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Image (B and W, Color) Extraction Approach Wide Quine Mc Cluskey's Tabular Method

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Abstract: This is a design approach of software on Image/pattern-recognition while eliminating the color /gray-code of an image for comparison. This approach is quite effective for both Black and White scenes or color scenes/images. Here we select particular part/parts of given image and we compare with the contents of database (image data). This approach will be the key idea for all the verification and identification system. Here the input is image (Black and White/Color) the output is a set of elements (pixels), we have various approaches they are Minterm (minimized term) Extraction for black/white image analysis for handling various gray levels through variables like A, B, C, D,… like wise, White pixels can be maintained through their inverse ie $\overline{A},\overline{B},\overline{C}$, ..., Respectively and Maxterm Extraction for color images for handling the RGB (Red, Green, Blue and Colors) through nested minterm extraction and it is opt to handle various color-gray levels the variables like R_1, R_2, R_3, R_4, color Green is processed through G_1, G_2, G_3, G_4 and color Red is processed through R_1, R_2, R_3, R_4 and color Blue is processed through B_1, B_2, B_3, B_4.

Key words: Prime Implicant (PI), Sum of Products (SOP), Minimized term (Minterm), probabilistic determination ($\Sigma f(x,y)$)

INTRODUCTION

Image/Pattern recognition is concerned with the automatic detection (or) classification of Object (or) Events. Pattern recognition is mostly used for medical images, magnetic images, human speech recognition, finger prints, hand shape and size, retinal scans, voice characteristics, typing pattern and hand writing, etc (Jain, 1988).

Edge and line detection is another technique and feature on Constructionof image Image analysis Extraction process with Geometric method/model and Mathematical (Boolean) approach. In earlier and existing method, pattern recognition is concerned by clustering process by probabilistic and deterministic method/ modeling and function for pattern recognition is mostly as probabilistic determination $\Sigma f(x,y)$ (Jain *et al*., 2000) i.e. fraction image.

$$\Sigma f(x, y) = [g_{max}(x, y) \_ g_{min}(x, y)]/g_{max}(x, y)$$

Thus the above said existing technique will give the result through approximation (or) probabilistic and deterministic method, this will be suitable for analogous process but not perfectly suitable for digital process, but in digital analysis both analog method and digital analysis are wealthy towards result. Thus each and every pixel is compared with this new extraction approach (Moris, 2003).

Min term: A product term of any "n" variable function containing all the literals and is called a minterm, "n" variable functions have 2^n minterms,these are denoted as m_1, m_2, m_3, m_4, …..,. In minterms each variable taking value"1" appears in Uncomplemented form and each variable taking value "0" appears in complemented form thus the complete expression is obtained by SOP(Sum of Products). Product terms in SOP expression are called Implicants, there are 2 types of implicants Prime and Nonprime, A prime implicant is one which cannot be enclosed by a larger implicants.Non prime implicant can be enclosed by a larger implicants (Moris, 2003).

Quine mc cluskey's tabular method -procedure: This method is capable enough to handle larger number of pixels and this procedure is also suitable for programming on a digital computer while the analysis of digital pixels.

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This method consists of the following steps:

- A set of all prime implicants of the function are obtained at a time.
- From the set of all prime implicants, a set of prime implicants is determined by making a prime implicant chart/date set.
- The minterm which are not covered by essential prime implicants are then considered and a minimum cover is obtained from the remaining prime implicant.

If we consider the image is a fingerprint, Procedure for finding all Prime Implicants (PI), for the functions like Terminations-pixels, Bifurcation-pixels, Lake pixels, Independent ridge pixels, Point/Island pixels, Spur pixels, Cross over pixels etc. They are:

- Express each minterm by its binary representation.
- Arrange the minterm according to increasing index, where index is defined as the number of 1's in a minterm (pixel position for a particular function like Termination, Bifurcation, etc.). Separate the sets of minterms of equal index by lines.
- Compare each term of index "N" with each term of index "N+1" for each pair of terms that can combine. Write the newly formed terms. Only those terms can be combined. which differ only at one place and a X is placed at the position in the newly formed term which has been eliminated as a result of combination and checked. After all pairs of terms with implicants/indices N and (N+1) has been considered a line is drawn under the last term.
- The above procedure is repeated for all groups of term ie for N = 0, 1, 2, 3,... This completes one stage of elimination.
- The next stage of elimination is done by the step III. In this case 2 terms can be combined only when they have X in the same position (function and set). Checks are placed as before.
- Repeat step V, until no new list can be formed.
- All terms /Pixels which remain unchecked are prime implicants.

This above procedure is applied on a Boolean function, Example, f(a, b, c, d) = Σm (0, 2, 3, 5, 8, 10, 11, 13)

Image/Pattern approach for various function like Termination, Bifurcation: At very first instance, We decide the core point and delta points, assume core point as center point of a four quadrant flat graph and place the

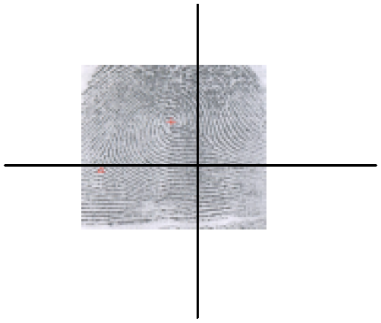


Fig. 1: The core point of a biometric (Finger print) and it moved and roteted as, core point in X and Z Jo = unction and delta point at Y axise

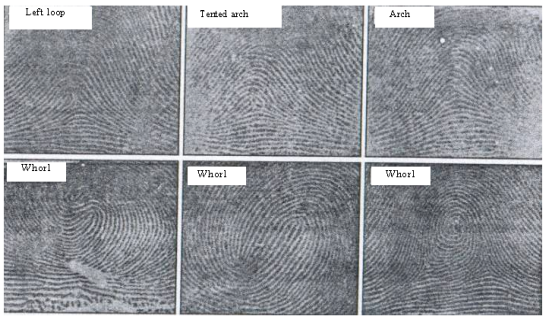


Fig. 2: Different types of fingerprints

delta point on + X axis, begin selection of function is notated as (Nalini, 2003)

f(T) : Termination _ pixel data set
f(B) : Bifurcation _ pixel data set
f(L) : Lake _ pixel data set
f(I) : Independent _ pixel data set
f(P) : Point / /Island _ pixel data set
f(S) : Spur _ pixel data set
f(C) : Cross over _ pixel data set (Fig. 1)

For all type like Left loop, Right loop, Whorl, Arch, Tented Arch, ... (Fig. 2).

Consider all the Square boxes as individual Pixel (Duda *et al*., 2000; Davide *et al*., 2003; Earl *et al*., 2000) (Fig. 3).

Here this sample has the data set of the Bifurcation, Termination and Lake Pixel Contents, But for sample we consider only Bifurcation Pixel data set and given to f(B) = Σm (18, 19, 25, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39) (Fig. 4).

This data is again treated with minterm like (Fig. 5).

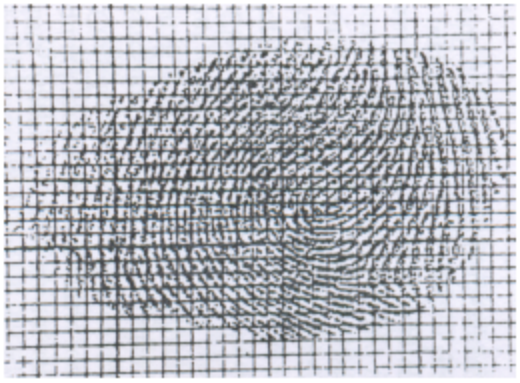
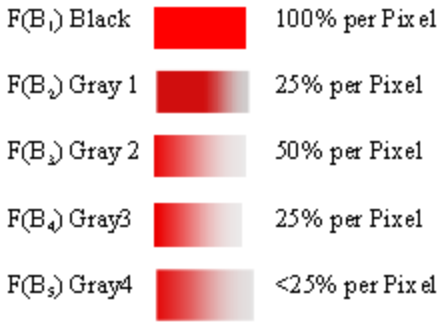


Fig.3: Individual pixcles of the fingerprints are considred from individual square location

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

Fig. 4: Any one of the continueous image line is considered for analysis



Depending upon our accuracy level we can decide required Gray levels 0, 1, 2, 3, 4, ….G the modules of G can decide result-quality.

According to Quine and Mc Cluskey for a system of tabular minimization method which would make it possible to computerized the operation of eliminating larger number of variables just like gray 1, gray 2, gray 3, ..etc.

This method is based on the fundamental concept

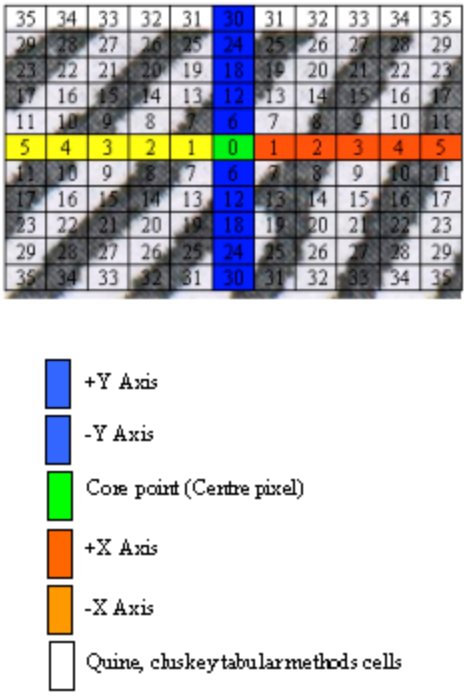


Fig. 5: The zoomed image of a sample fingerprints with individual pixel-cells

of combining adjacent cells and is independent of number of variables (gray levels) for image analysis (Rafael and Richard, 2002; Pavluidis, 1977).

Quine M C cluskey tabular model: Assume, given data for bifurcation data set of a template image and query image, for both template data (digital) and query data (digital) in a common DPI i.e, (500 dot per inch).

COMPARISON OF DIGITAL IMAGE DATA-SET

First elimination for query data: $f(B) = f(B_1, B_2, B_3, B_4\ldots) = \Sigma m\,(0, 2, 3, 5, 8, 10, 11, 13)$ since, f(B) is referred as set, the minterms of f(B) are $B_1, B_2, B_3, B_4\ldots$ from Query Data-set.

Second elimination for template data:

$f(B) = f(B_1, B_2, B_3, B_4\ldots) = \Sigma m\,(0, 2, 3, 5, 8, 10, 11, 13)$ since, f(B) is referred as set, the minterms of f(B) are $B_1, B_2, B_3, B_4\ldots$ from Template Data-set (Maris, 2003) (Table 1).

marked elements are considered for resultant. But * marked were compared and eliminated and shaded X 0 X 0 are Identical, so we take one term only.

Table 1: Manual calculation for f(B) = f(B_1, B_2, B_3, B_4,..)

No of 1's	Decimal value	Minterms (on binary's) B_1	B_2	B_3	B_4	Check …I[st]	Prime Implicant (PI)	First stage of elimination	Check …2[nd]	Prime Implicant (PI)	Second stage of elimination
0	0	0	0	0	0	*	0,2	0 0 X 0	*	0,2,8,10	X 0 X 0#
1	2	0	0	1	0	*	0,8	X 0 0 0	*	0,8,2,10	X 0 X 0#
1	8	1	0	0	0	*	2,3	0 0 1 X	*	2,3,10,11	X 0 1 X#
2	3	0	0	1	1	*	2,10	X 0 1 0	*		
2	5	0	1	0	1	*	8,10	1 0 X 0	*		
2	10	1	0	1	0	*	3,11	X 0 1 1	#		
3	11	1	0	1	1	*	5,13	X 1 0 1	#		
3	13	1	1	0	1	*	10,11	1 0 1 X	*		

RESULTS

$X\,1\,0\,1 + X\,0\,X\,0 + X\,0\,1\,X + X\,0\,1\,1$
$B_1\,B_2\,B_3\,B_4 \quad B_1\,B_2\,B_3\,B_4 \quad B_1\,B_2\,B_3\,B_4 \quad B_1\,B_2\,B_3\,B_4$

Here X is either 1 or 0 so we Ignore term"X"

$$B_2\,\bar{B}_3\,B_4 + \bar{B}_2\,\bar{B}_4 + \bar{B}_2\,B_3 + \bar{B}_2\,B_3\,B_4$$

Template:

$$f(B) = B_2\,\bar{B}_3\,B_4 + \bar{B}_2\,\bar{B}_4 + \bar{B}_2\,B_3 + \bar{B}_2\,B_3\,B_4 \qquad (1)$$

Similarly, Query image data can get any result for f(B), query for example

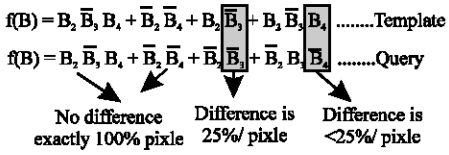
Query input image data for bifurcation. Ridge/valley query

Query:

$$f(B) = B_2\,B_3\,\bar{B}_4 + B_2\,\bar{B}_4 + B_2\,\bar{B}_3 + B_2\,B_3\,B_4 \qquad (2)$$

Here we can decide that the percentage of Variations for particular Gray levels,and can be prioritized from B_1, B_2, B_3, B_4, sequence. Because the gray level of that particular pixel is assigned like that. This is the accurate (not probabilistic/deterministic approach) method to consider the exact pixel contents of 2 images, Compare Eq. 1 and 2.

According to this above matching the image data, we obtained very very less difference between individual pixels. Hence, it is an effective method on image/pattern analysis.



CONCLUSION

Through the above method the following wealthy features are available, they are Pattern of pixels can be modified to suite to our biometric identification/ verification process and/or for the nature of the biometric which we have, i.e Circle, Square, Rectangle, Hexagonal. We may use any Color or B/W image for the above said approach/application. Required gray levels can be selected by the user even at the time of process. Through the above nature, any gray/color combination can be compared individually for any 2 images. The important thing is the identical image can be analyzed if it is pictured on different light/colored light, by the way we can do the cleansing process on Brightness/Color effect also, using gray level adjustments. This is an effective and speedy approach for all gray level, we can manage, more than 10 gray levels ie for every 10% of grouped pixels, for various Computer Applications. This same technique can be used for all the Valley/Minutiae types like. Termination, Bifurcation, Lake, Independent, Point, Spur, Crossover. This same can be used for the valley data also, this is an excellent method on analysis for the latent image if it is synthetic one. This is the right approach to analyze the different angle of light focused-on. By the final result we can also generate synthetic biometric image (Finger print), using the digital picture/ image data set. Depending upon our required DPI and part/parts to be examined, we can construct the Prime implicant Chart (PC).

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