參考點偵測方法探討

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大綱

- 指紋參考類型簡介

- 參考點偵測方法介紹

- 實驗結果討論

參考點類型
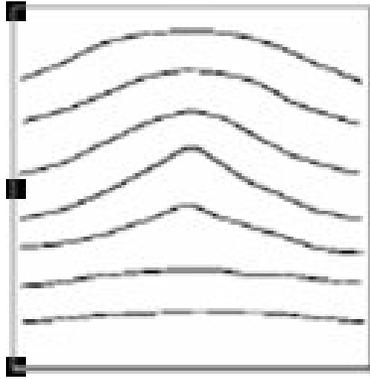
拱型
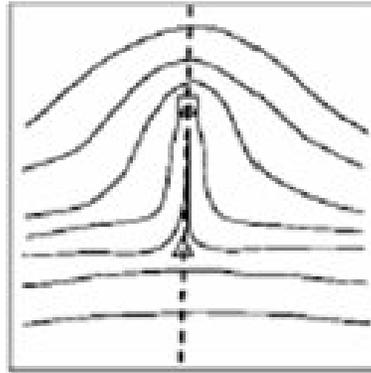
尖拱型
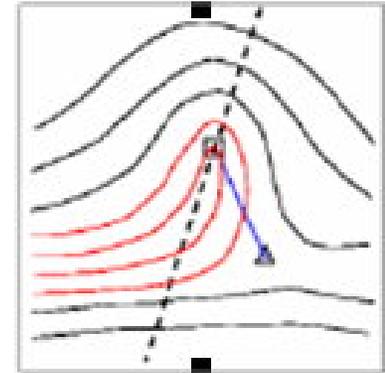
左環型
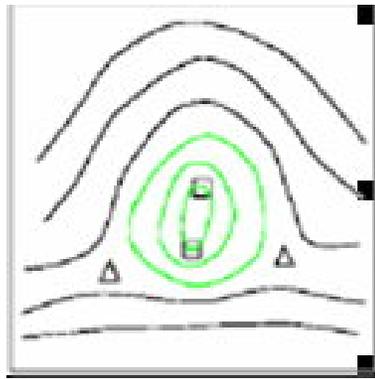
雙環型
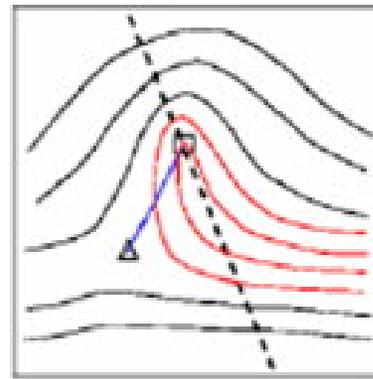
右環型

Modified Averaging Squared Directional Field(MASDF)
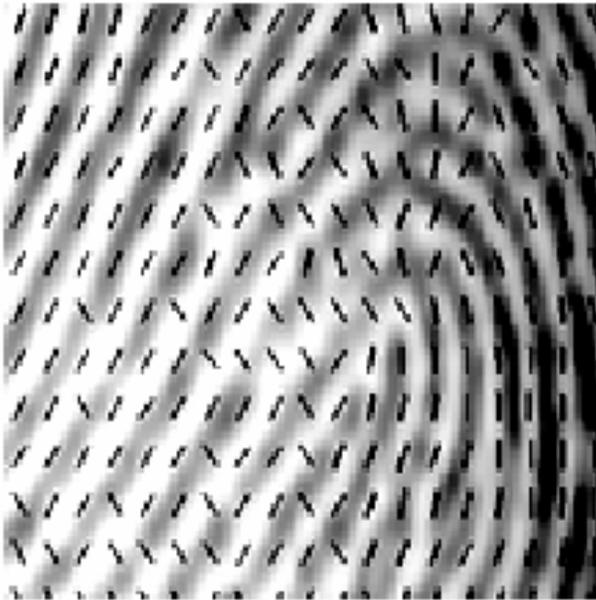
Sobel filter

ASDF

-1	0	+1
-2	0	+2
-1	0	+1

Gx

+1	+2	+1
0	0	0
-1	-2	-1

Gy
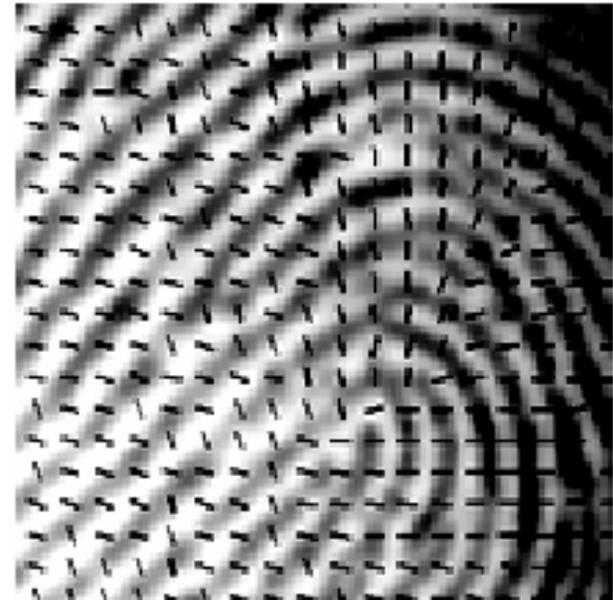
$$G_{xx} = \sum_w G_x^2 \qquad G_{yy} = \sum_w G_y^2$$

$$G_{xy} = \sum_w G_x G_y \qquad \phi = \frac{1}{2}\arctan(\frac{2G_{xy}}{G_{xx} - G_{yy}})$$

$$其中 -\frac{\pi}{2} < \phi \le \frac{\pi}{2} \qquad \phi = \phi + \frac{\pi}{2}$$
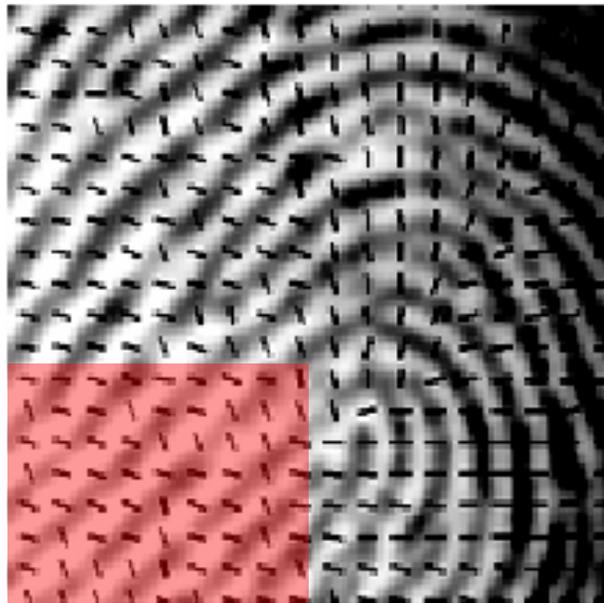
Modified Averaging Squared Directional Field(MASDF)

$$\phi_x = \cos(2\phi) \qquad \phi_y = \sin(2\phi)$$

H為low-pass filter

$$\phi_x' = \sum\sum_w H\phi_x \qquad \phi_y' = \sum\sum_w H\phi_y$$

$$\phi' = \frac{1}{2}\arctan(\frac{\phi_y'}{\phi_x'})$$
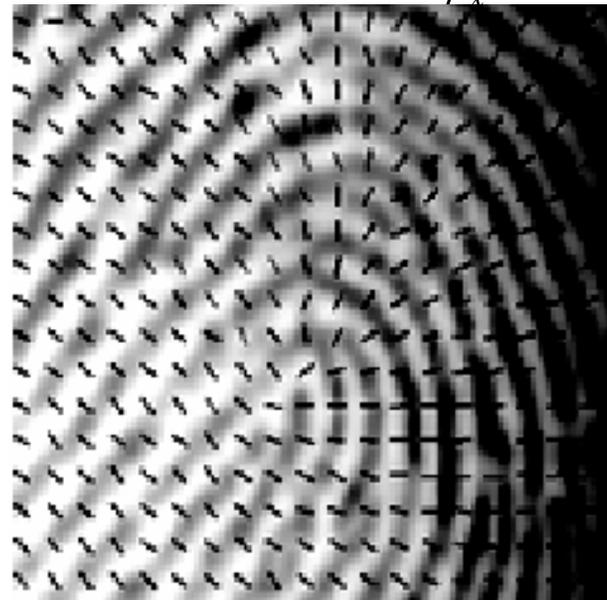
ASDF

MASDF

Modified Averaging Squared Directional Field(MASDF)

- ϕ' 介於0到90之間，設定為白色，除此之外，都定為黑色

Closing $\longrightarrow$ Opening

Dilation$\rightarrow$Erosion $\rightarrow$ Erosion $\longrightarrow$ Dilation

$$O_G(A, B) = D_G(E_G(A, B), B)$$

$$C_G(A, B) = E_G(D_G(A, B), B)$$

$$\text{Dilation}(A, B) = \max\{a[m - j, n - k] + b[j, k]\}$$

$$\text{Erosion}(A, B) = \min\{a[m + j, n + k] - b[j, k]\}$$
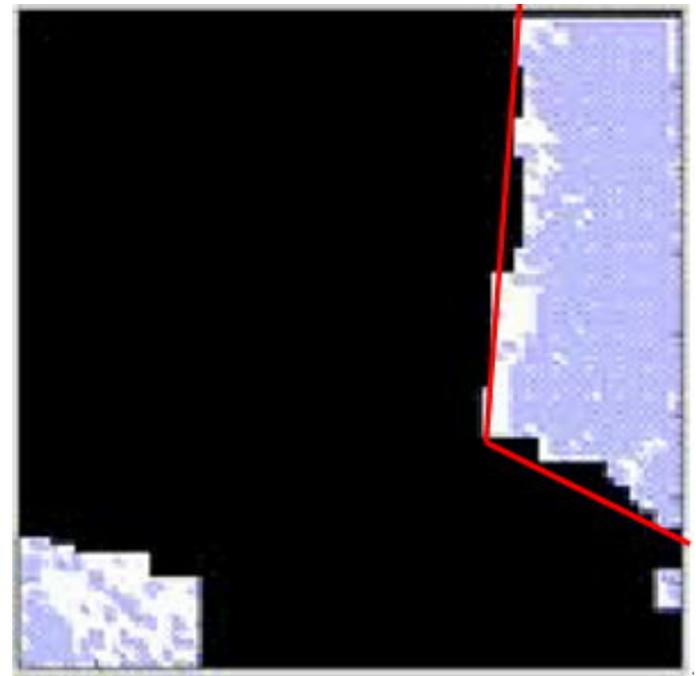
Modified Averaging Squared Directional Field(MASDF)

Method	False CPs
a. ASDF [4]	6.25%
b. ASDF with morphology	5.00%
c. MASDF	5.00%
d. MASDF with morphology	3.13%

Method	False CPs	Speed Factor
MASDF with morphology	3.13%	0.7
Poincare Index	5.63%	1

A New Reference Point Detection Algorithm Based on Orientation Pattern Labeling in Fingerprint Images

A New Reference Point Detection Algorithm Based on Orientation Pattern Labeling in Fingerprint Images
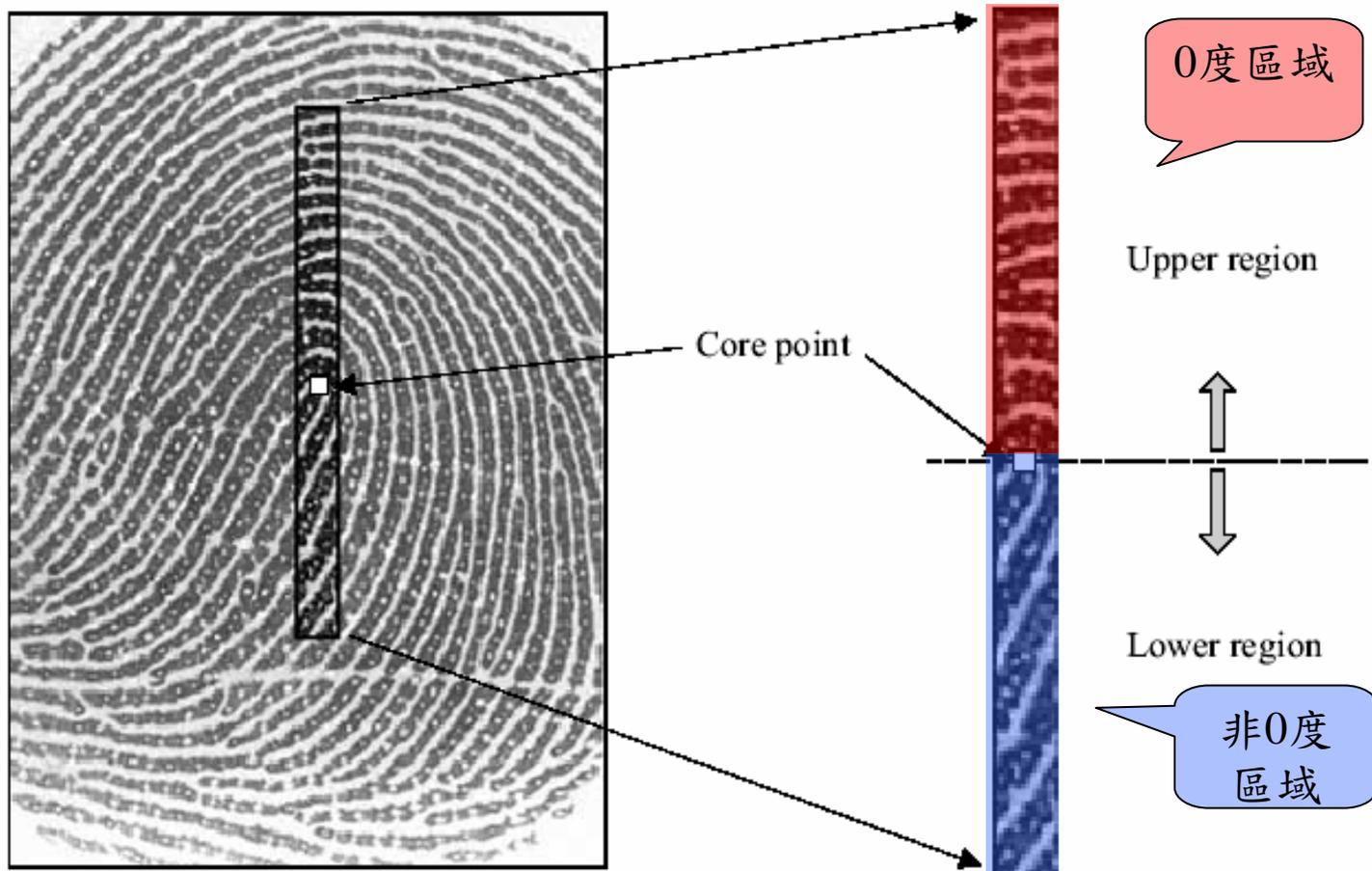
$$O(i, j) = \frac{1}{2}\arctan(\frac{\sum_{u=i-\frac{w}{2}}^{i+\frac{w}{2}}\sum_{v=j-\frac{w}{2}}^{j+\frac{w}{2}}2G_x(u,v)G_y(u,v)}{\sum_{u=i-\frac{w}{2}}^{i+\frac{w}{2}}\sum_{v=j-\frac{w}{2}}^{j+\frac{w}{2}}(G_x^2(u,v)-G_y^2(u,v))})$$
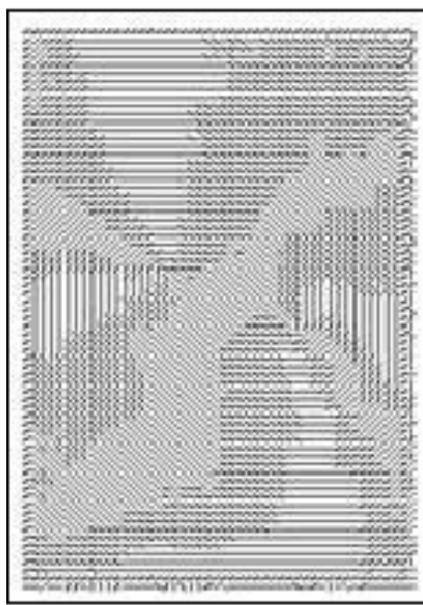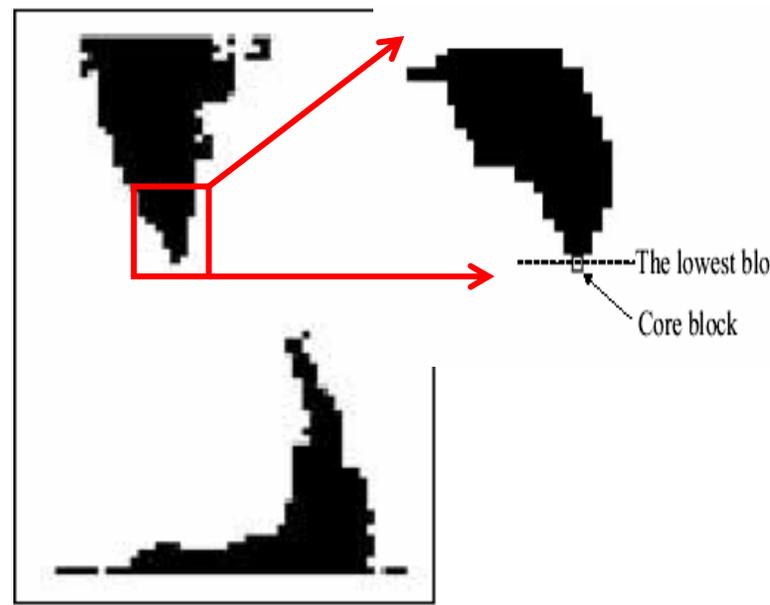
- 先做Sobel運算可得到Gx、Gy分量
- 將每個pixel透過公式利用Gx、Gy算出角度
- 將所得角度算出其cos(2O(i,j))、 sin(2O(i,j)) 在利用均值濾波得到角度值

原始影像　　　　　　方向性影像　　　　　　分類影像

The lowest blo

Core block

A New Reference Point Detection Algorithm Based on Orientation Pattern Labeling in Fingerprint Images

- 問題：當0度上下區域相連時，將無法找出非0度的區域
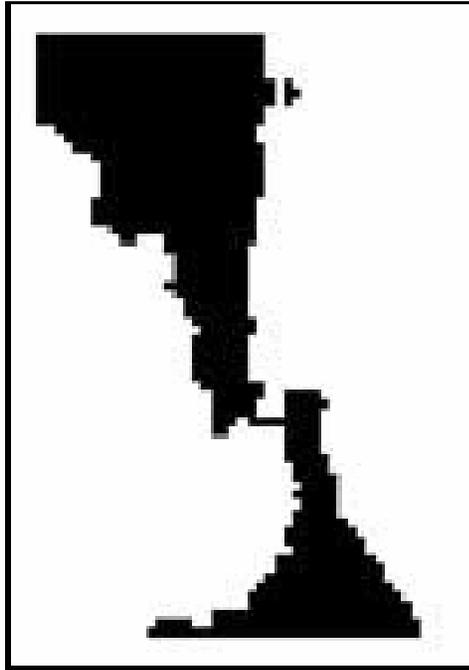
重新定義分類影像

步驟一：將每個區塊加或減
　　　　個角度

步驟二：再畫出0度區域分
　　　　類影像圖

步驟三：搜尋0度上半部區
　　　　域最低點，定義此
　　　　點為參考點

原始影像　　　　　0度區域相連影像

A New Reference Point Detection Algorithm Based on Orientation Pattern Labeling in Fingerprint Images

|	A	TA	LL	RL	TL	W	Total
Number	30	5	140	105	185	235	700

	A	TA	LL	RL	TL	W	Total
Poincaré	6.2	6.6	6.7	11.0	10.4	6.9	8.4
Sine map	141.9	146.0	144.0	154.4	140.2	145.2	144.9
Proposed	5.9	5.4	5.7	6.7	6.2	6.6	6.3

	A	TA	LL	RL	TL	W	Total
Poincaré	0.0	100.0	92.4	92.4	98.8	95.2	91.1
Sine map	53.5	100.0	90.5	93.3	98.8	94.3	92.9
Proposed	46.7	100.0	95.2	96.2	98.8	95.2	94.3

	Speed	Rotation	Low quality	Arch type
Poincaré	High	High	Low	Low
Sine map	Low	Low	High	Medium
Proposed	High	Medium	Medium	Medium

A reference point for fingerprint recognition
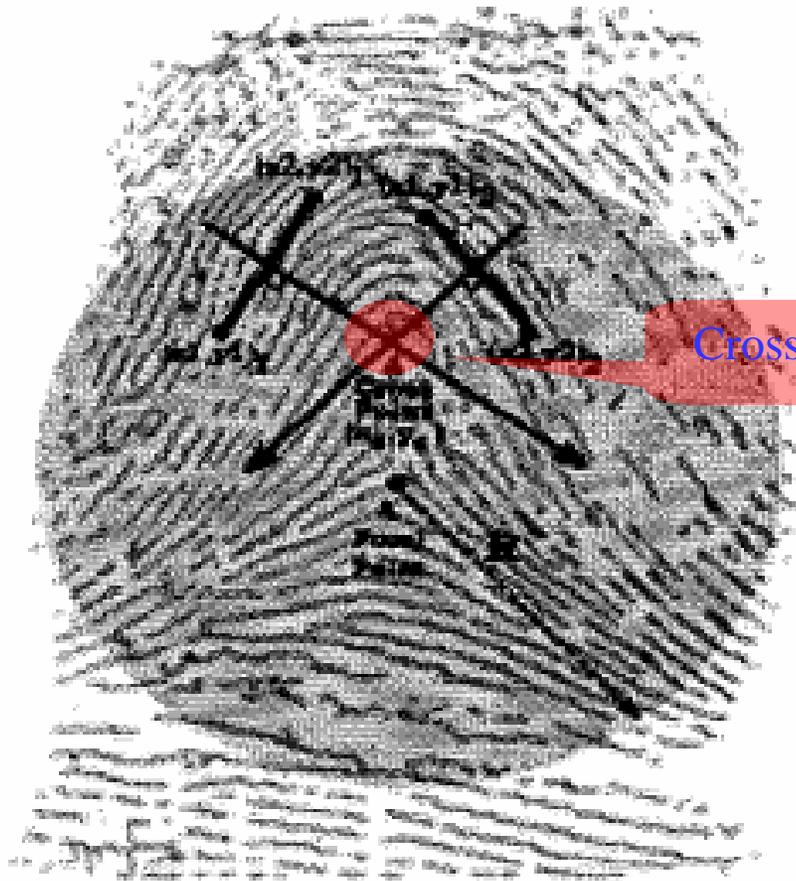
Cross point

- 不用偵測方向就可以找出參考點的方法
- 步驟一：去搜尋兩點cross-point，取平均為質心，其中L的長度為3到10個pixel
- 步驟二：以質心為圓心，半徑為250個pixel去搜尋cross-point，重複這過程3次，直到找到3個新的cross-point，找出新質心
- 步驟三： 重複步驟二五次，所得到新質心為參考點

A reference point for fingerprint recognition

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END