮技術發展)
處理技術改進
- 協助診斷：生理參數之萃取
相關資訊之整合及比對
- 協助治療：機械手臂手術之應用

氣象衛星雲圖

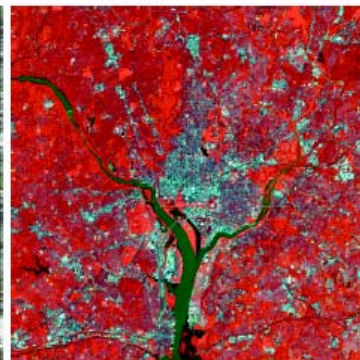


GIS

Washington, D. C.

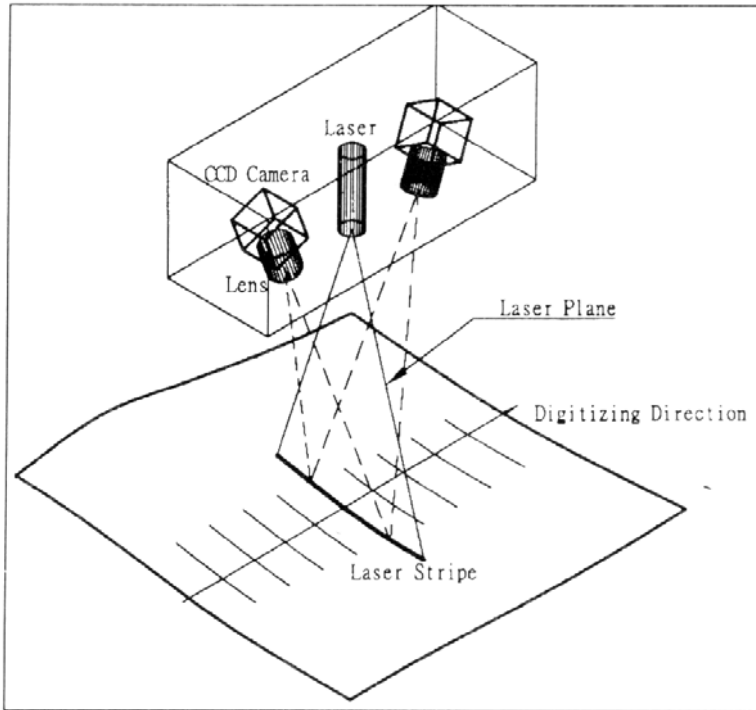


(R,G,B)

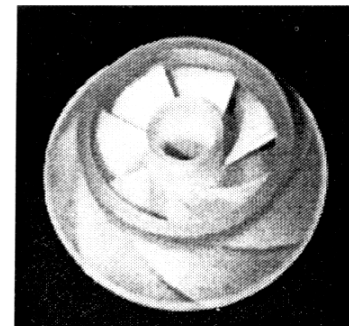
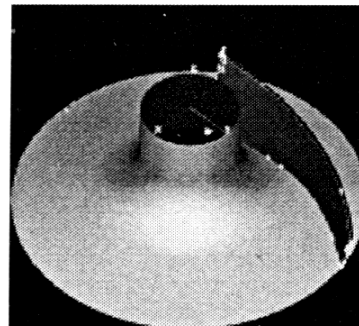
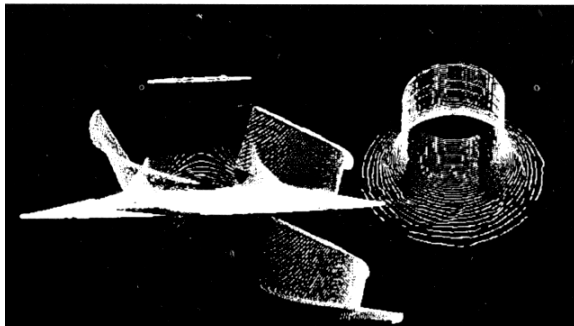


(Near IR,G,B)

- Biomass (red)
- Human-made features (bluish)



影像重建(逆向工程)



(a)



(b)



(c)

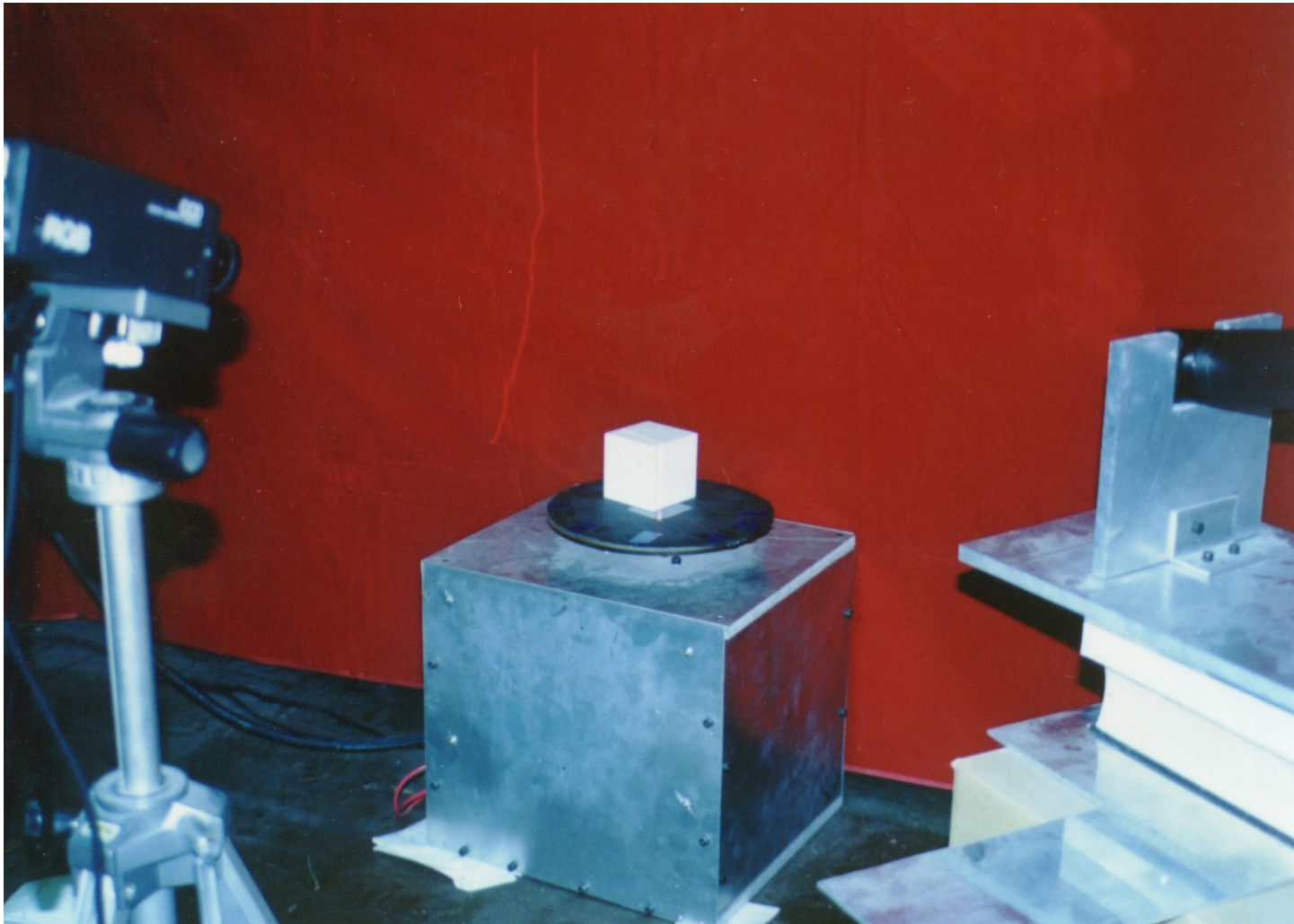


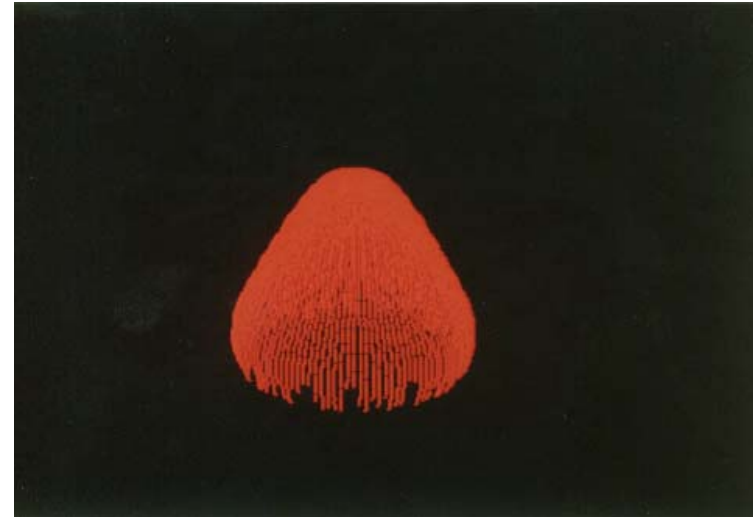
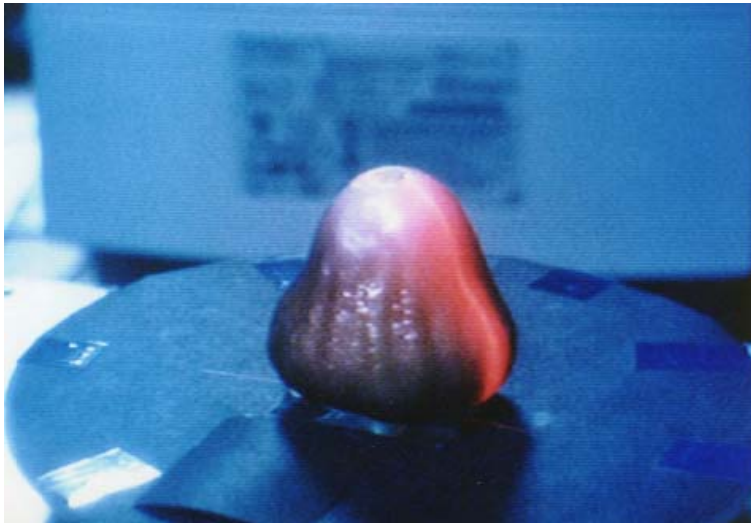
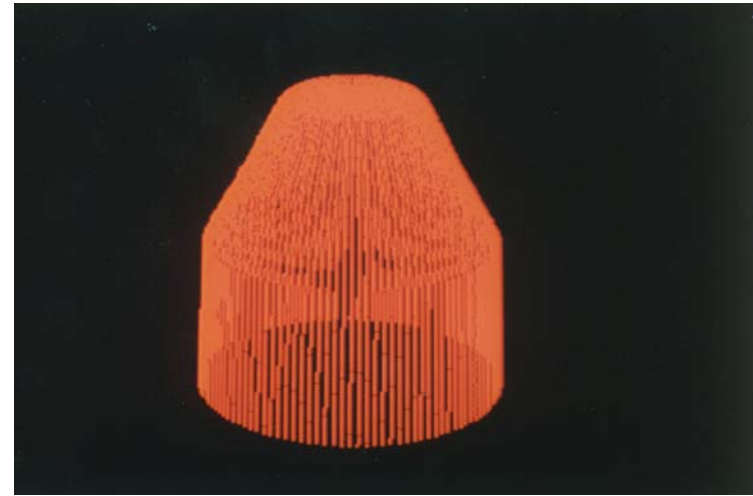
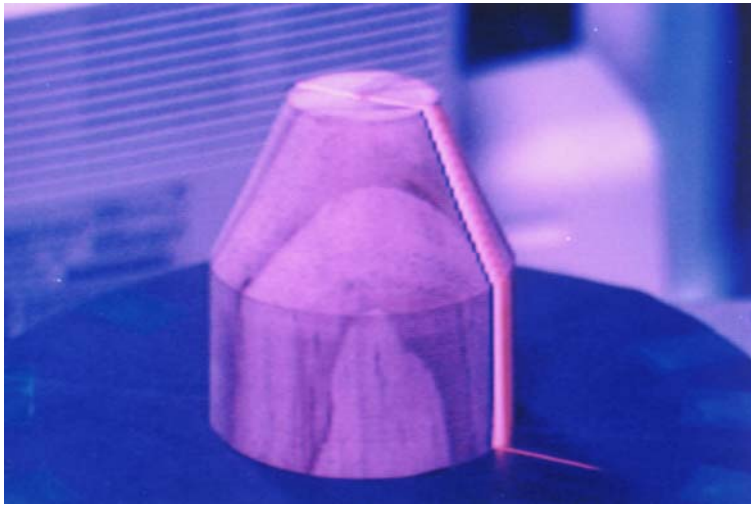
(d)



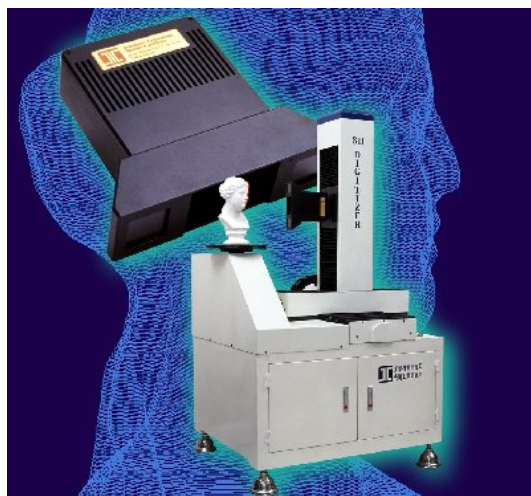
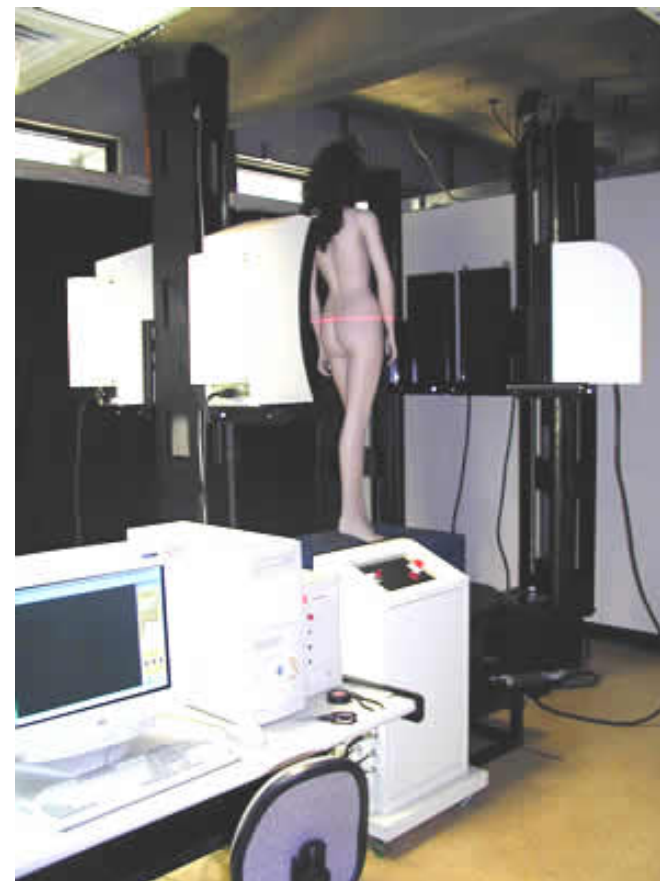
(e)

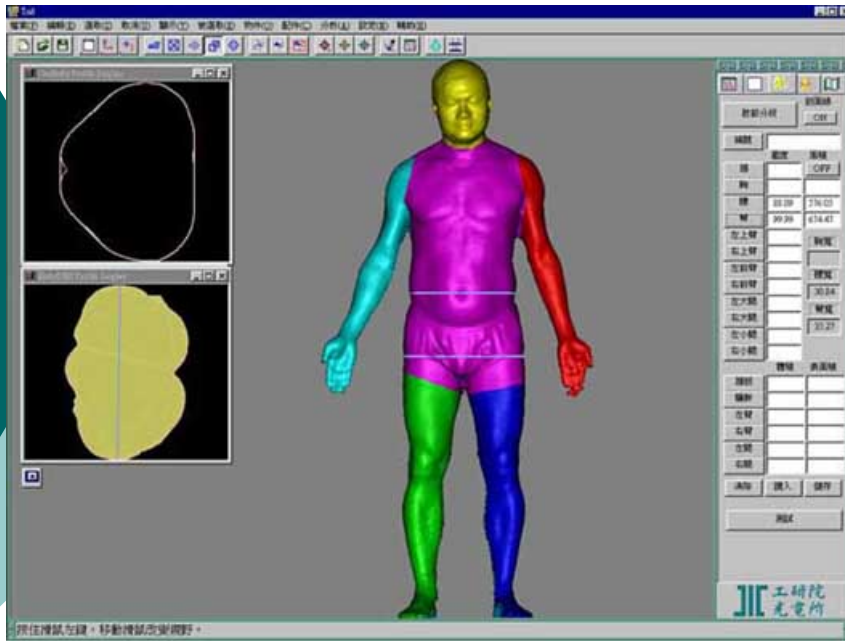




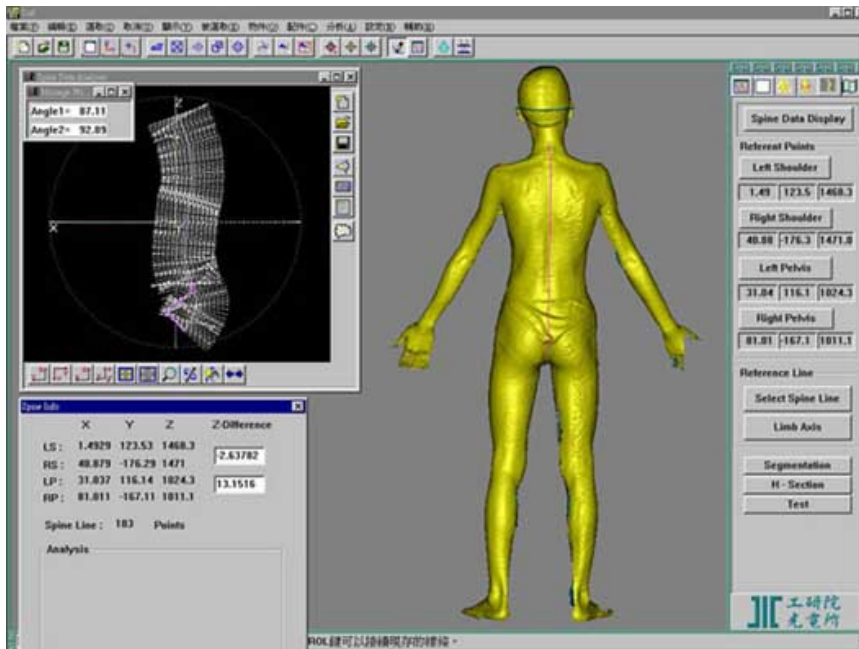


立體掃描器



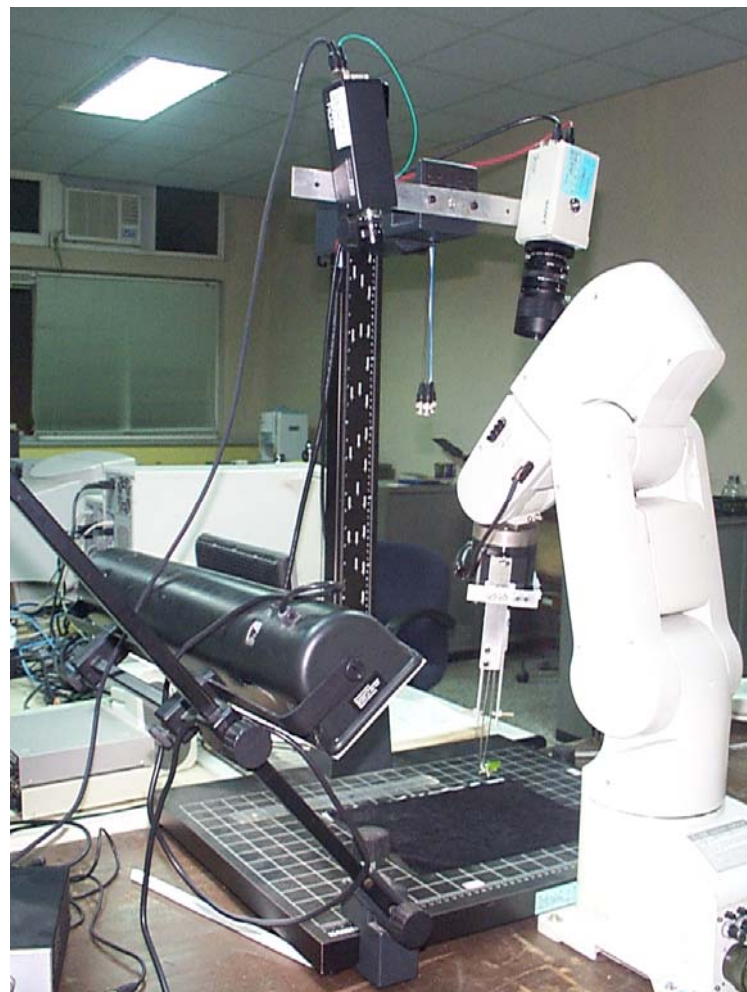


- 寬度(width), 深度(depth)
- 圍度(Circumference):
- 剖面積(Area)
- 曲線長度(Length)
- 表面積(Surface Area)
- 體積(Volume)

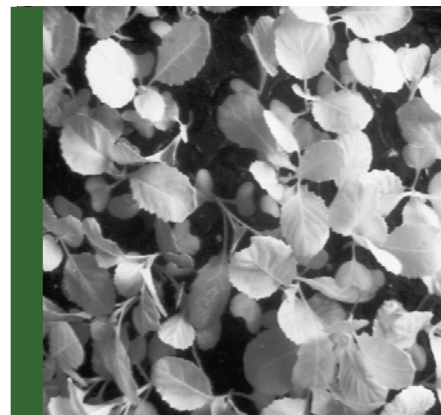
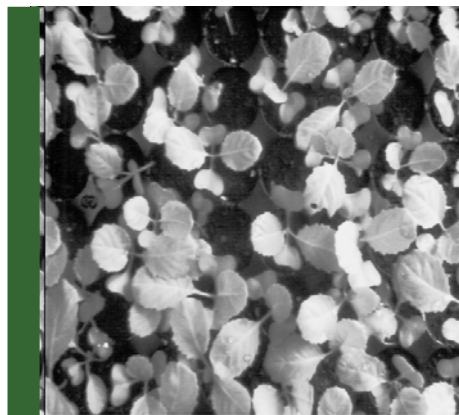
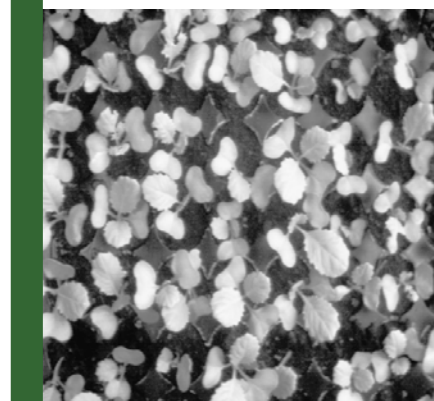
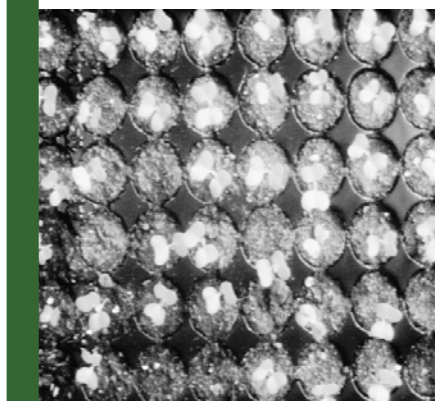
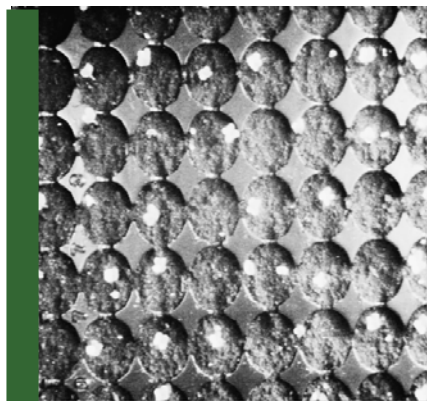


- 脊椎曲線分析功能:
- 左肩點，右肩點，左髌脊點，與右髌脊點之計算分析
- 脊椎曲線之夾角計算
- 軀幹之軸心線計算

苗移的移植



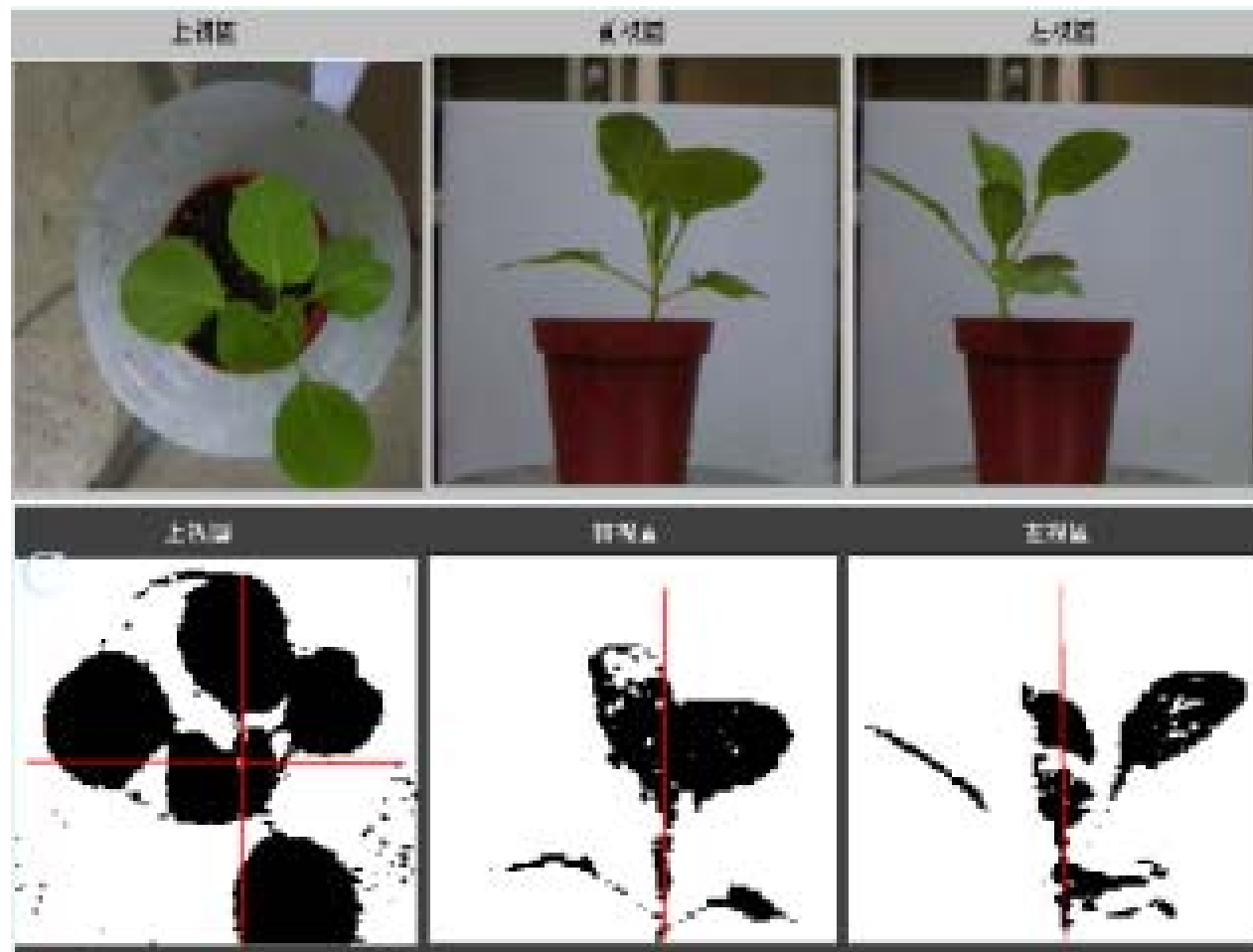
穴盤種苗之生長量測



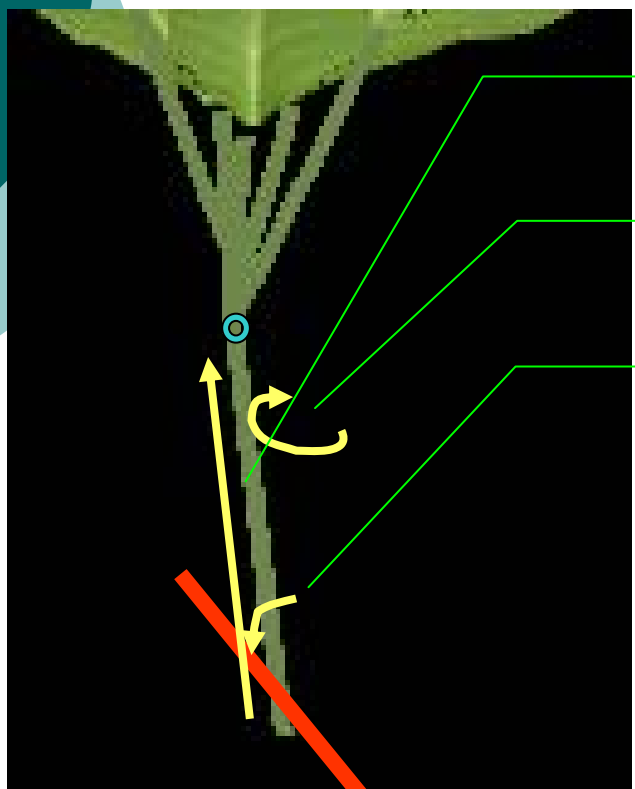
田間自走車視覺導引



植物生長模擬



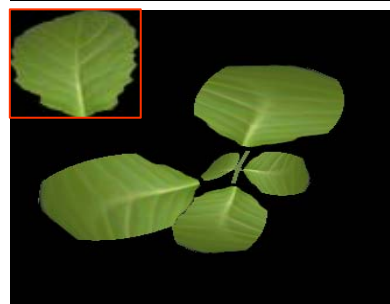
植物生長模擬



莖的長度

Y軸轉角

X軸轉角



END



Throw Basketball