

淺談 QR Code

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什麼是QR Code？

- QR 來自英文「Quick Response」的縮寫
- 日本DENSO WAVE公司於1994年發明
 - 原本是用來記錄工廠生產線資訊的一種二維條碼
 - 在2000 年獲得ISO 國際標準採用
 - ISO/IEC 18004:2006

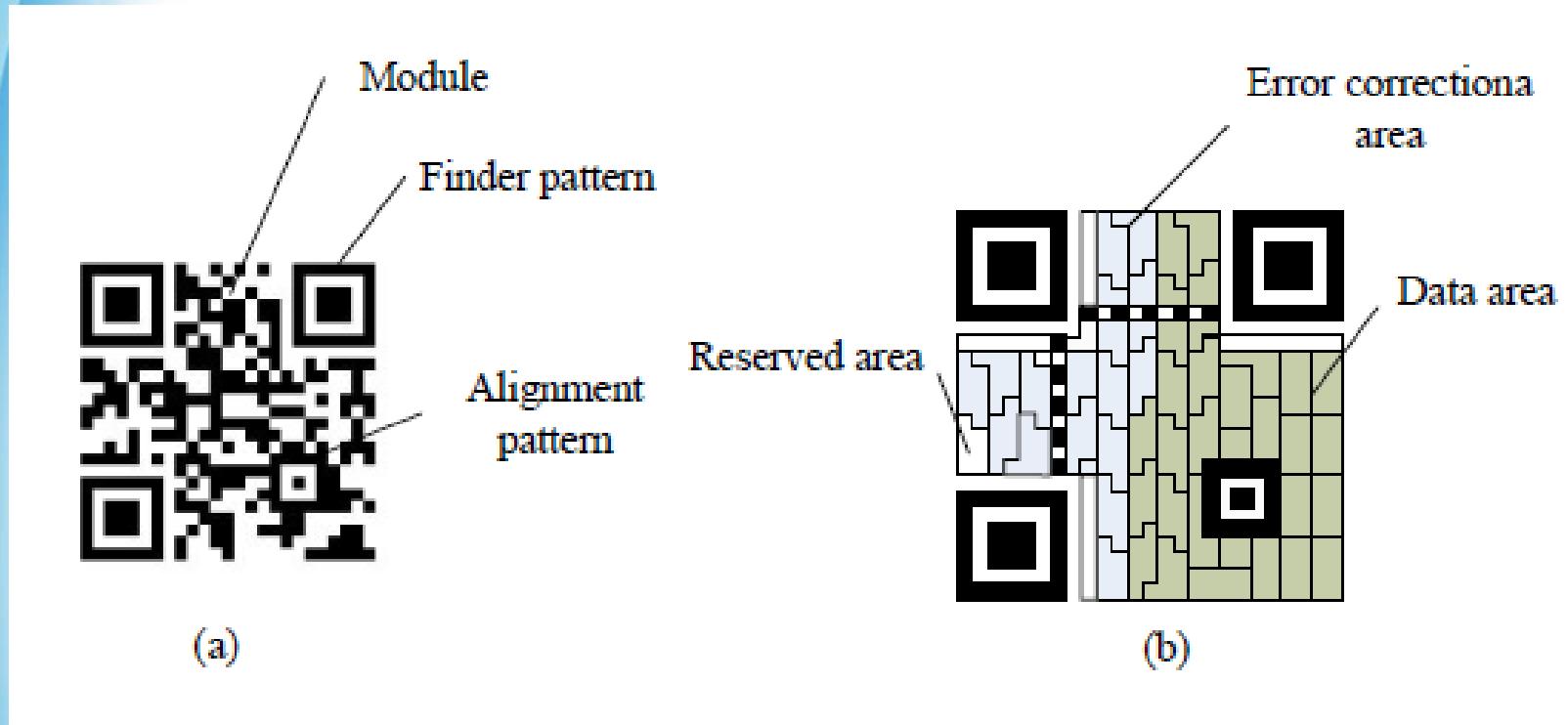


二維條碼比較

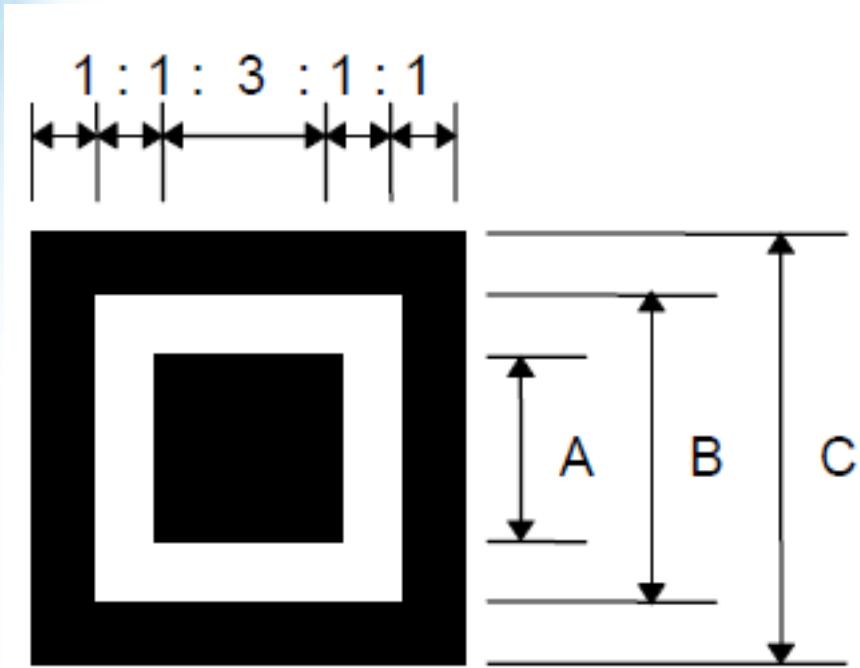
	PDF417	DATA MATRIX	MAXI CODE	QR Code	Aztec Code
Developer (Country)	Symbol (USA)	CI Matrix (USA)	UPS (USA)	DENSO (Japan)	Hand Held Products (USA)
Code type	Multi-low	Matrix	Matrix	Matrix	Matrix
Data size (Alphanumeric)	1,850	2,355	93	4,296	3,067
Characteristics	High capacity	High capacity Small space	Fast reading	High capacity Small space Fast reading	High capacity
Main market	OA	FA, Medical	Logistics	All industries	Air Line, Railroad
Standard	AIMI ISO	AIMI ISO	AIMI ISO	AIMI ISO JIS	AIMI



QR Code 基本架構



Structure of finder pattern



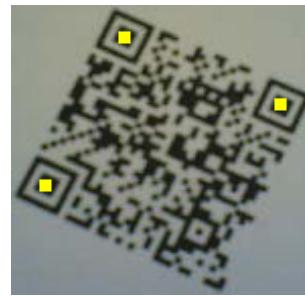
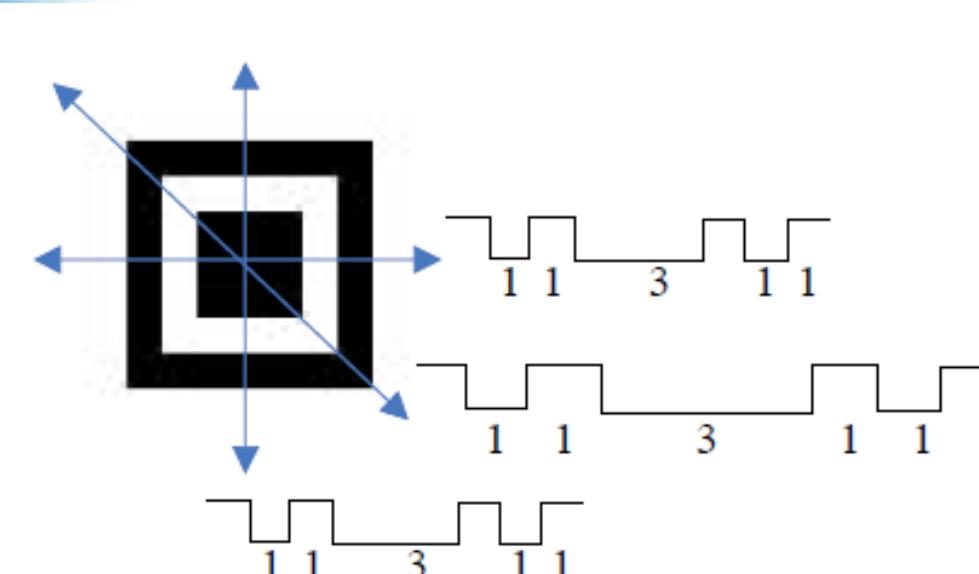
A: 3 modules

B: 5 modules

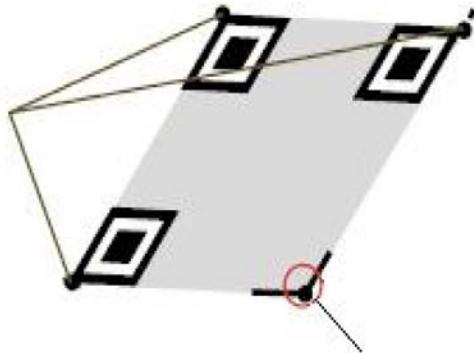
C: 7 modules



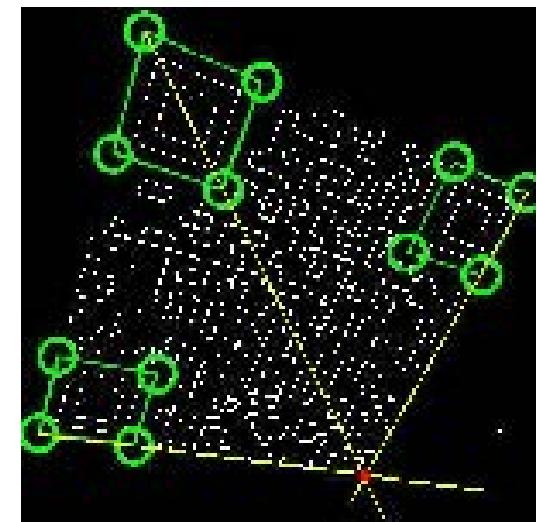
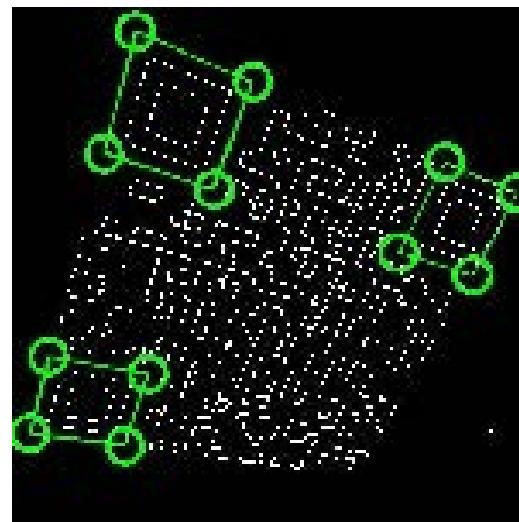
即使拍照時沒對正也能找到



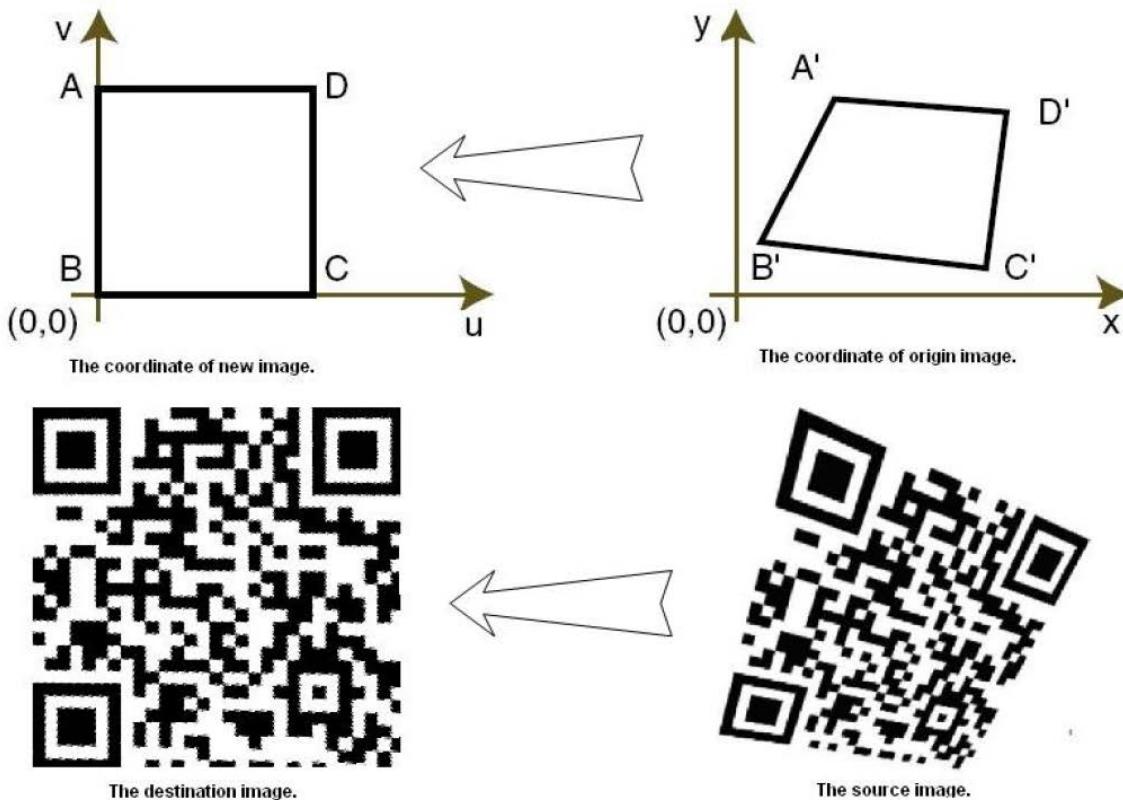
Three real existing corner points.

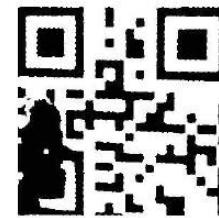


This corner point is usually a virtual one.



Inverse perspective transformation





(a)

(b)

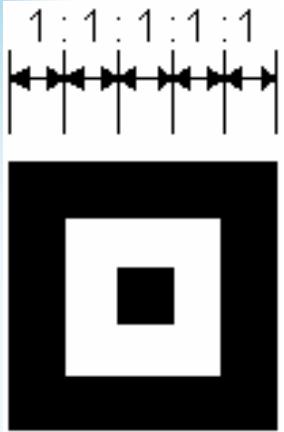
(c)



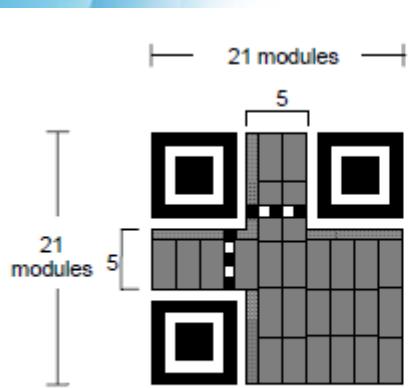
計算機概論

Chang et al., ISMW '07, 2007

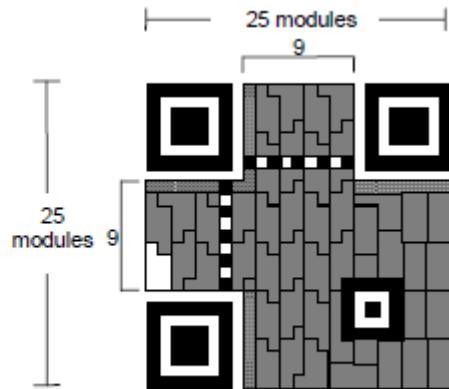
Alignment Pattern



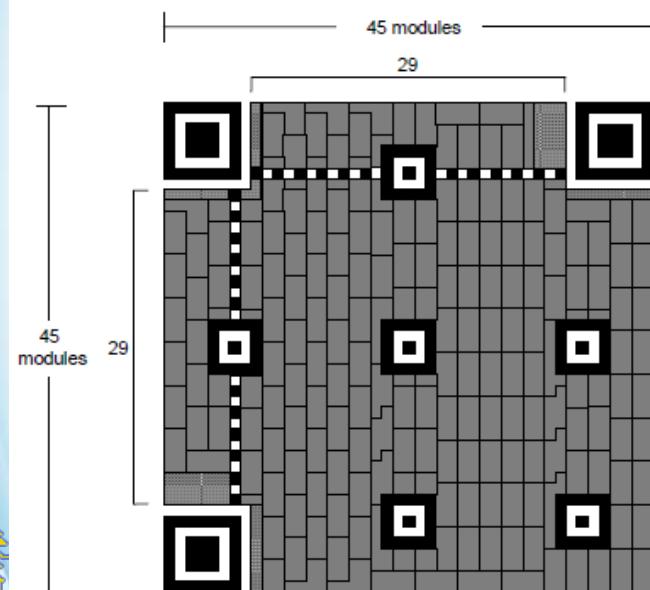
各種不同的版本



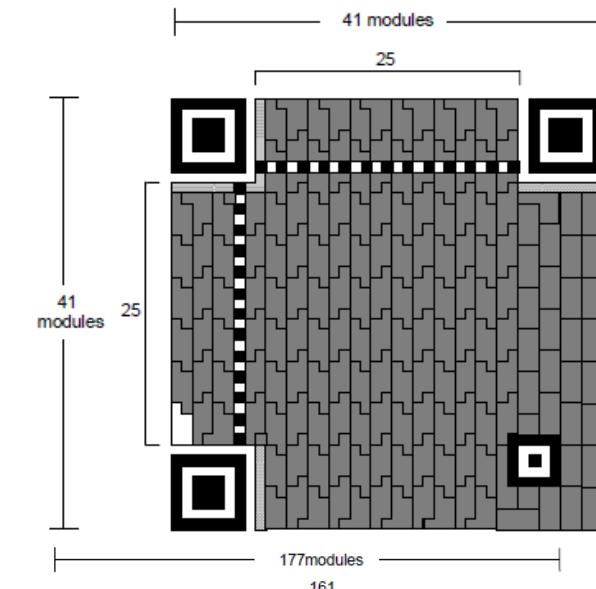
Version 1



Version 2



Version 7

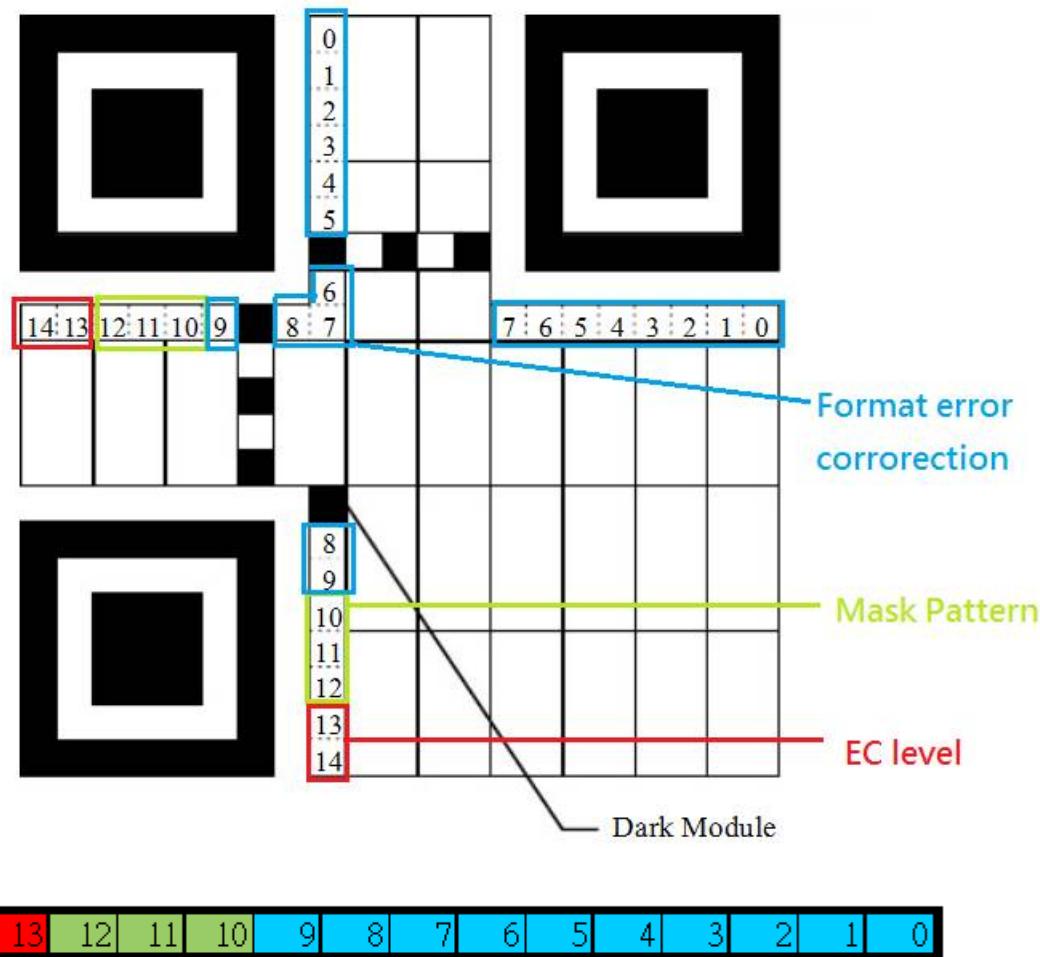


Version 40



香港
大學

QR Code 資訊位置



容錯等級

二進制 表示	容錯 等級	容錯率
01	L	7%
00	M	15%
11	Q	25%
10	H	30%



QR Code資料容量

資料型別	編號位元串例	可儲存容量
數字	0001	7089字元
英數字	0010	4296字元
位元組	0100	2953字元
日語漢字	1000	1817字元



英數字

Char.	Value																
0	0	6	6	C	12	I	18	O	24	U	30	SP	36	.	42		
1	1	7	7	D	13	J	19	P	25	V	31	\$	37	/	43		
2	2	8	8	E	14	K	20	Q	26	W	32	%	38	:	44		
3	3	9	9	F	15	L	21	R	27	X	33	*	39				
4	4	A	10	G	16	M	22	S	28	Y	34	+	40				
5	5	B	11	H	17	N	23	T	29	Z	35	-	41				

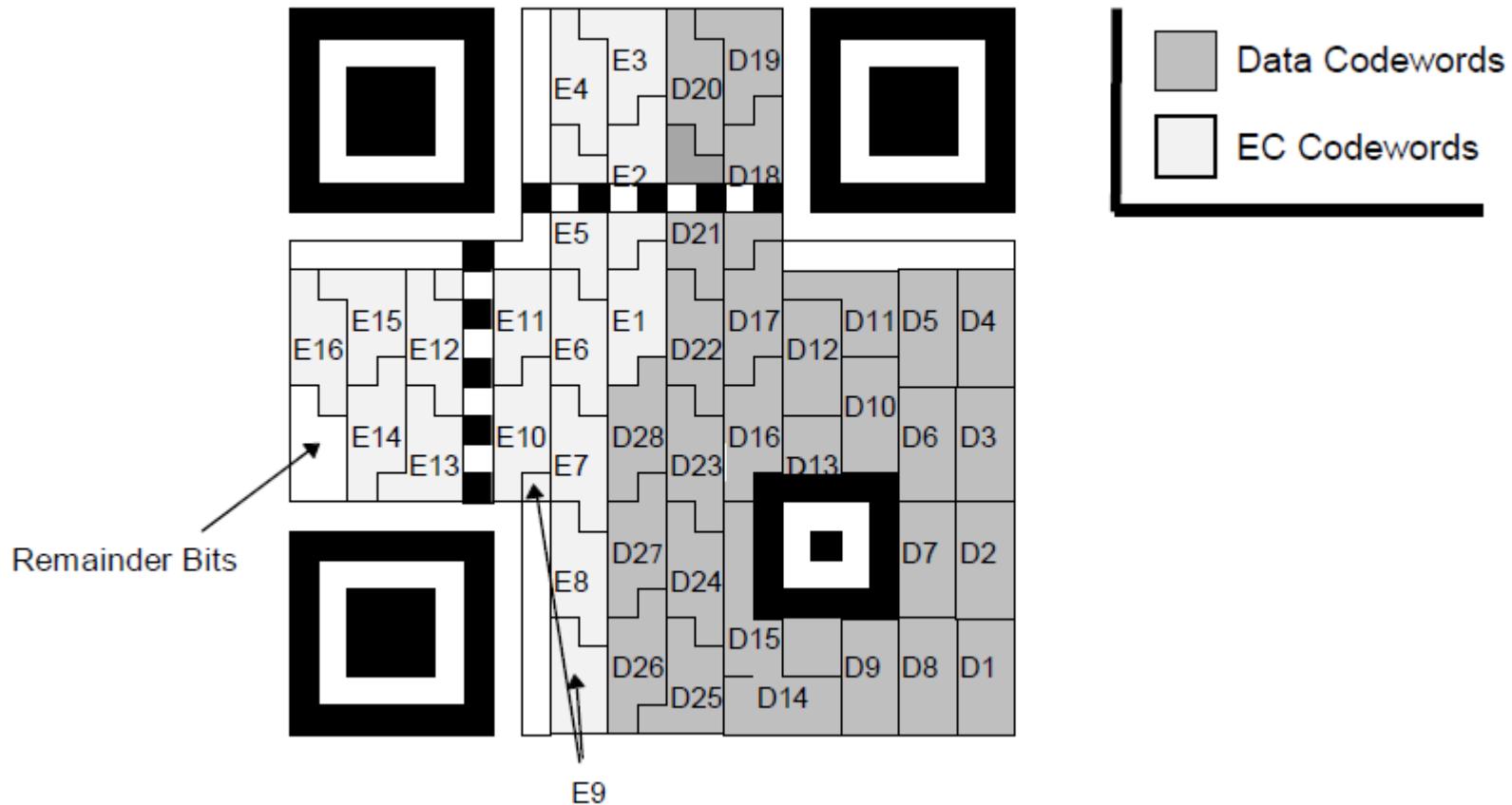


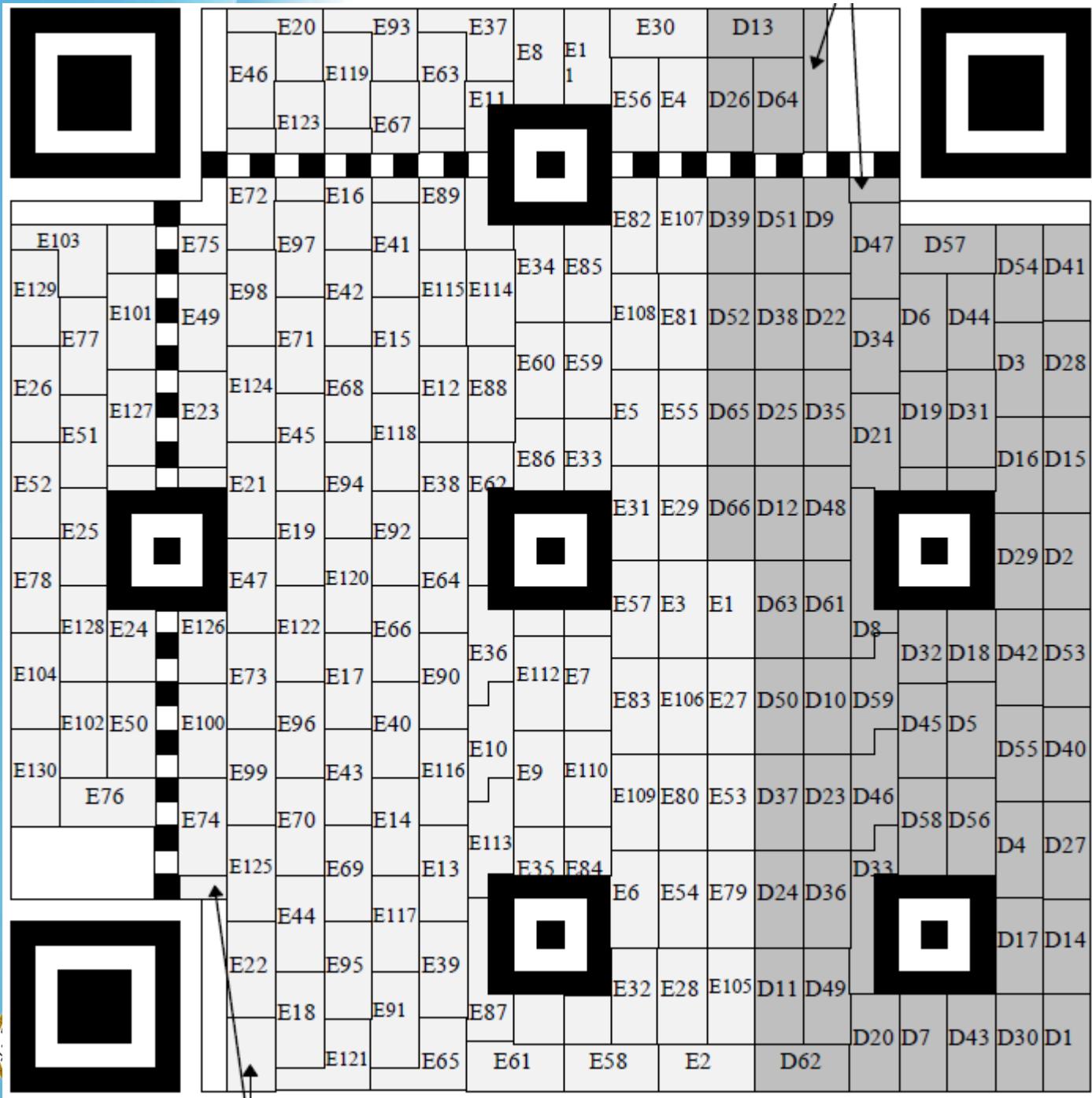
資料區及錯誤修正區排列

	Data codewords					Error correction codewords				
Block 1	D ₁	D ₂	D ₁₁		E ₁	E ₂	E ₂₂	
Block 2	D ₁₂	D ₁₃	D ₂₂		E ₂₃	E ₂₄	E ₄₄	
Block 3	D ₂₃	D ₂₄	D ₃₃	D ₃₄	E ₄₅	E ₄₆	E ₆₆	
Block 4	D ₃₅ ↓	D ₃₆ ↓	D ₄₅ ↓	D ₄₆ ↓	E ₆₇ ↓	E ₆₈ ↓	E ₈₈ ↓	



QR Code 資料區塊排列





Upwards Downwards

0	1
2	3
4	5
6	7

6	7
4	5
2	3
0	1

2	3	4	5
0	1	6	7

0	1	2	3
4	5		
6	7		

CHAR. 2

0	
1	2
3	4
5	6
7	

CHAR. 1

0	
1	
2	
3	
4	5
6	7

Upwards

實際例子

Content: 20160329

Mode: 0001

Length: 0000001000

Data: 0011001001 1001011011 0011101

terminator: 0000

padding to 8 bits: 000

pad codewords: 11101100 00010001

D1=00010000

D2=00100000

D3=11001001

D4=10010110

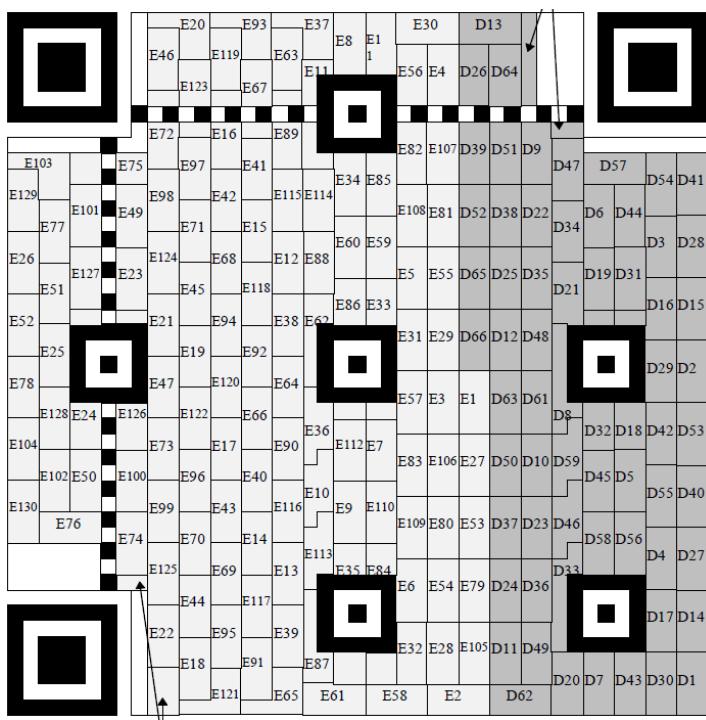
D5=11001110

D6=10000000

D7=11101100

D8=00010001





D1=00010000

D2=00100000

D3=11001001

D4=10010110

D5=11001110

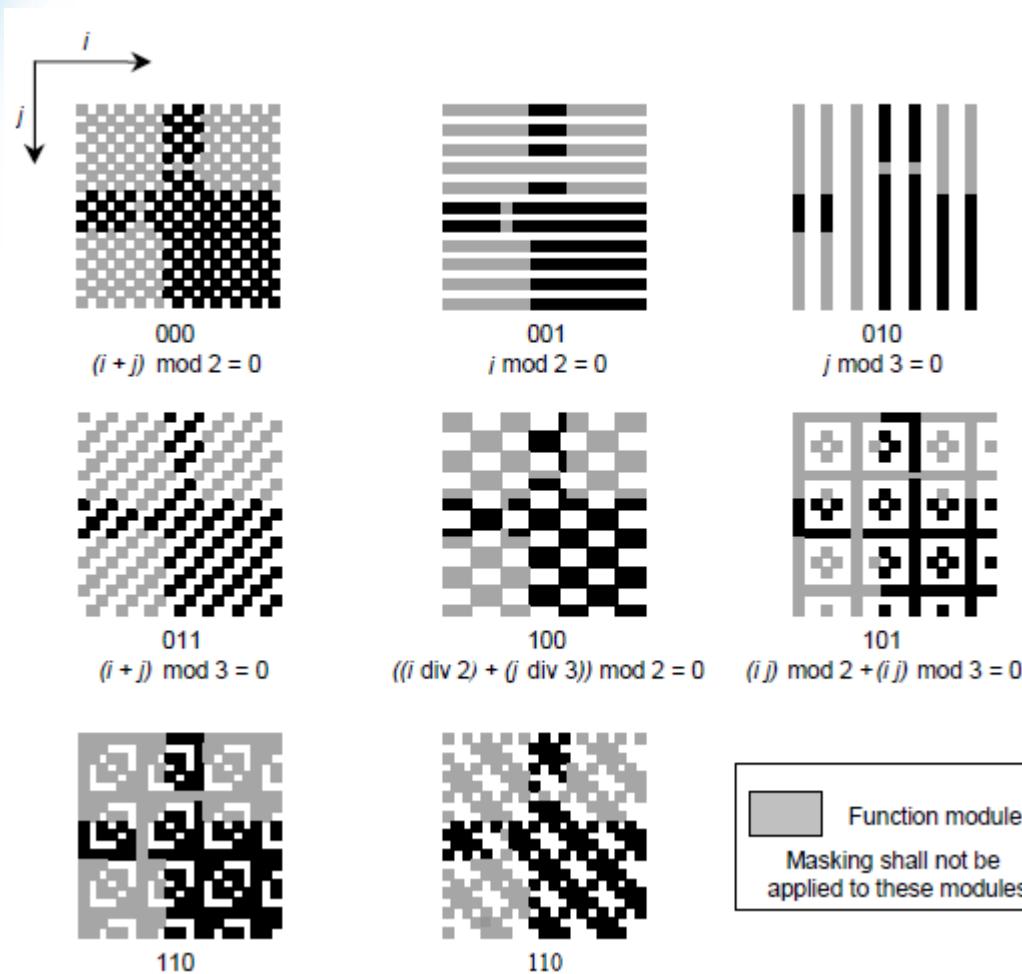
D6=10000000

D7=11101100

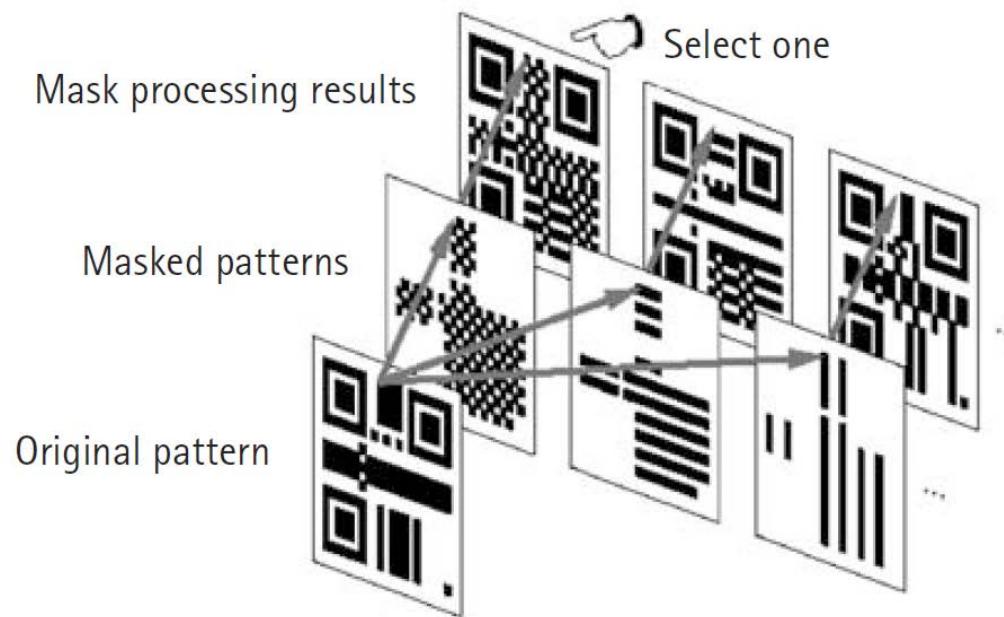
D8=00010001

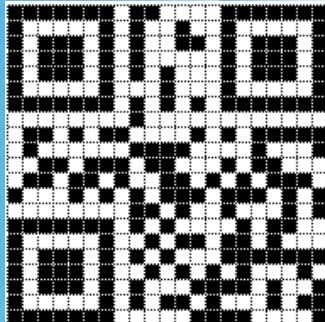


Mask Pattern

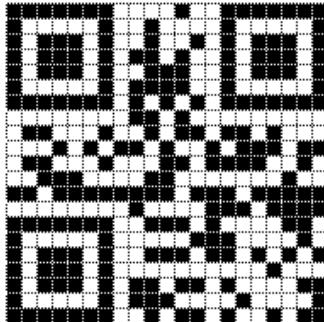


Mask Pattern

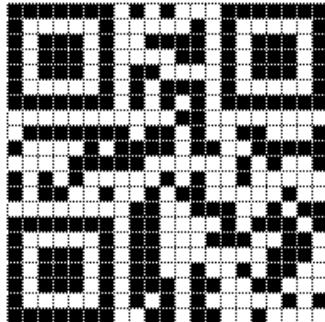




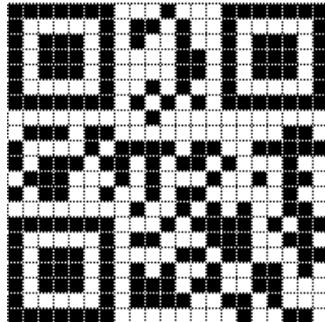
Mask Pattern 0
Penalty 1: 180
Penalty 2: 90
Penalty 3: 80
Penalty 4: 0
Total: 350



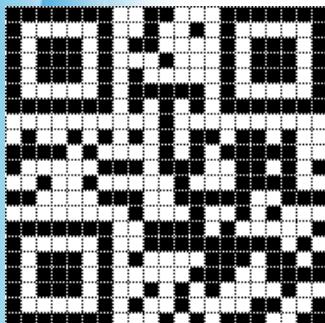
Mask Pattern 1
Penalty 1: 172
Penalty 2: 129
Penalty 3: 120
Penalty 4: 0
Total: 421



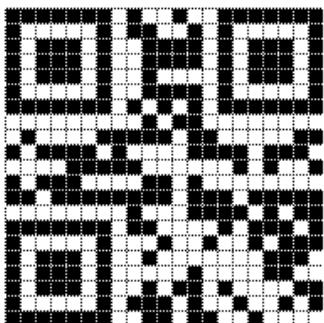
Mask Pattern 2
Penalty 1: 206
Penalty 2: 141
Penalty 3: 160
Penalty 4: 0
Total: 507



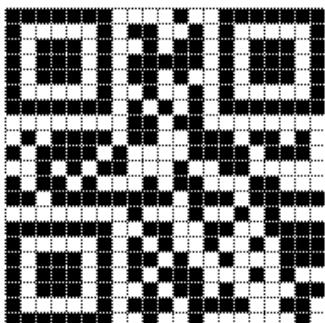
Mask Pattern 3
Penalty 1: 180
Penalty 2: 141
Penalty 3: 120
Penalty 4: 2
Total: 443



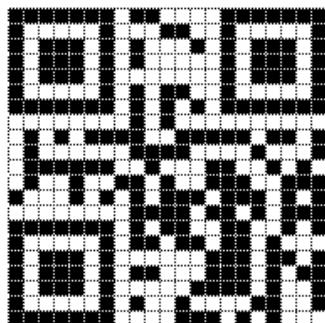
Mask Pattern 4
Penalty 1: 195
Penalty 2: 138
Penalty 3: 200
Penalty 4: 0
Total: 553



Mask Pattern 5
Penalty 1: 189
Penalty 2: 156
Penalty 3: 200
Penalty 4: 2
Total: 547



Mask Pattern 6
Penalty 1: 171
Penalty 2: 102
Penalty 3: 80
Penalty 4: 4
Total: 357



Mask Pattern 7
Penalty 1: 197
Penalty 2: 123
Penalty 3: 200
Penalty 4: 0
Total: 520



Beautify QR Code



(a)



(b)



(c)



(d)



(e)



(f)



Beautify QR Code

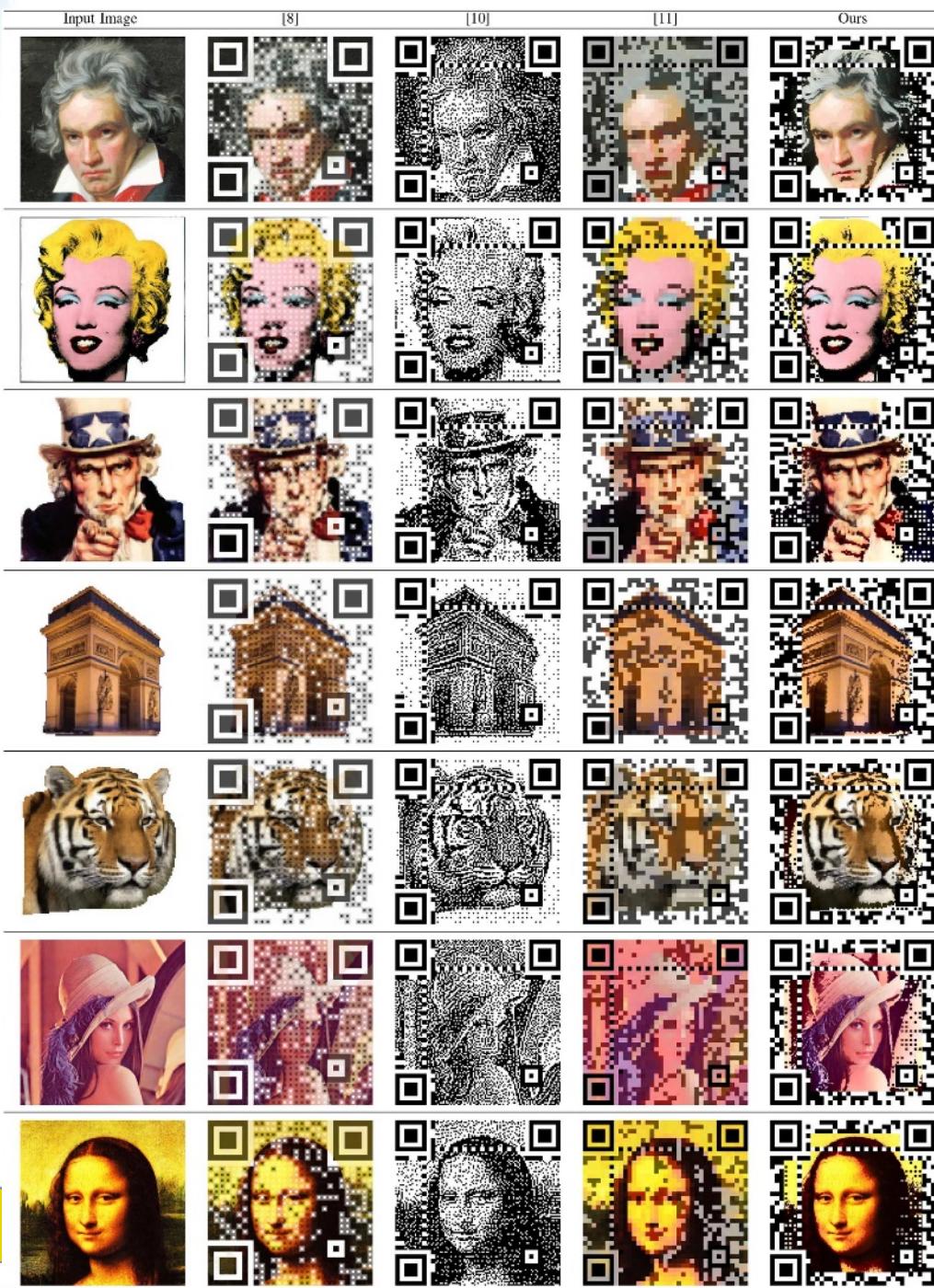
Changing Module Shape/Color



jamp37c/Lab by David Warlick

Embedding a Picture





計算機



作業一

- 請以QR Code 介紹一個新的軟體"、新的網路服務或構想未來QR Code的前瞻性應用
- 內容如下
 1. 官方網址
 2. 軟體名稱
 3. 介紹文字 (可中文或英文)



作業——內容格式

- 將上的介紹文字內容以下面的格式製作成QR Code

[網址] <http://xxxxxx/>

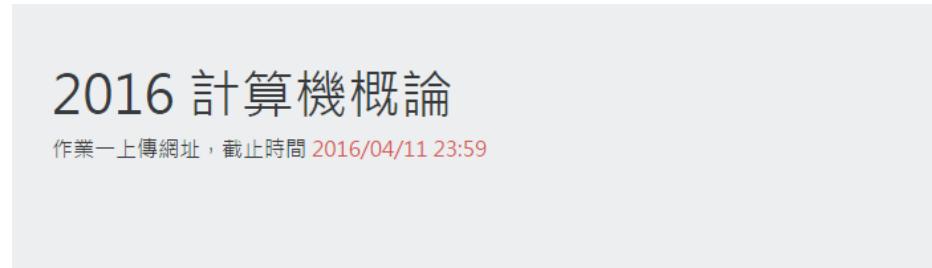
[名稱] XXXXX

[介紹] XXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX



作業一 - 繳交方式

- 上傳網址：
 - <https://goo.gl/j2NnzZ>



作業評分方式

- 評分時會將所繳交的 QR Code 顯示在螢幕上，然後再用智慧型手機拍攝，看是否能讀的出內容。
- 分數依據：
 - 內容：所介紹的內容敘述
 - 美化：美化的可看性



QRCode Generator

- <https://goo.gl/DQneUc>

Create your QR code

URL Text Phone WiFi

Website (URL)

http://www.example.www

QR Code Size

Error Correction Label

L M Q H

Border size

0 1 2 3 4 5



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Back to top

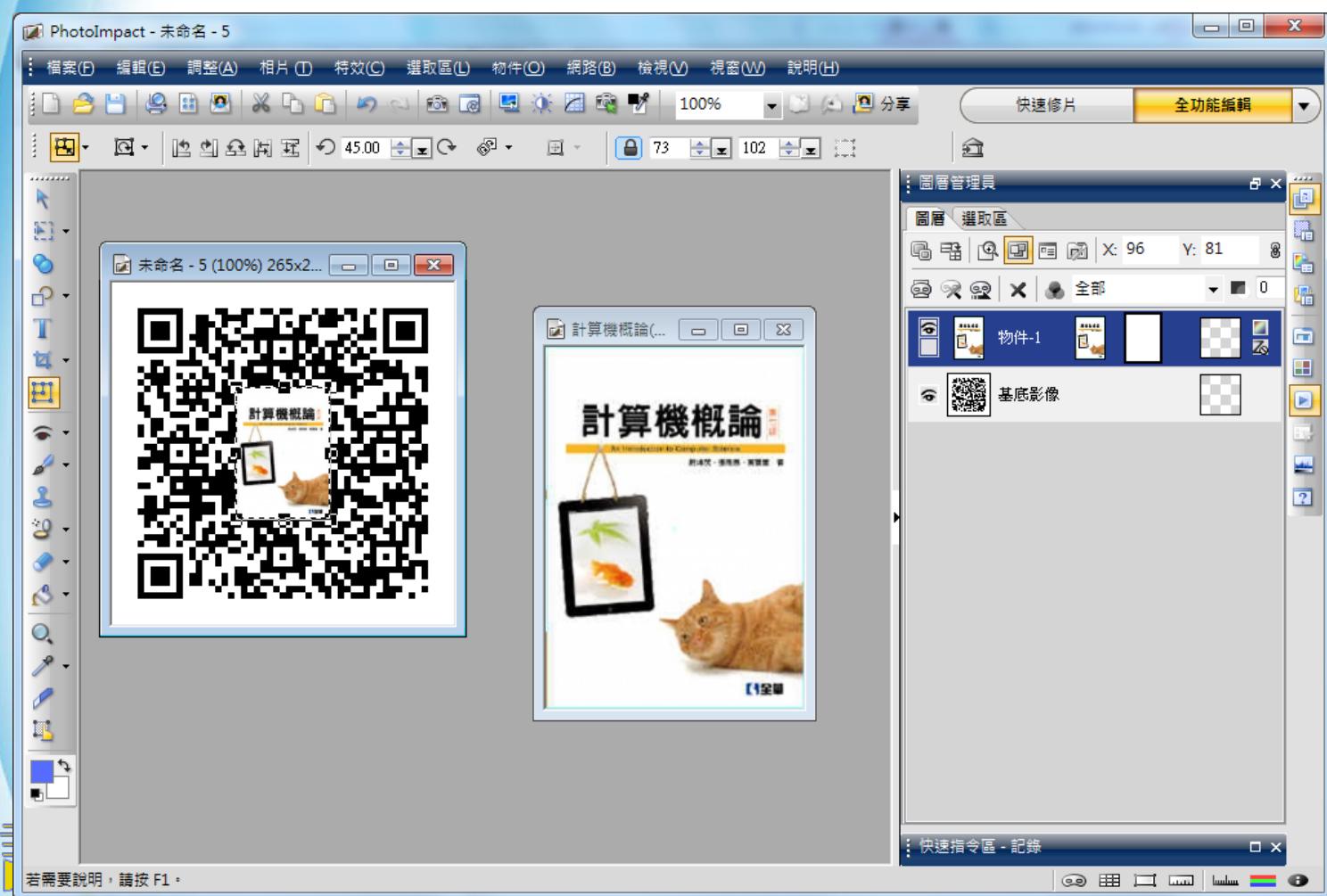


計算機概論

PhotoImpact

- <http://download.cc.ntu.edu.tw>

請用學校信箱登入



Reference

1. ISO/IEC 18004:2006, http://www.iso.org/iso/catalogue_detail?csnumber=43655
2. A Sun, Y Sun, C Liu, *The QR-code reorganization in illegible snapshots taken by mobile phones*, ICCSA 2007, 2007
3. Y-H Chang, C-H Chu and M-S Chen, A General Scheme for Extracting QR Code from a non-uniform background in Camera Phones and Applications, IEEEISM, 2007
4. SAMRETWIT and WAKAHARA, *Measurement of Reading Characteristics of Multiplexed Image in QR Code*, INCoS 2011, 2011
5. Garateguy, Arce, Lau and Villarreal, *QR Images: Optimized Image Embedding in QR Codes*, IEEE Trans. Image Process, 2014
6. S-S Lin, M-C Hu, C-H Lee and T-Y Lee, Efficient QR Code Beautification With High Quality Visual Content, IEEE Trans. Multimedia, 2015

