



[image]

Image Processing and Computer Vision Applications

3D Facial Animation

Non-photo-realistic Image Processing

Content-Based Image Retrieval (CBIR)

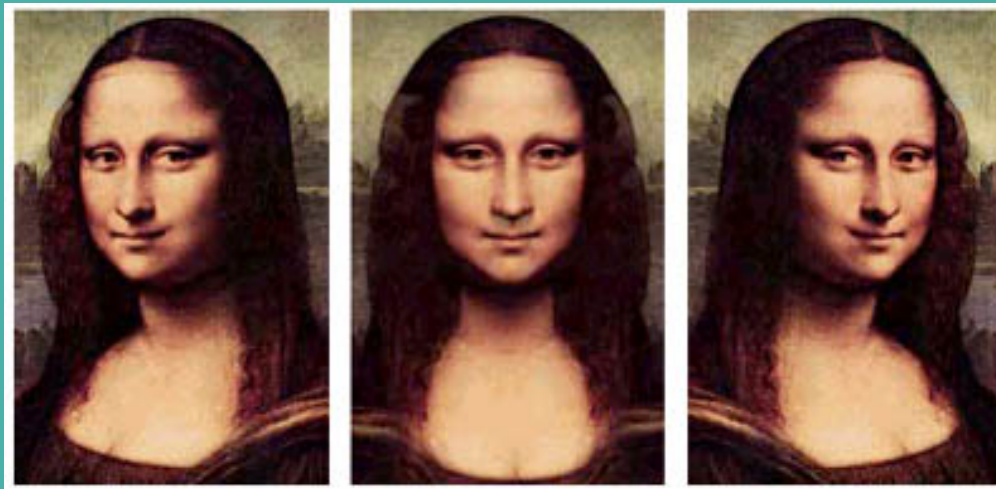
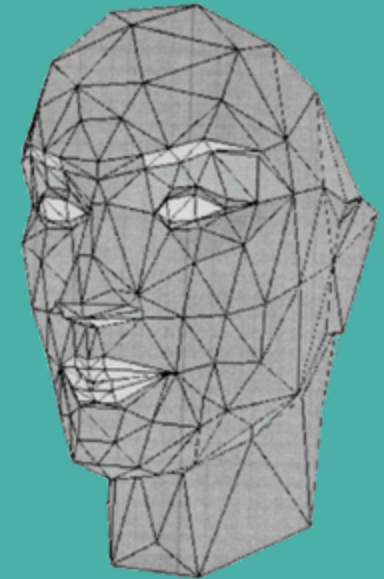


蔣依吾

國立中山大學 資訊工程學系

E-mail: chiang@cse.nsysu.edu.tw

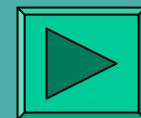
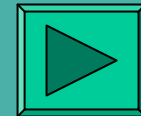
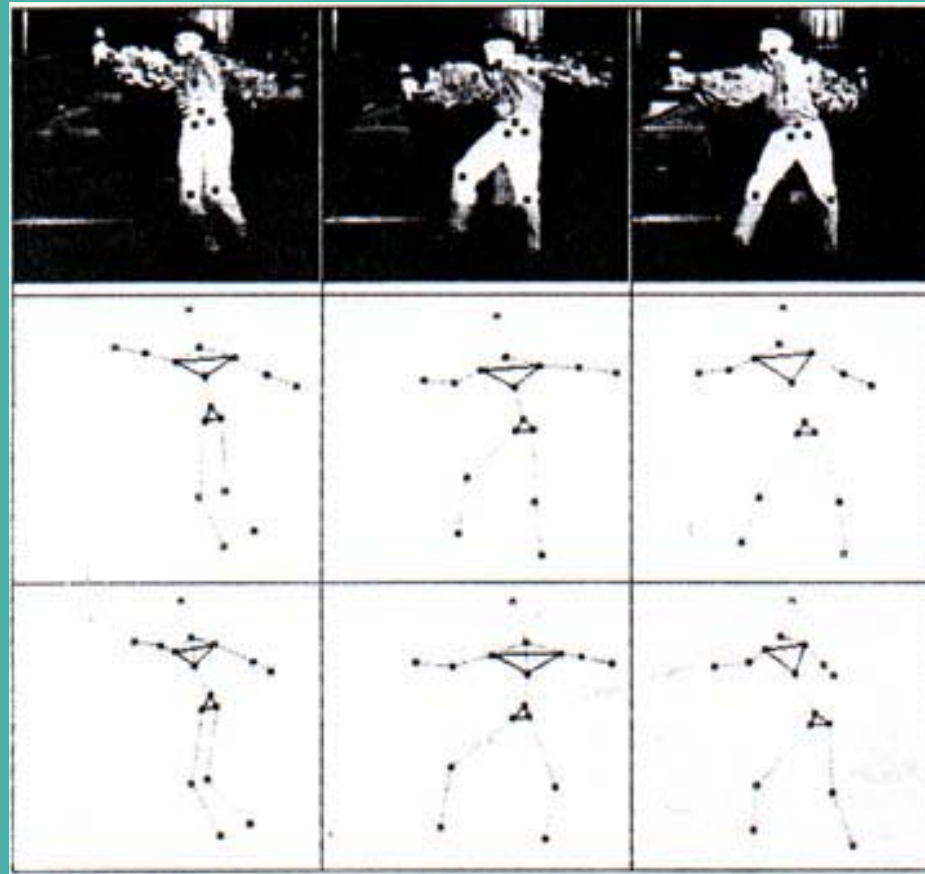
Web: <http://image.cse.nsysu.edu.tw>





[image]

Motion Detection





Morphing [1999, Frederic Pighi]



+



=



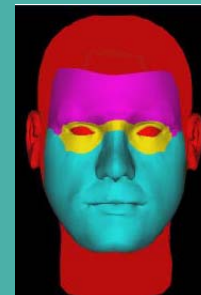
Surprise 50%

Sad 50%

Worry



+



+

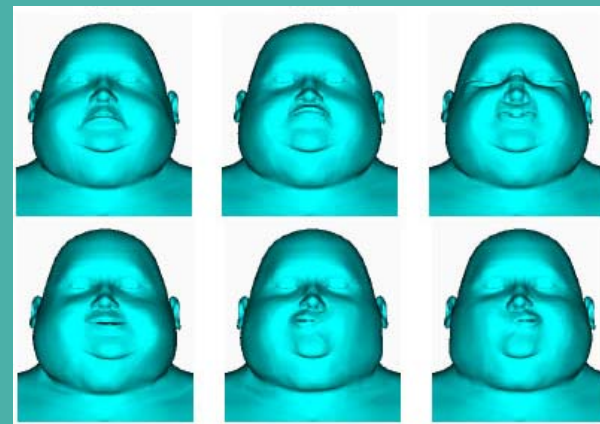
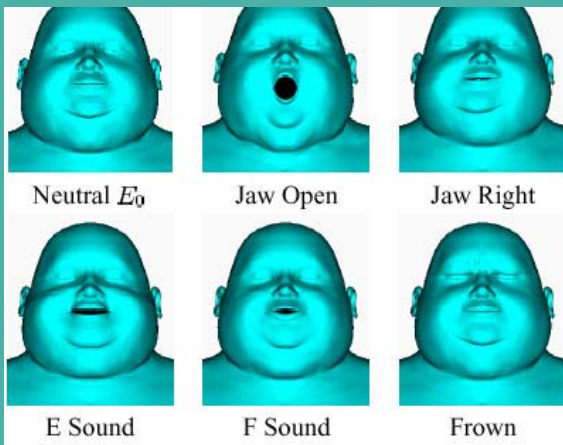
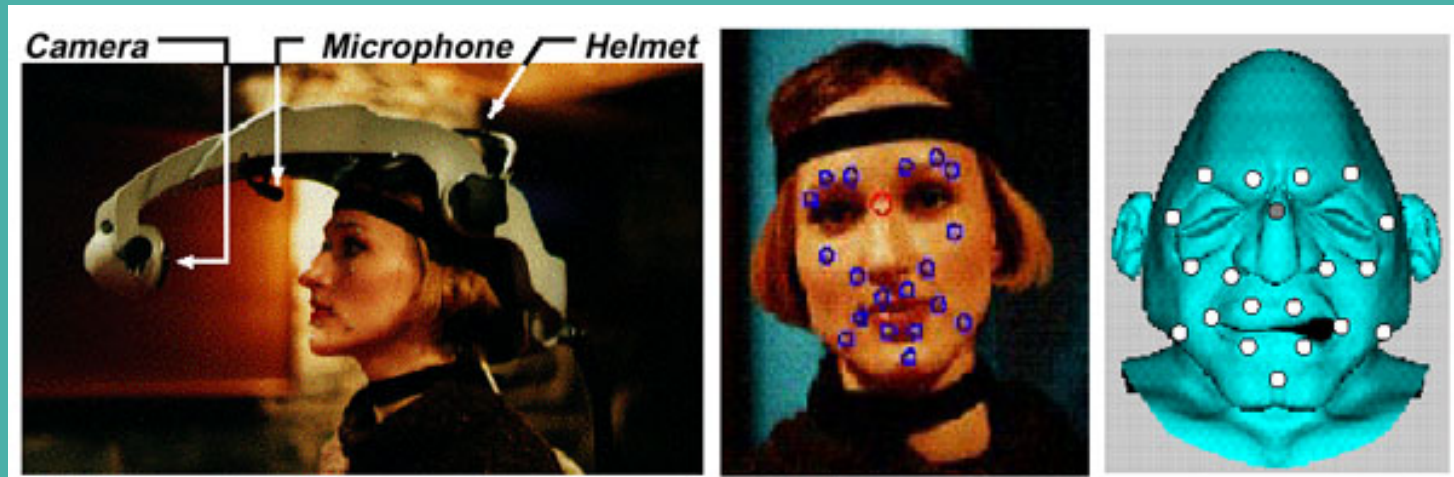


->



Sensor

[image]

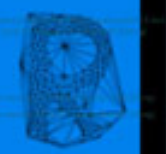


Cyriaque Kouadio, Pierre Poulin, and Pierre Lachapelle (1998)



[image]

image processing



特徵擷取

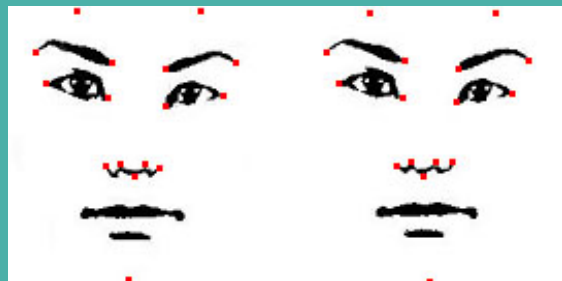
1. [A. Kapoor, R. W. Picard, MIT Media Laboratory, 2002]
2. [清華大學, 2001]



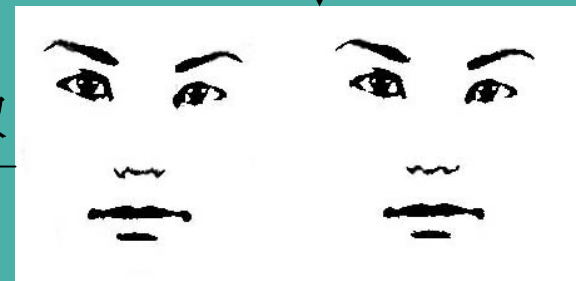
二元化



連接區塊分析

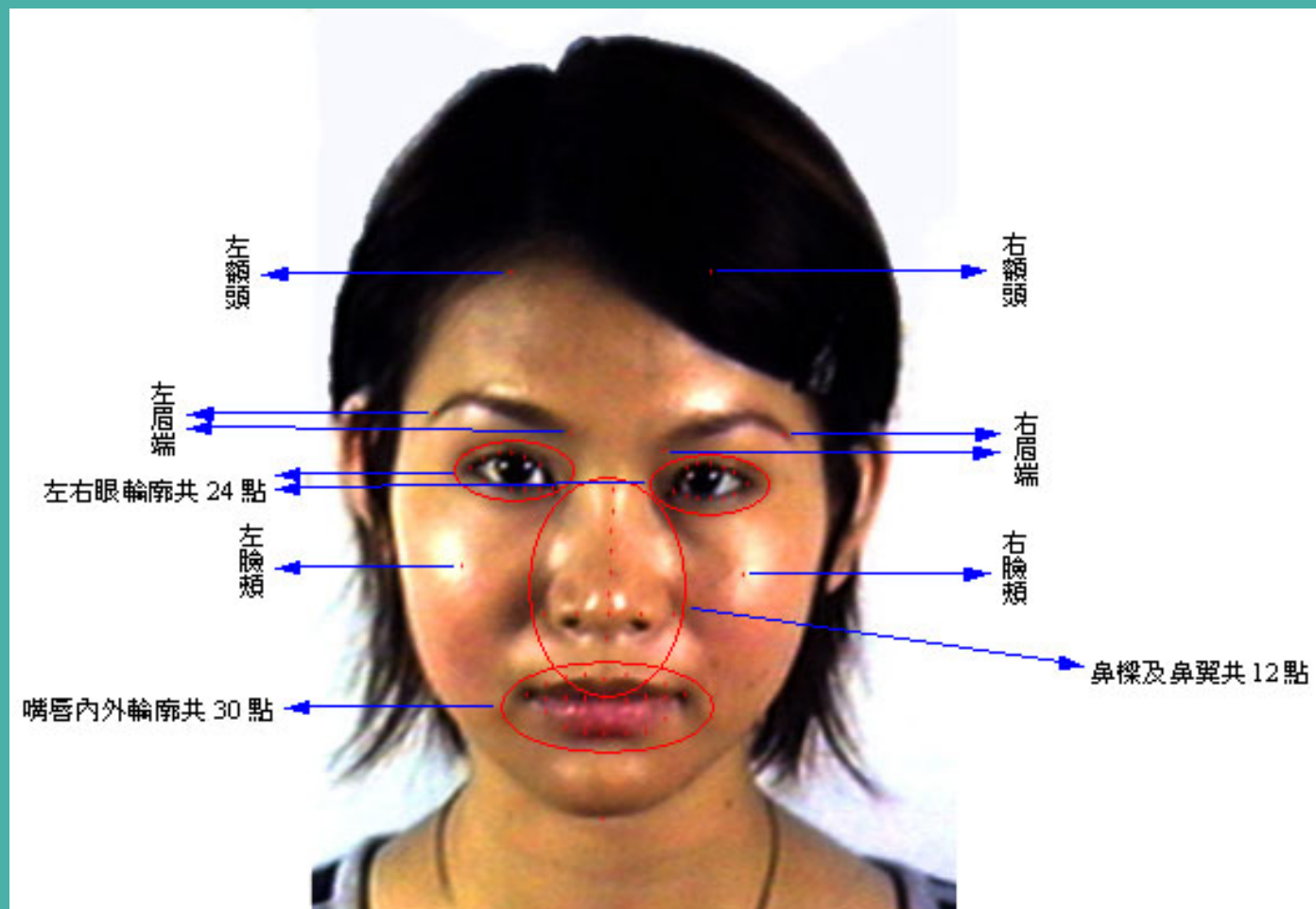


主要特徵擷取





所有特徵點

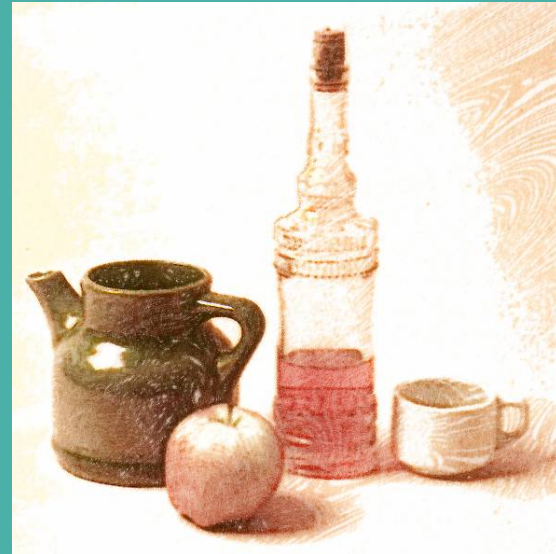
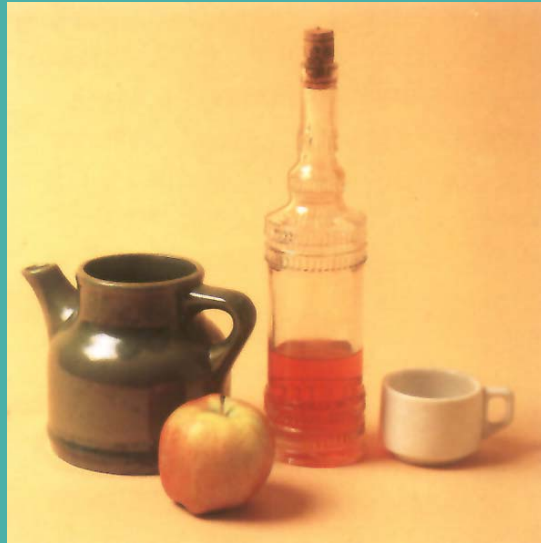




[image]

概要

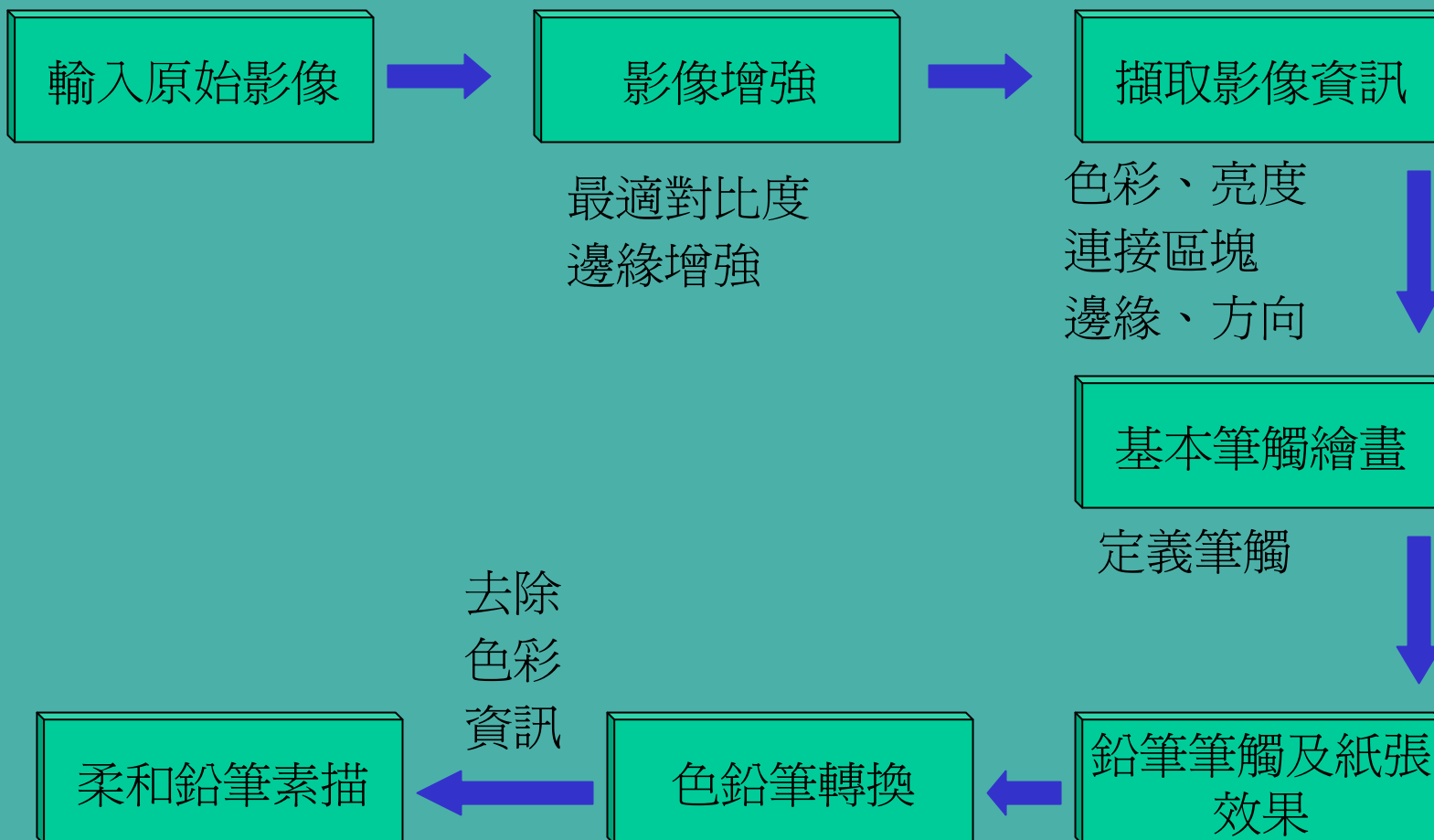
1. Non-Photo-realistic rendering
2. 以實際影像為依據
3. 輸出素描、彩色素描



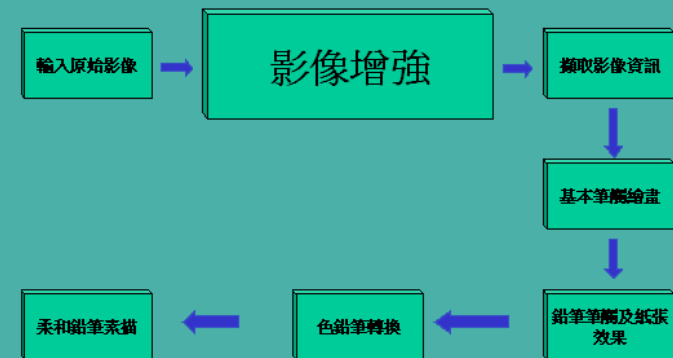
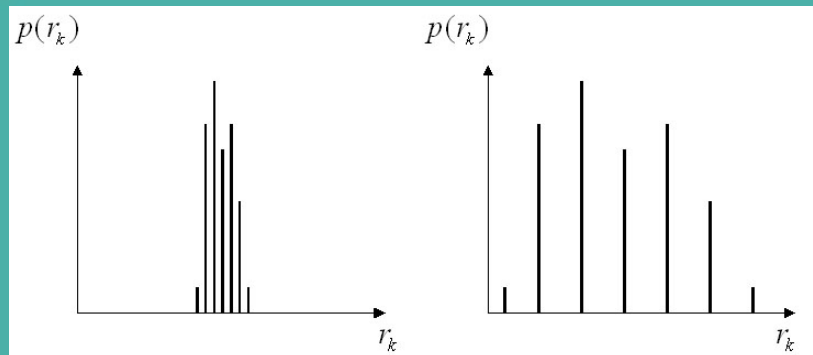


[image]

流程



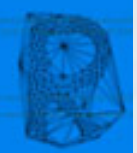
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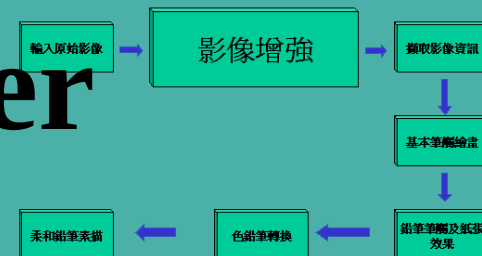


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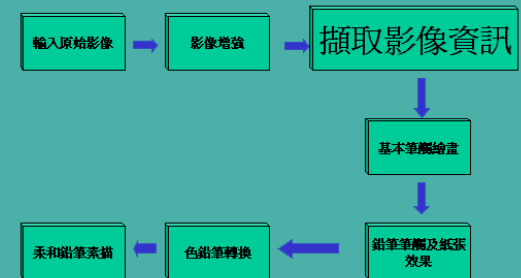
image processing



High-boost filter



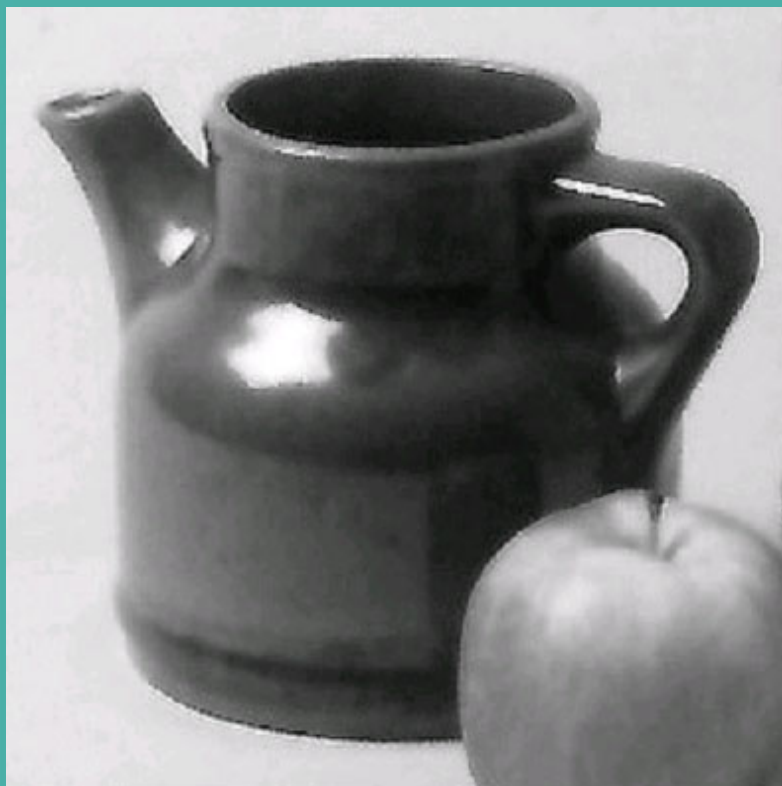
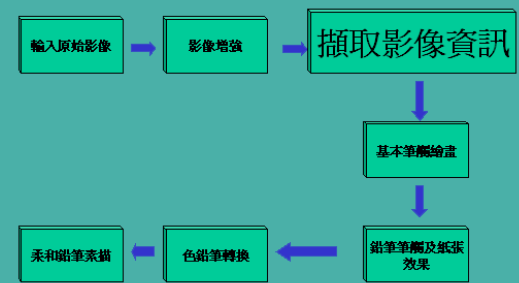
Connected component





[image]

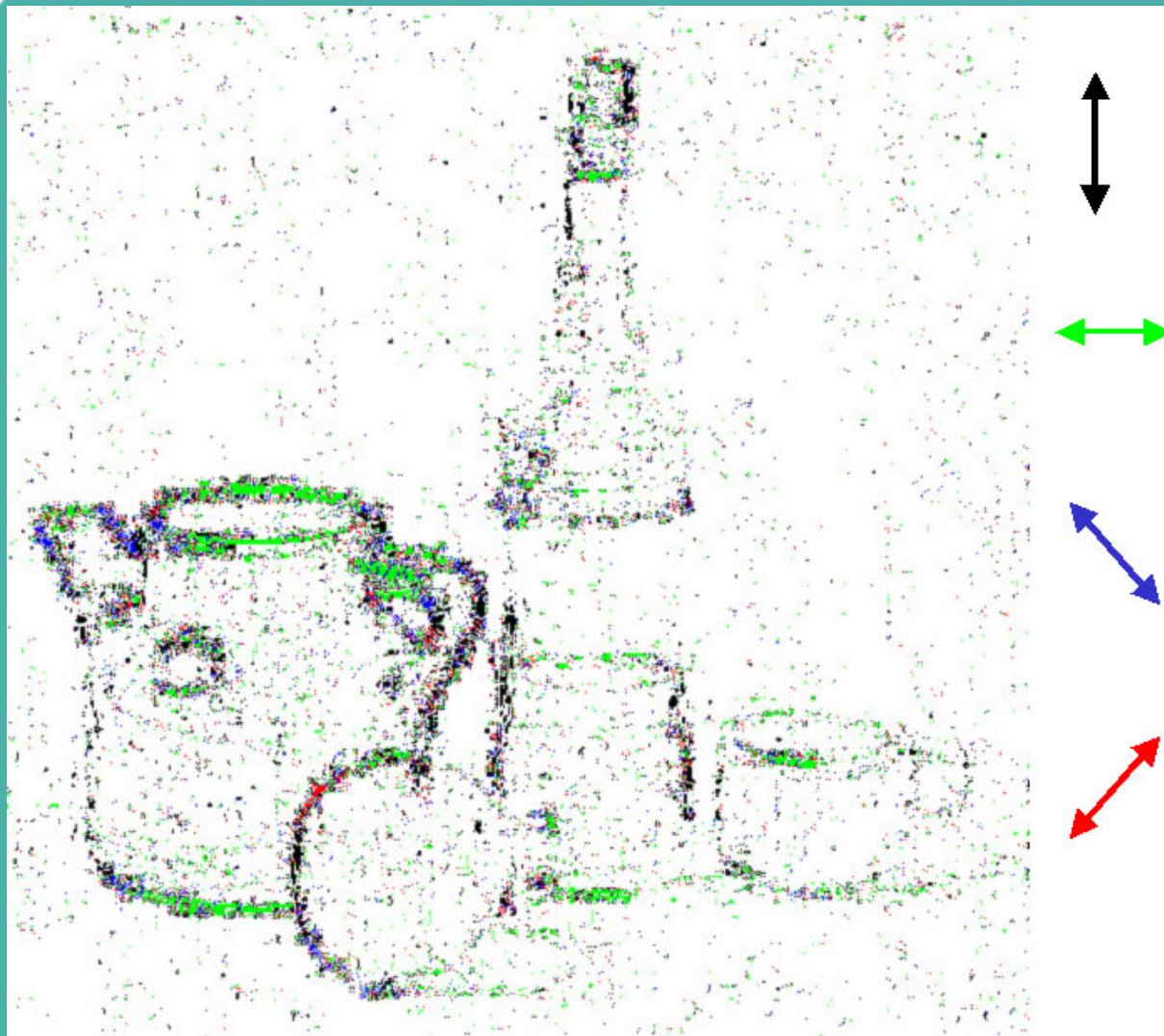
image processing



利用空間域高通濾波器擷取邊緣



[image]



邊上的每點的方向性



[image]

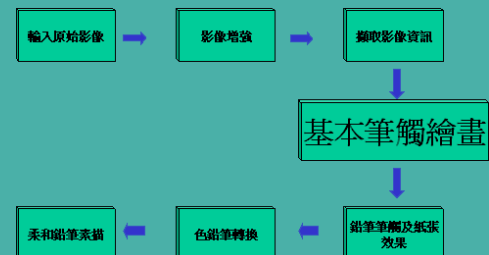
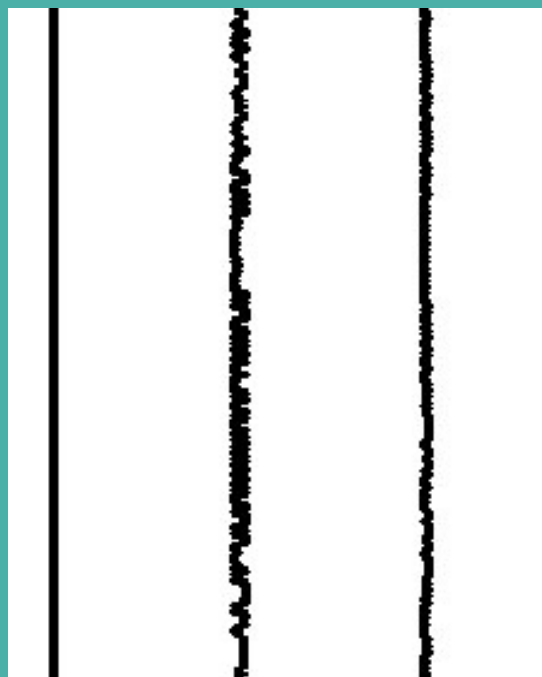
imageproc (Image Processing) Environment (V2.0.0)
http://imageproc.nyu.edu/

imageproc (Image Processing) Environment (V2.0.0)
http://imageproc.nyu.edu/

imageproc (Image Processing) Environment (V2.0.0)
http://imageproc.nyu.edu/

imageproc (Image Processing) Environment (V2.0.0)
http://imageproc.nyu.edu/

手繪線段

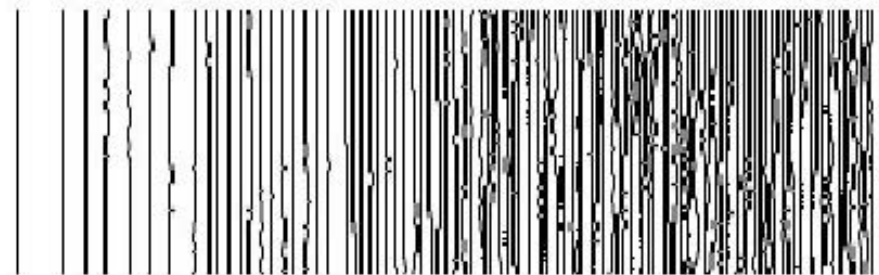
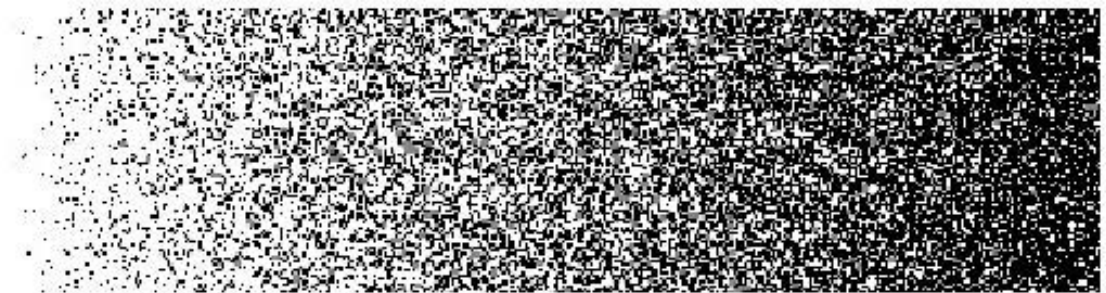
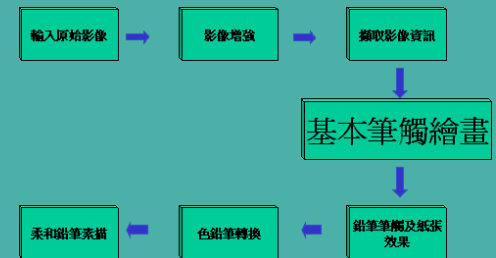


$$P(t) = P(t) + \tilde{A} \sin(2t / \tilde{\omega})$$



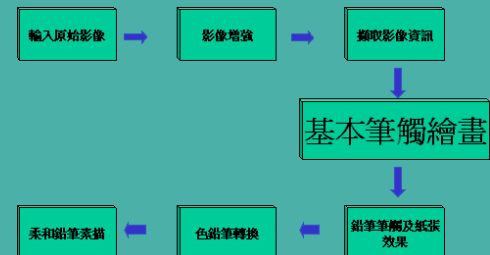
[image]

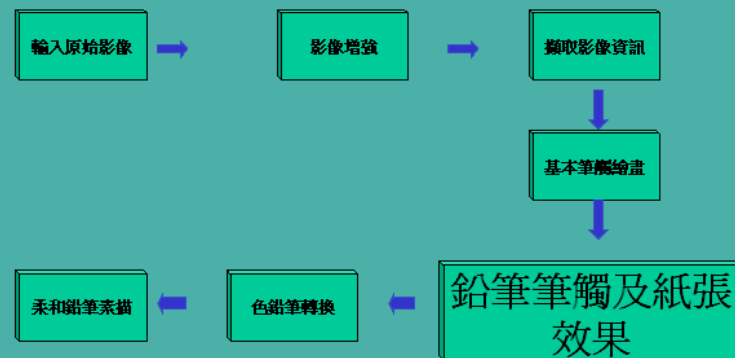
hatching





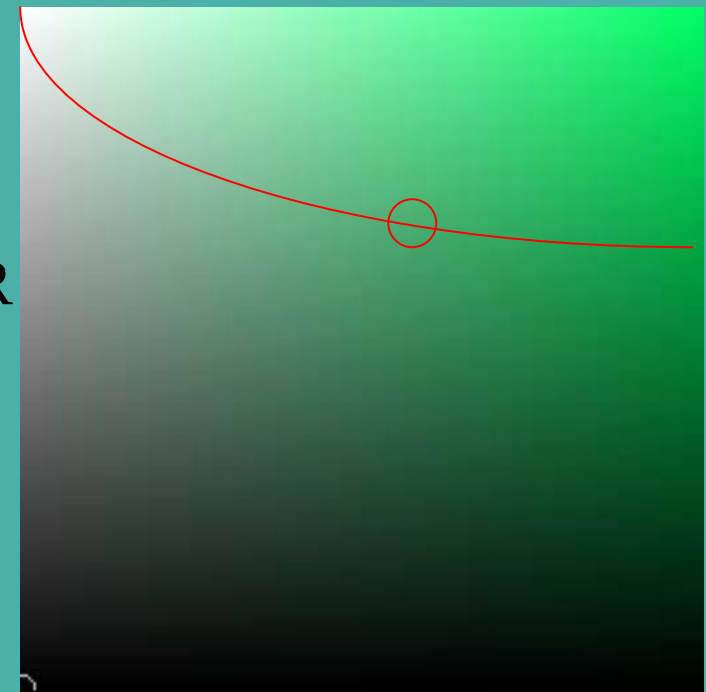
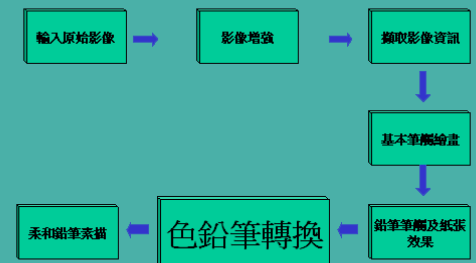
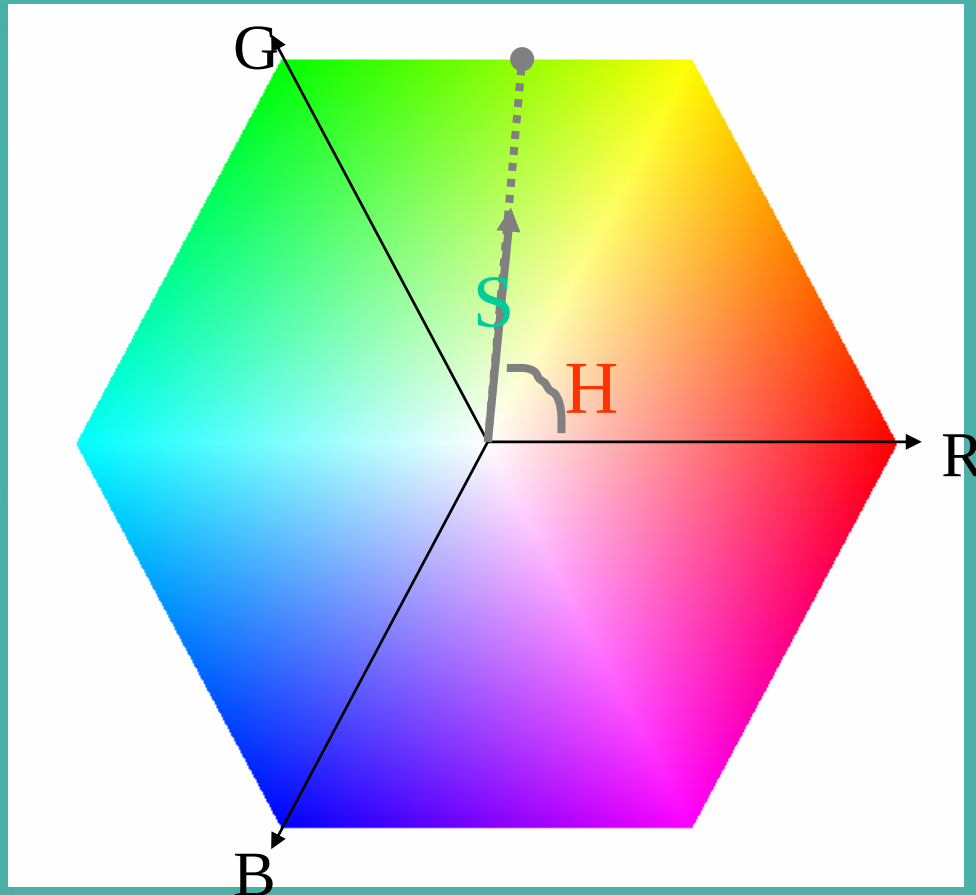
[image]







[image]



HSL系統 H：色調 S：飽和度



image processing

影

[Image Processing Laboratory]
像.處.理.實.驗.室

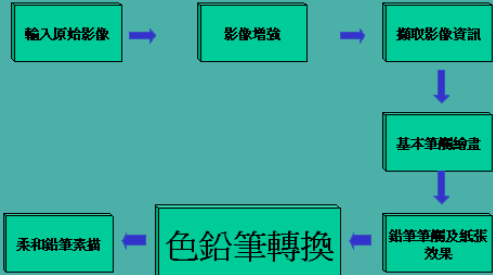
國立中山大學資訊工程系

image processing

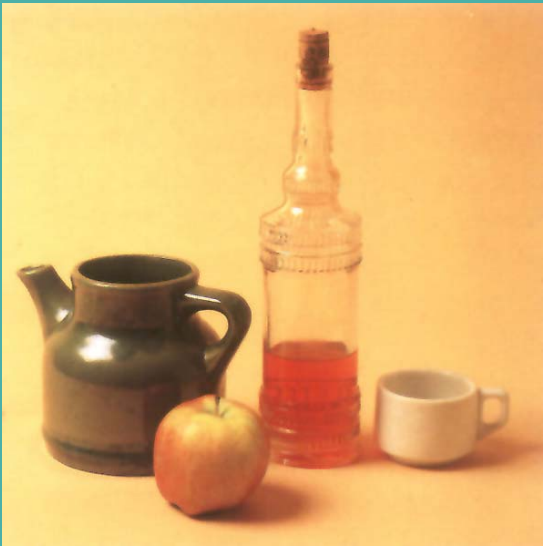
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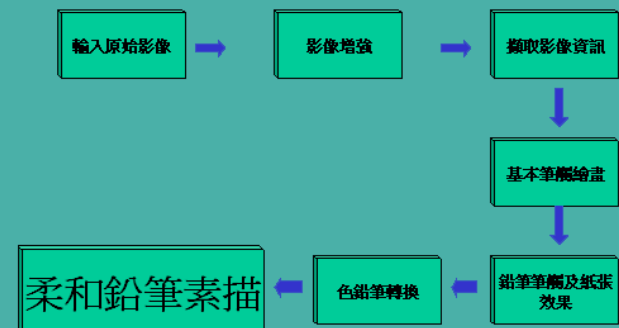


```
graph LR; A[輸入原始影像] --> B[影像增強]; B --> C[擷取影像資訊]; C --> D[基本筆觸繪畫]; D --> E[鉛筆筆觸及紙張效果]; E --> F[色鉛筆轉換]; F --> G[柔和鉛筆素描];
```



21/63

[image]

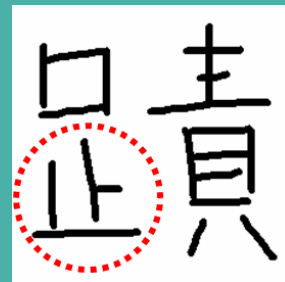
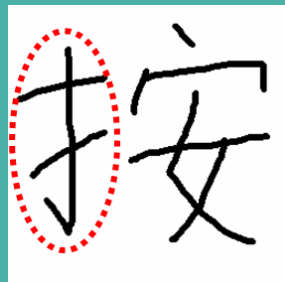
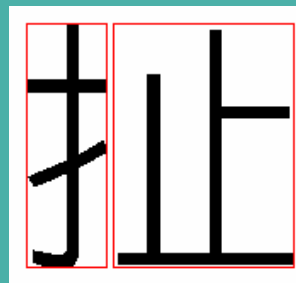


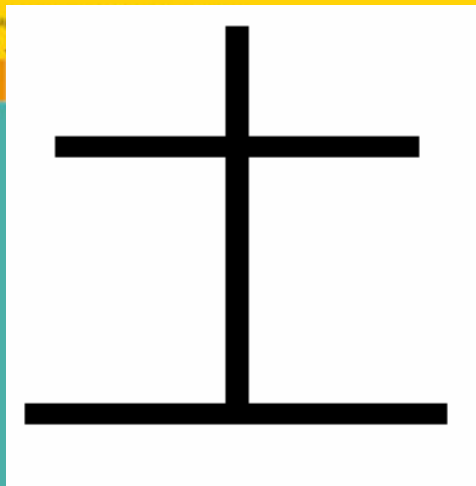


[image]

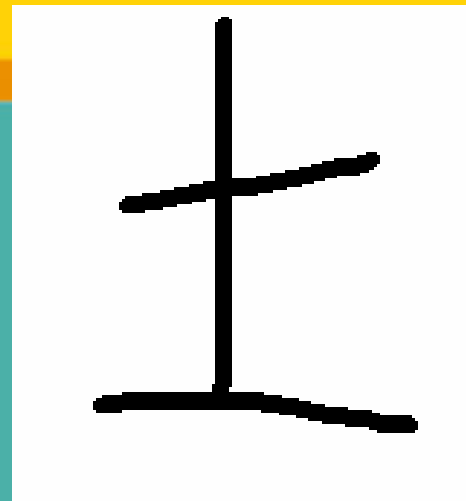
Personalized Font

- 標準字元處理
- 手寫字元分析
- 特徵套用

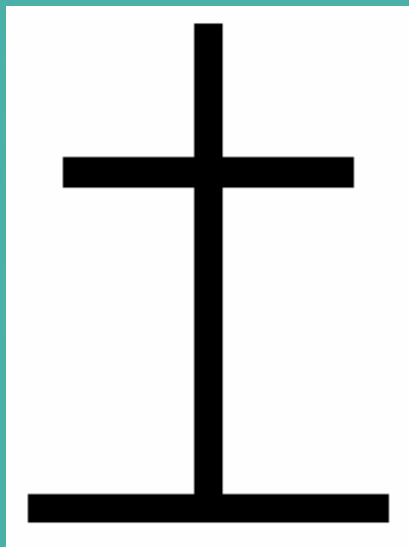




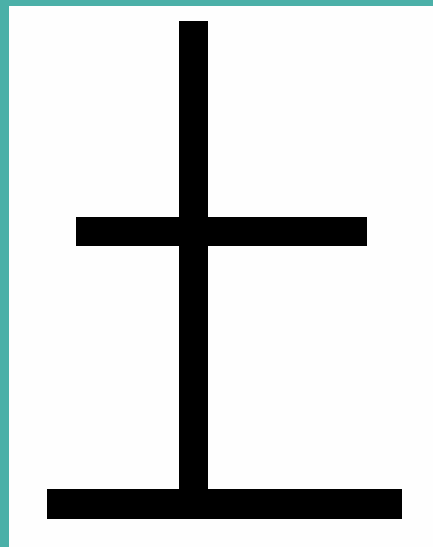
標準細黑體“土”字



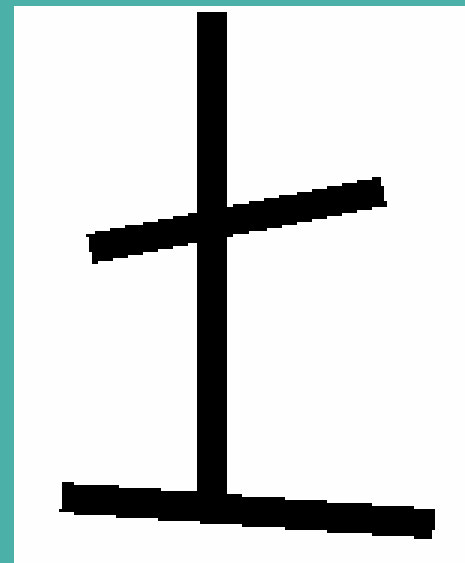
手寫影像



套用筆畫長度



套用各相交筆畫之交點
至各端點間線段長度比例



套用斜率



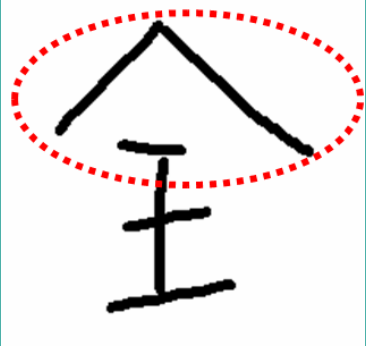
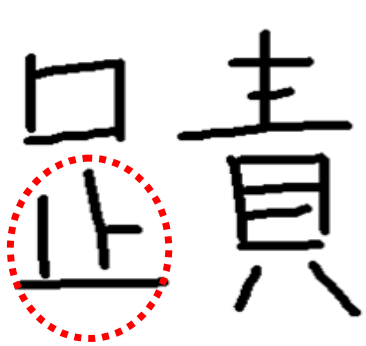
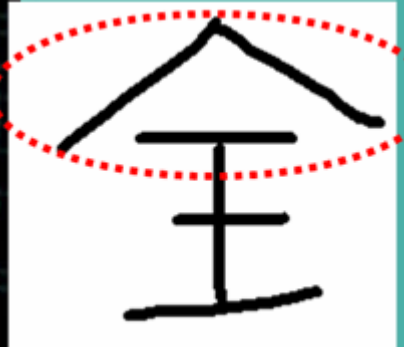
image processing

Image Processing Laboratory
像.處.理.實.驗.室

國立中山大學資訊工程系

image processing

[image]





25/63



玫

[image]

www.nyu.edu/~cs/vis/vis.html
www.nyu.edu/~cs/vis/vis.html
www.nyu.edu/~cs/vis/vis.html
www.nyu.edu/~cs/vis/vis.html
www.nyu.edu/~cs/vis/vis.html
www.nyu.edu/~cs/vis/vis.html
www.nyu.edu/~cs/vis/vis.html
www.nyu.edu/~cs/vis/vis.html



停

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敢

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玫



[image]

停蹟按尖詳岸石欠工力虫公尸月
萌異全玩符敢治因絲帛杓
場才古恢漫至女尼社役車由陽
小生延仔需



[image]

大海裡，有一個不為人知文明王國-人魚王國。公主艾蜜莉，不僅美又有一副美妙歌喉，大家都喜歡艾蜜莉唱歌。巫女拉拉也喜歡公主歌唱。可是，好幾個月都沒聽到艾蜜莉歌唱，大家感到奇怪。今天拉拉變成艾蜜莉的妹妹，親近艾蜜莉，並知道事情緣因，艾蜜莉幾個月前救了人類王子，偷偷喜歡上他，因此患了相思病，整天前海裡盤旋著，想再見到王子。因此拉拉叫艾蜜莉來找自己。艾蜜莉不理會家人反對，偷偷跑去找拉拉。拉拉告訴艾蜜莉，用美妙聲音交換，就可以去見王子。



[image]

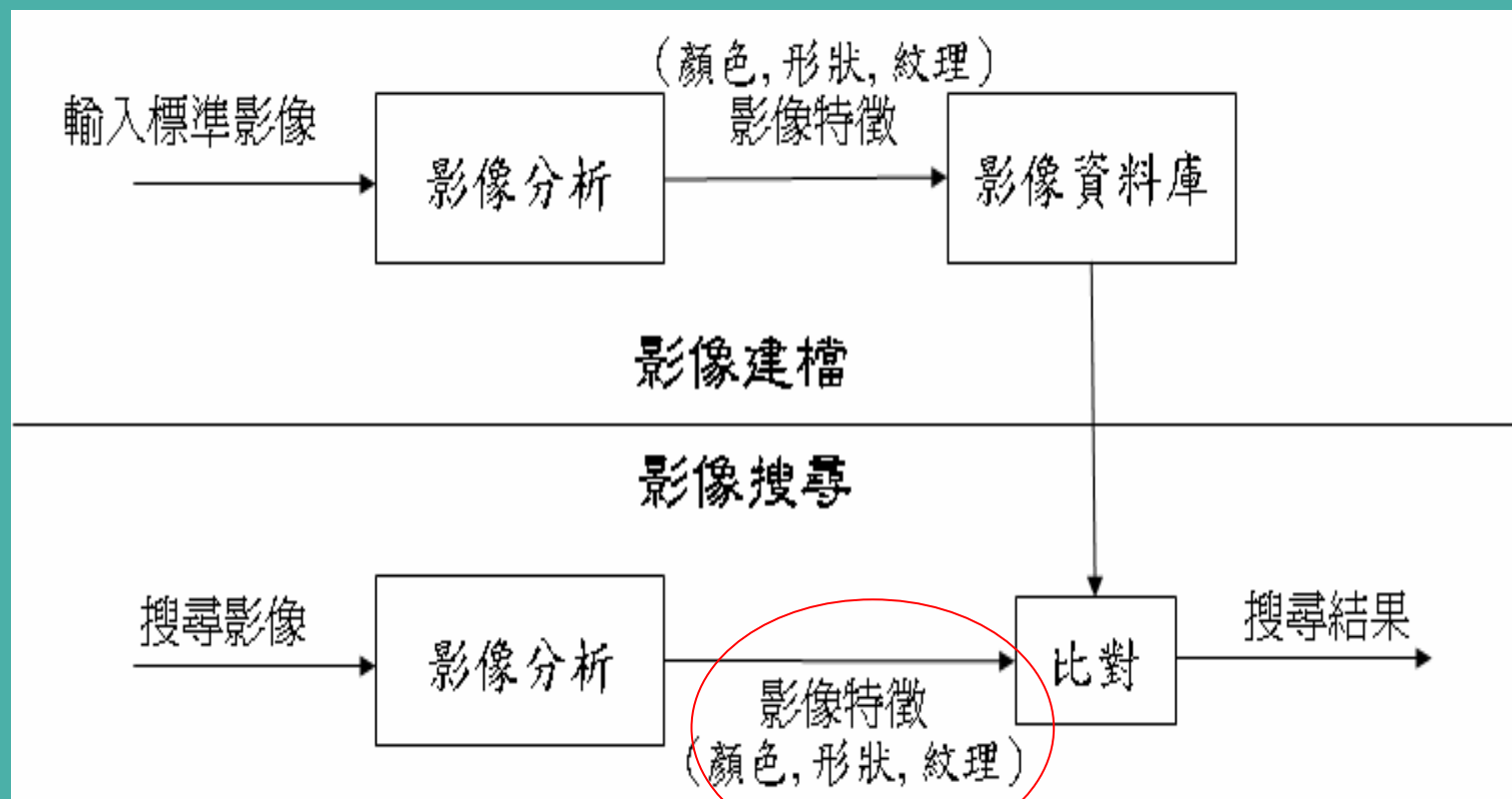
資料庫

- 傳統資料庫
 - 資料庫中主要資料為文字
 - 資訊描述容易
 - 搜尋正確性高
- 影像資料庫
 - 昔日以文字描述
 - 資訊不易描述
 - 搜尋正確性低



[image]

影像搜尋基本模型



(顏色, 形狀, 紋理)

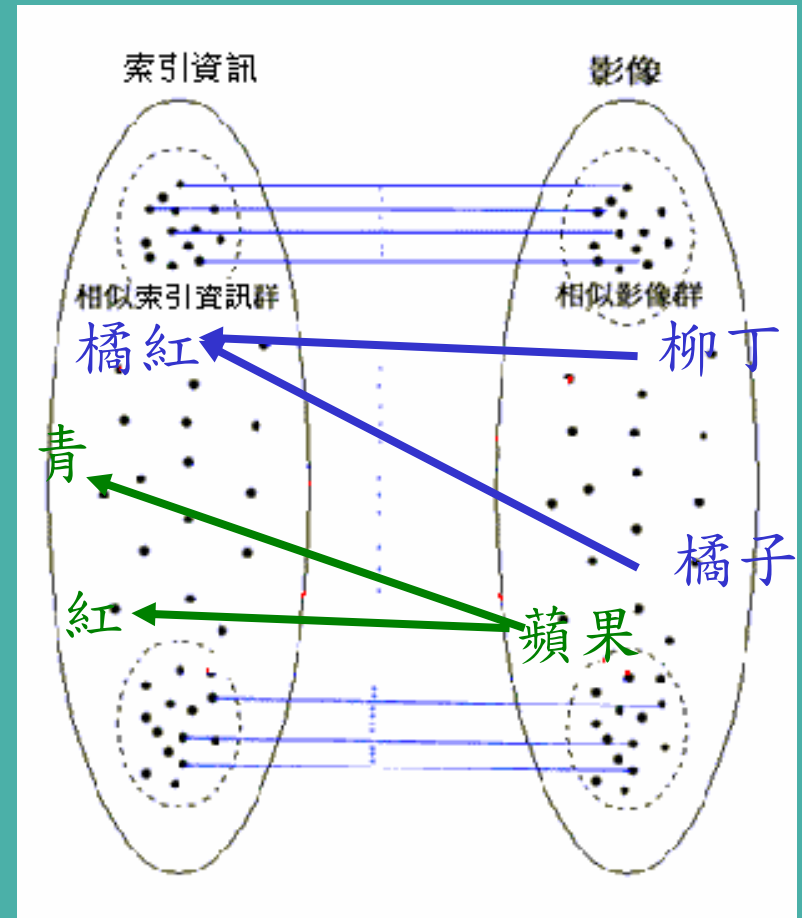


影像特徵擷取方法-顏色(Color)

**Color Histogram [Ballard91]
[Novak92][Swain94]**

**Reference Color Table
Method [Mehtre95][Mital98]**

事物不相似卻有相似顏色;同
一件事物有不同顏色代表之





影像特徵擷取方法-形狀(Shape)

[image]

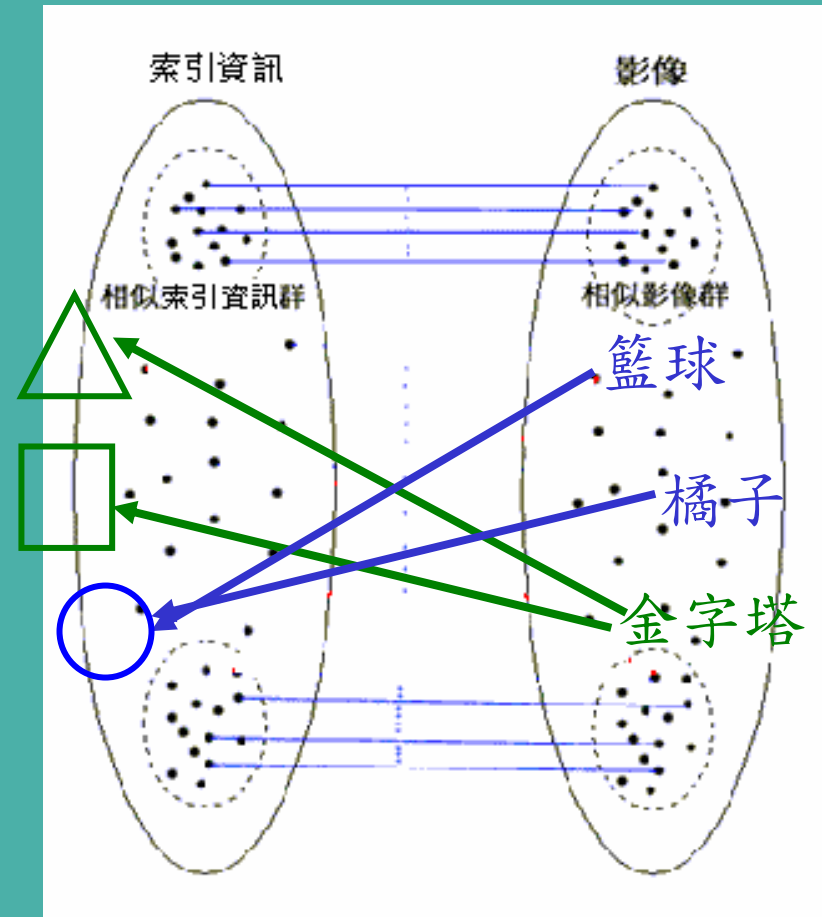
Sobel Edge Detection

[Shu87][Chan92]

Chain Code

[Gam82][Kaneko85]

事物不相似卻有相似形狀;同
一件事物有不同形狀代表之



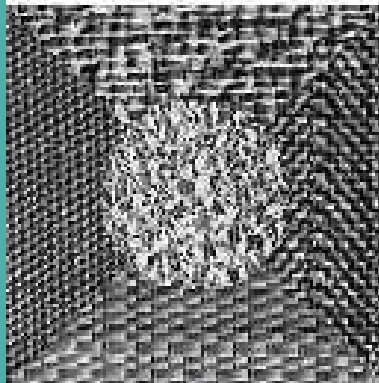


影像特徵擷取方法-紋理(Texture)

影像具重複性週期性出現之特徵單元以區分影像

Co-occurrence Matrix [Haralick70][Argenti90]

Tamura Texture[Tamura78][Bae97]

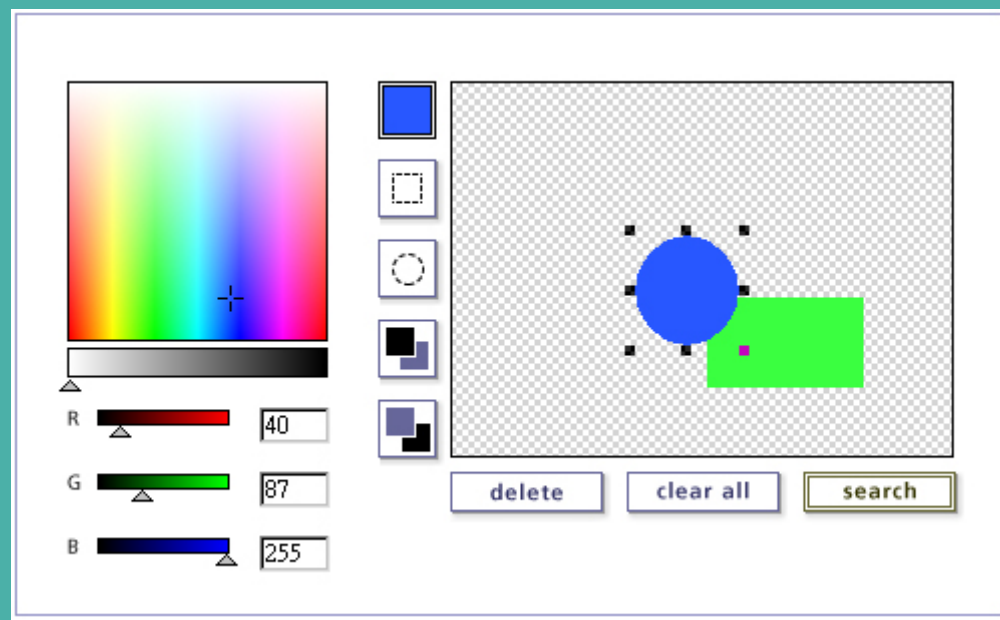
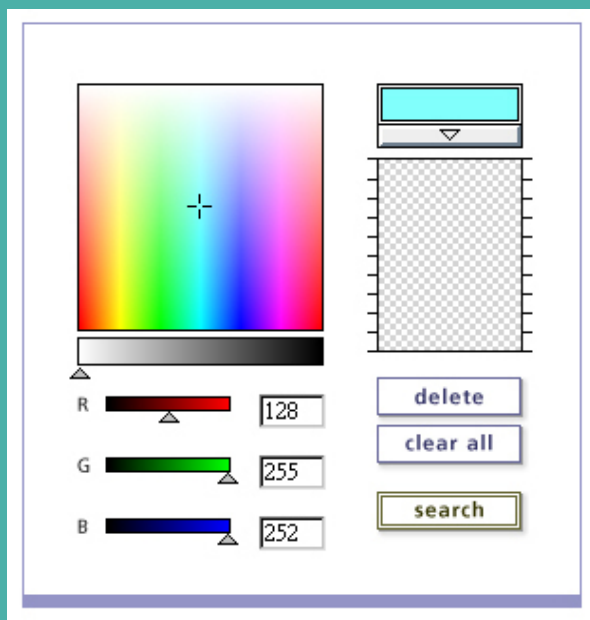


只適用在純紋理的影像



影像搜尋應用：

多數影像搜尋系統不會只使用單一方法擷取特徵，例如：QBIC：提供顏色、形狀、空間關係；



上述所建立索引檔資訊仍不能明確代表影像



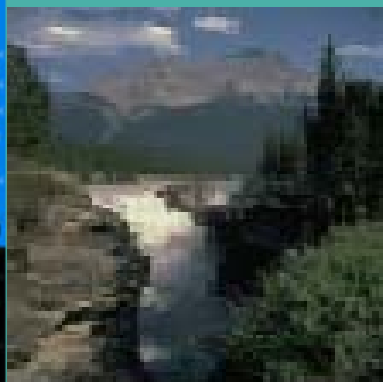
[image]

- 使用碎形正交基底技術，具良好索引性質 (Z. Z. Tsai, 2003)
- 單一張影像進行檢索條件不明確
- 輸入多張影像，透過Multiple-Instance Learning 法則自動找出影像特徵，使搜尋條件更為明確。

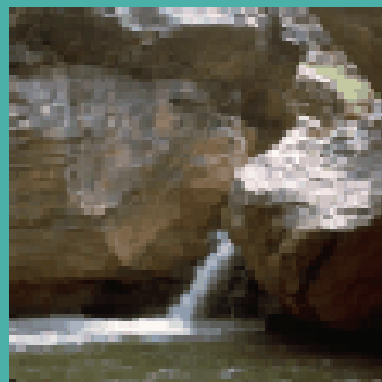


Multiple-Instance Learning (MIL)

[image]



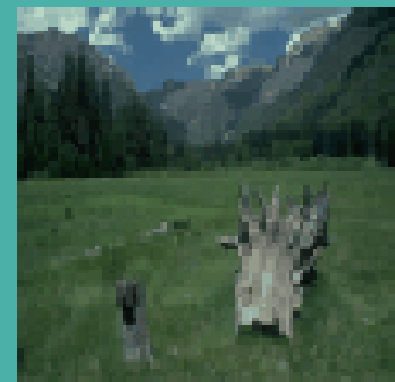
P_1^+



P_2^+



P_3^+



N_1^-

{藍天、白雲、樹木、**岩石**、**瀑布**、**河流**、**岩石**、**瀑布**}

正相關影像特徵：
2. {**岩石**、**瀑布**、**河流**}
3. {樹木、**岩石**、**瀑布**}

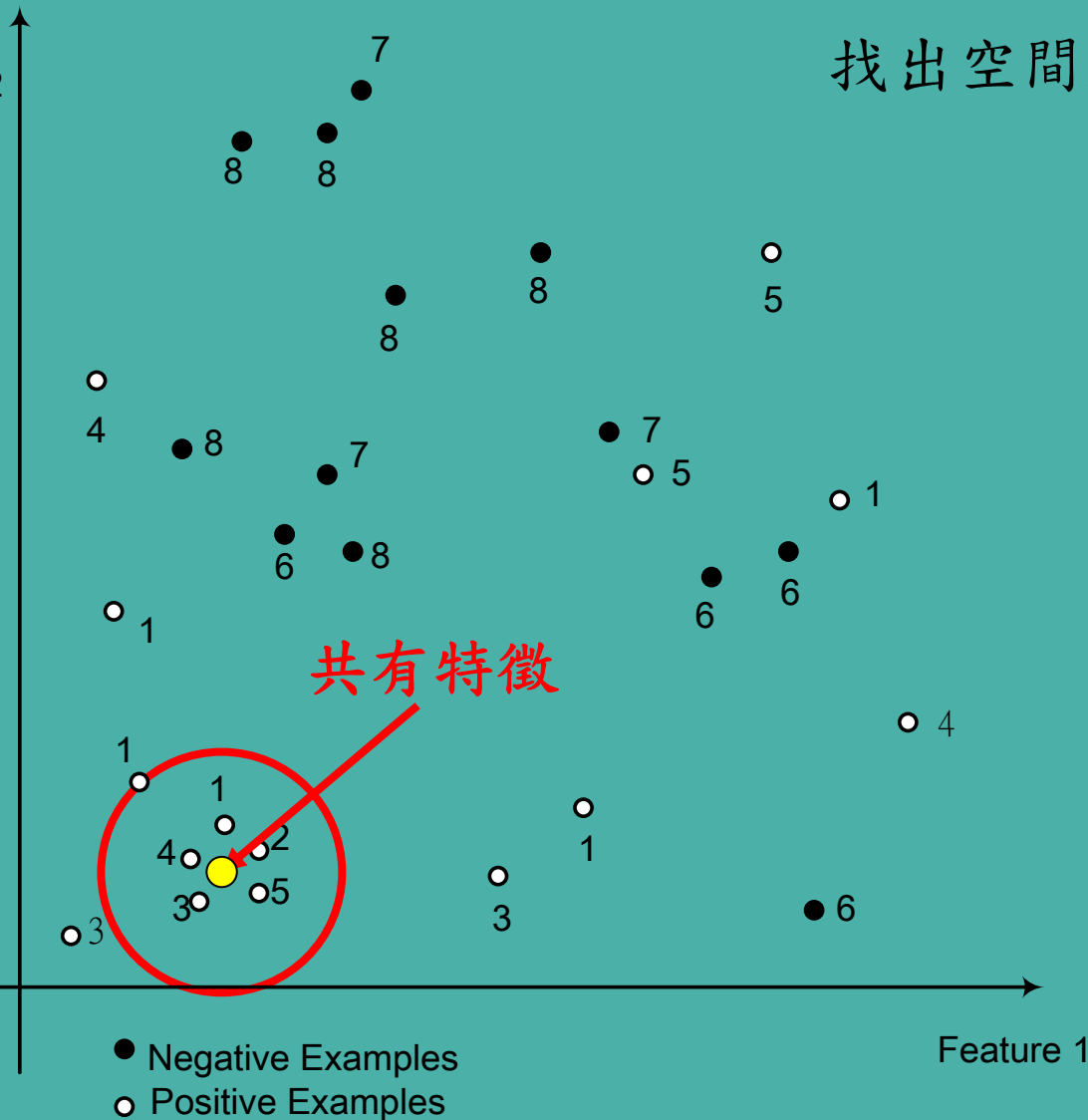
負相關影像特徵：藍天、白雲、草原、**岩石**

Concept = {**岩石**、**瀑布**} - {藍天、白雲、草原、**岩石**} = {**瀑布**}



Diverse Density (DD)[Maron98]

找出空間上一理想特徵點 t

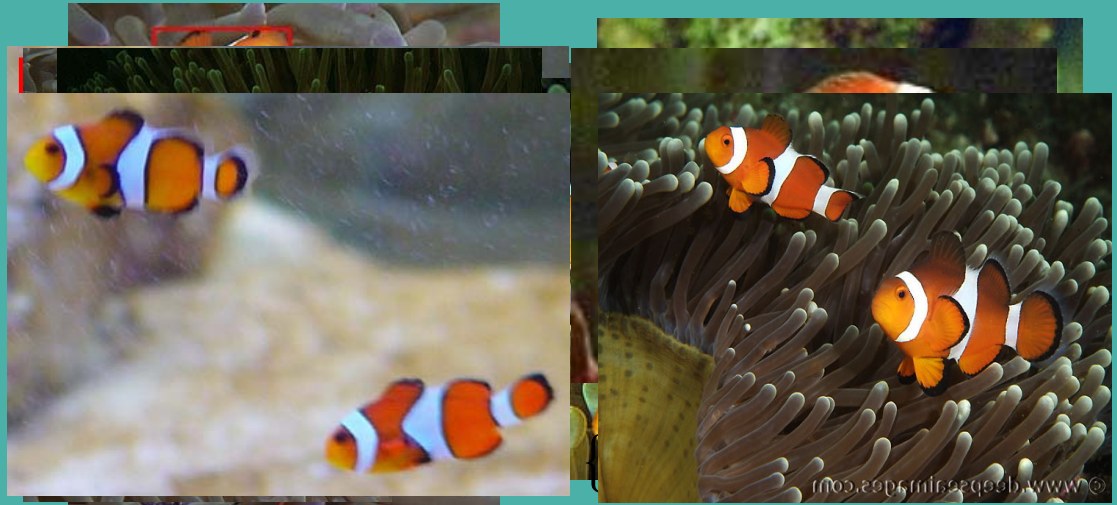


5張正相關影像，
標示為1~5；
3張負相關影像，
標示為6~8



影像物件在空間上相似性測量

- 物件方位關係
- 物件個數
- 大小
- 顏色分類
- 距離



碎形正交基底相似性測量

- 特徵區域分散程度
- 特徵群比例
- 特徵群結構





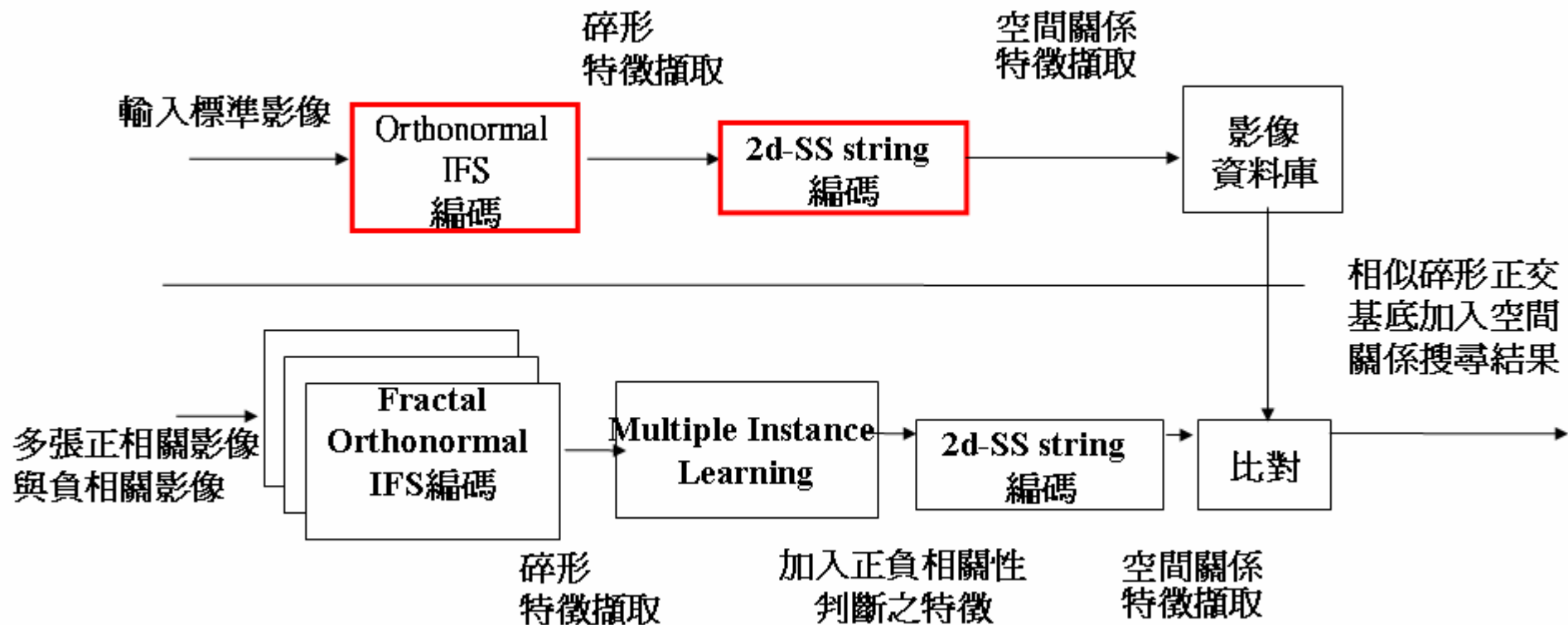
影像資料庫建立

- 影像尺寸不限，熱帶魚影像數目:3138





系統模型



“相同特徵表示” + “相異空間限制” 比較方法1: SSR(2004)
比較方法2: SBA(2005)

“相異特徵表示” + “相同空間限制”
比較方法3: Vector quantization(1997)
比較方法4: Multiscale Entropy(2000)



實驗結果

Precision:

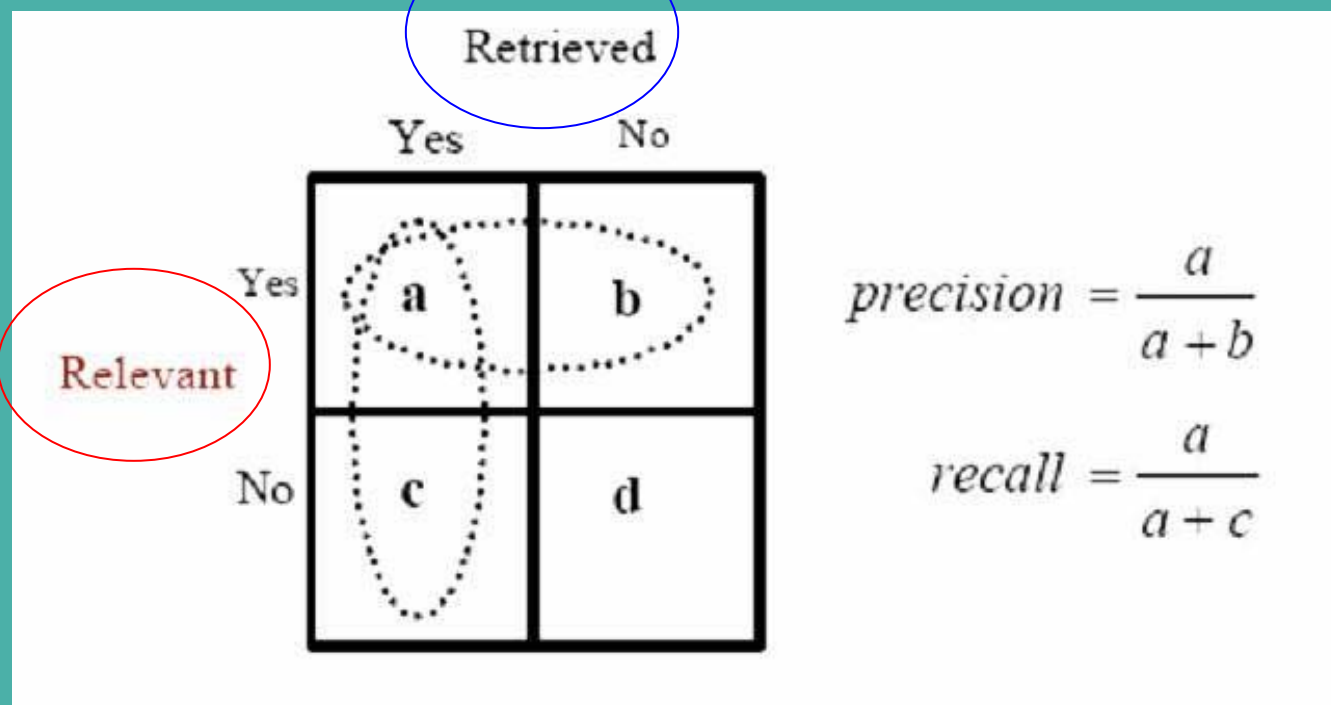
相似影像輸出數

搜尋輸出影像總數

Recall:

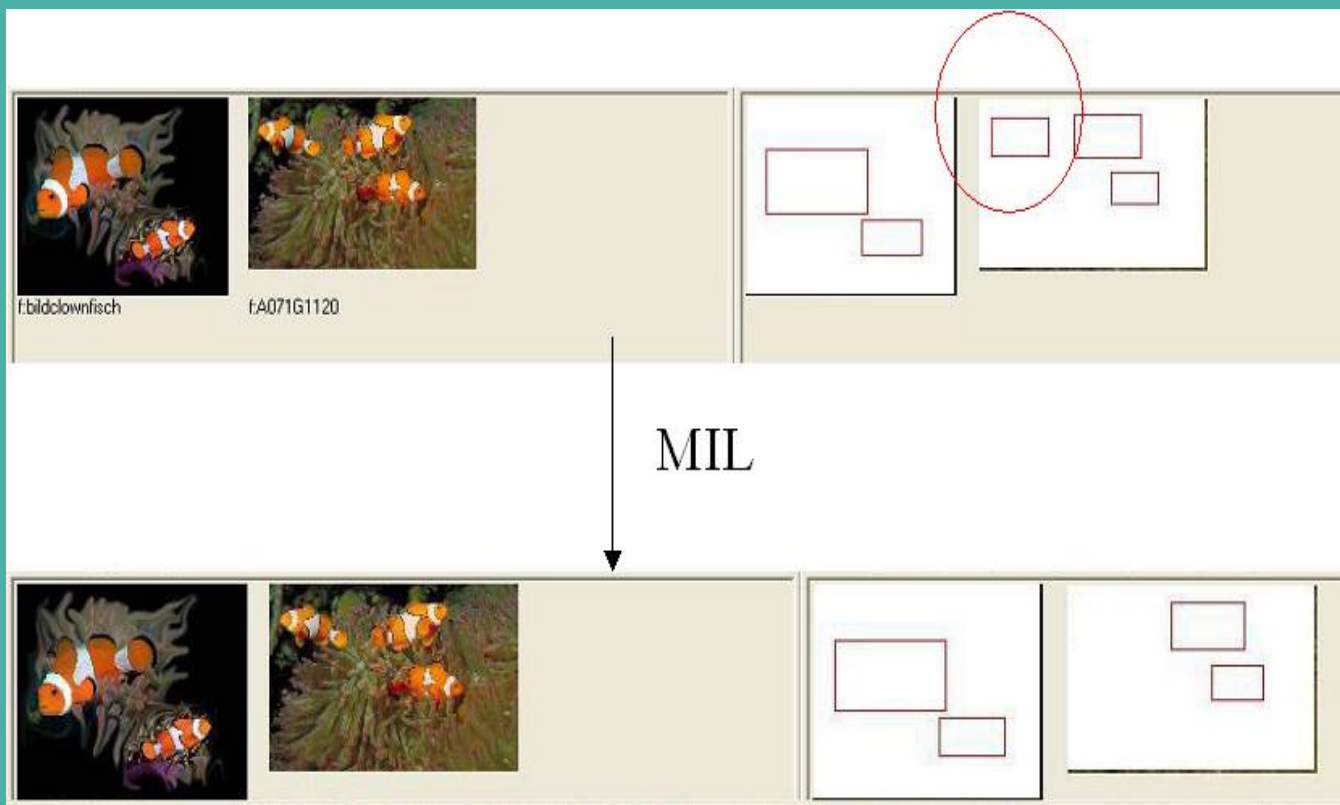
相似影像輸出數

所屬搜尋影像類別之總數

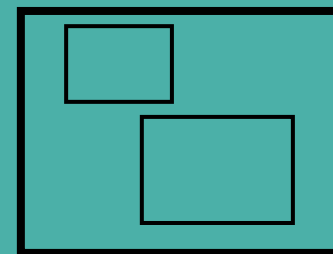


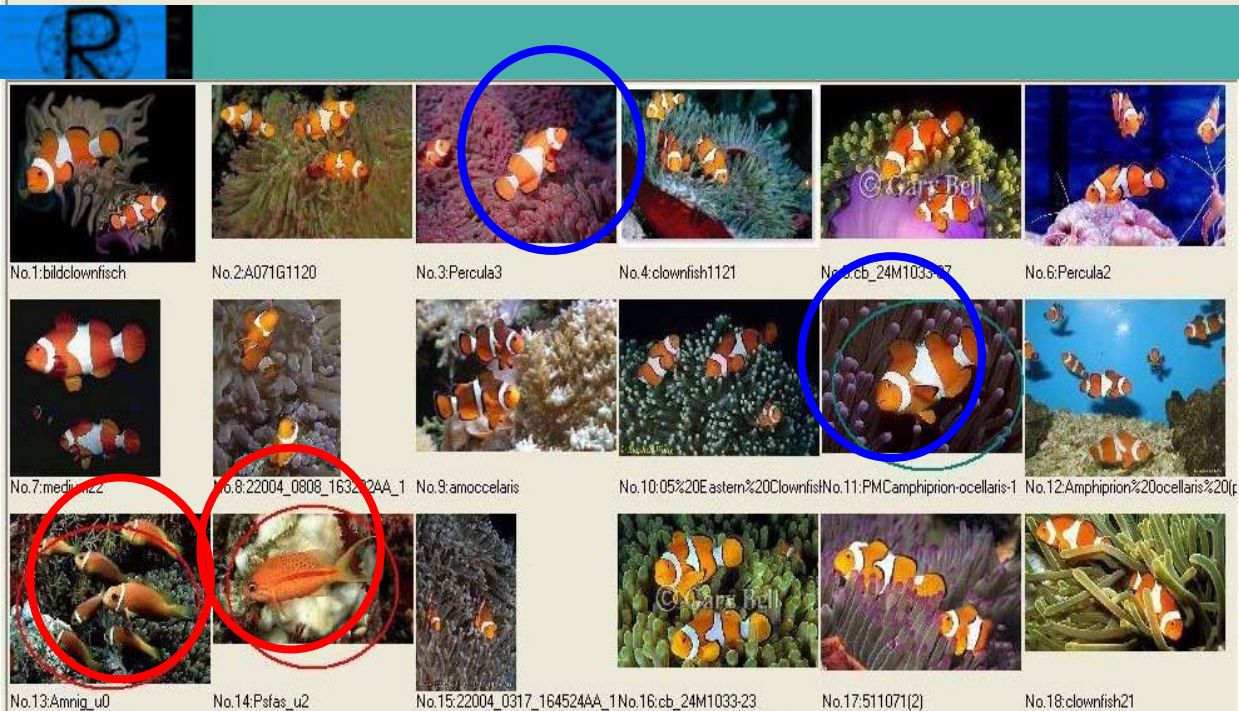


Example : Clownfish (小丑魚)



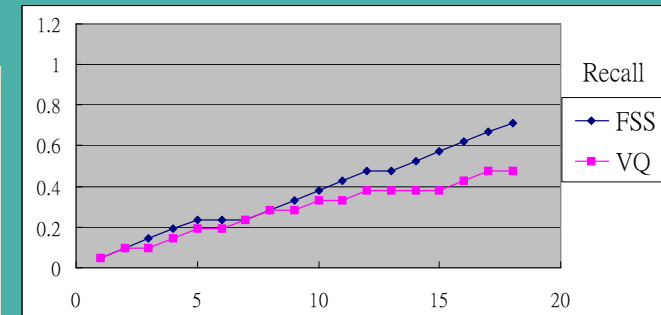
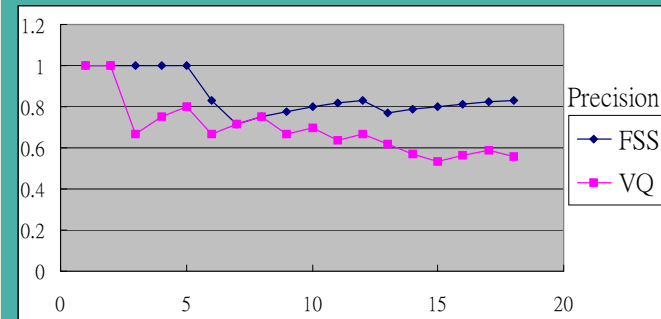
所屬搜尋影像類別總數: 21





相異特徵表示 + 相同空間限制(2d-SS)

FSS method
碎形正交基底



比較方法1:

VQ method

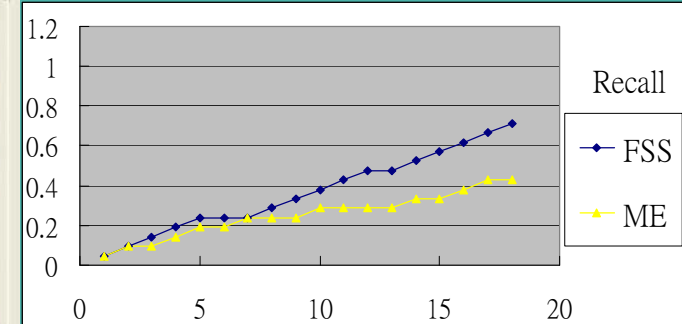
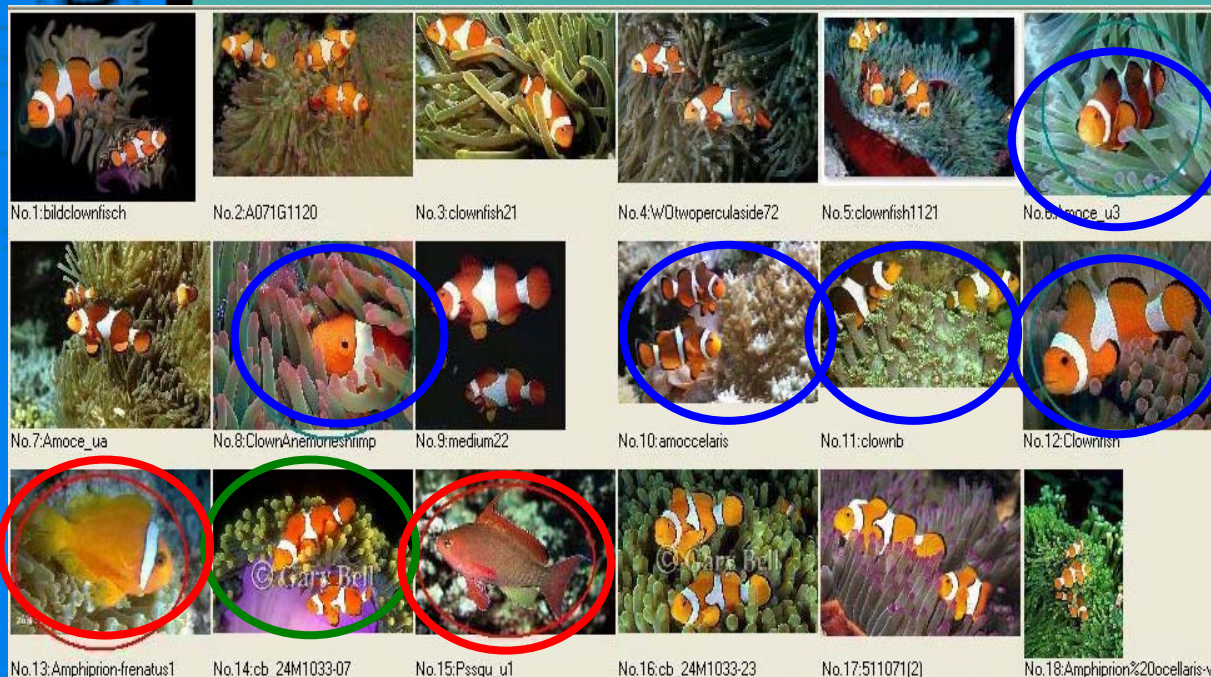
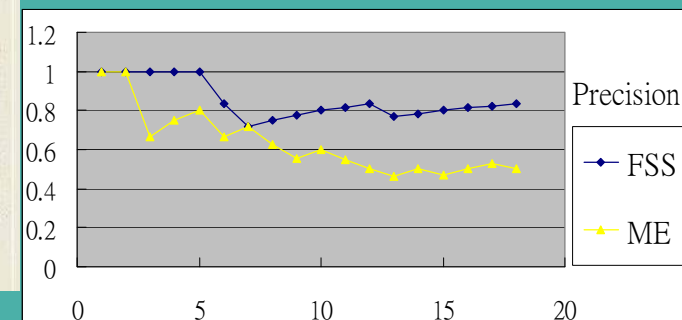
R,G,B Codebook訓練
by LBG algorithm. 43/63



相異特徵表示 + 相同空間限制(2d-SS)

FSS method

碎形正交基底



比較方法2:
proposed method
Wavelet transform

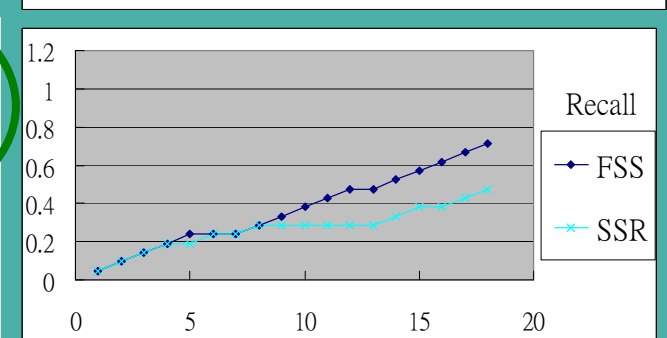
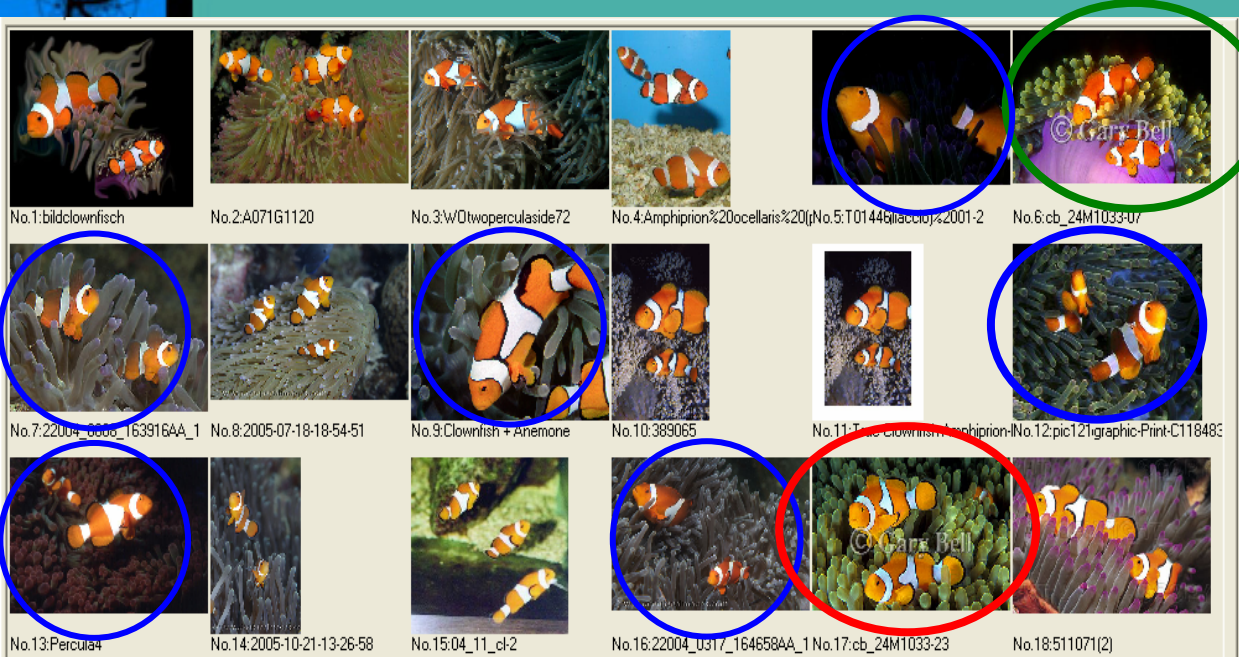
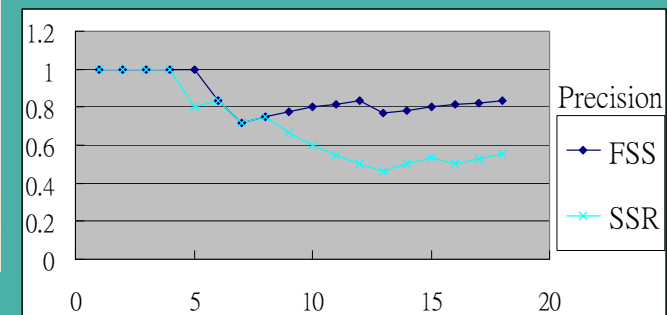


相同特徵表示(fractal)+ 相異空間限制

FSS method

Overlap: 17

Non-Overlap: 20

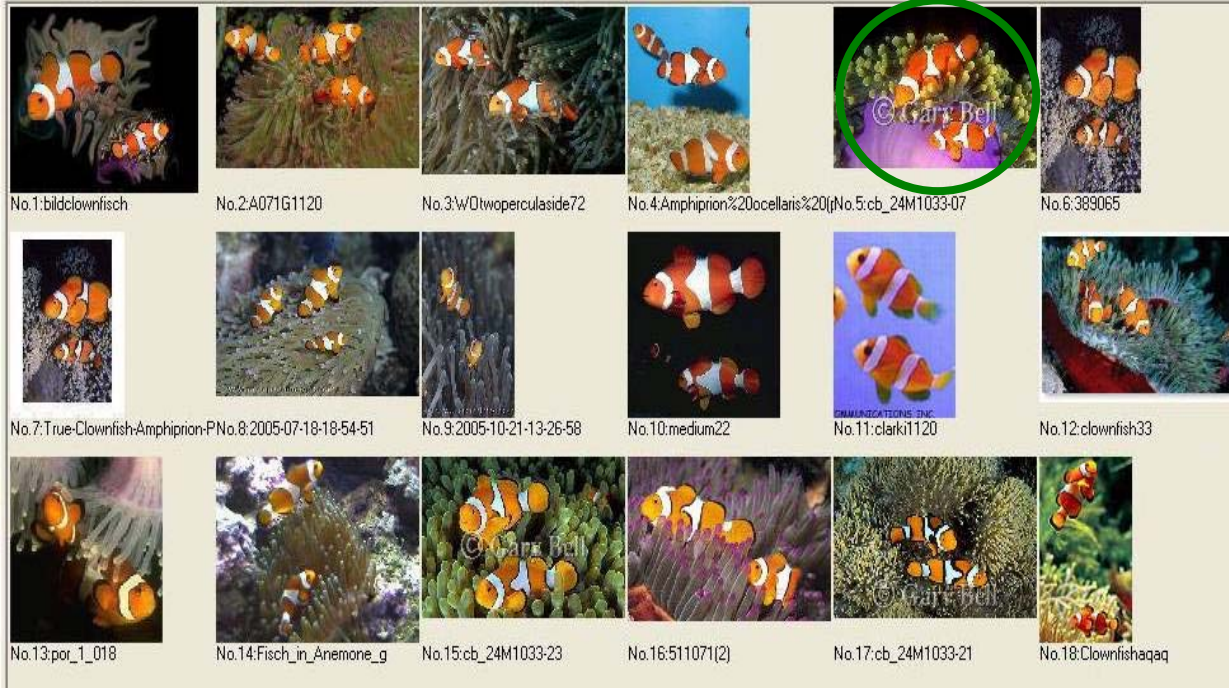


比較方法3:

SSR

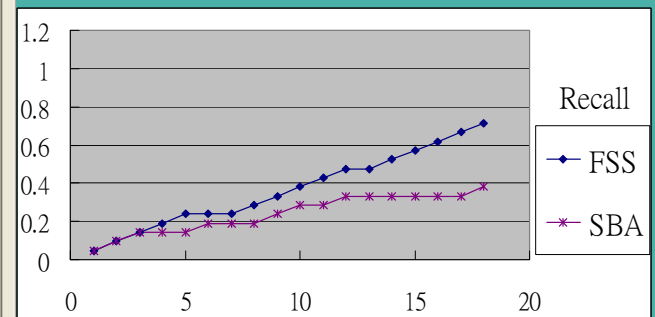
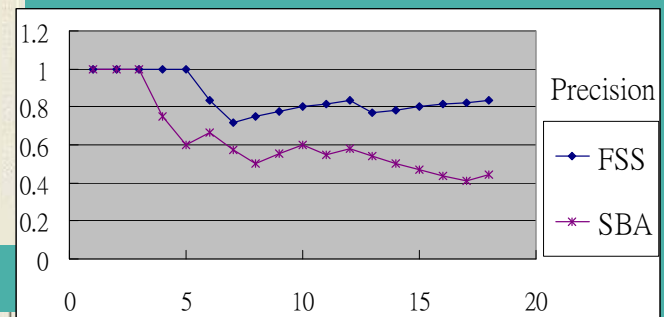
Overlap: 9

Non-Overlap: 8



相同特徵表示(fractal)+ 相異空間限制

FSS method
Overlap: 17
Non-Overlap: 20



比較方法4:
SBA method
Overlap: 5
Non-Overlap: 2