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DETECTING LINE-ROAD AND ROAD-INTERSECTION PATTERNS AT VARIOUS A--ETC(U)
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Detecting line-road and
road-intersection patterns
at various angles

J. Robert Singleton
Pi-Fuay Chen



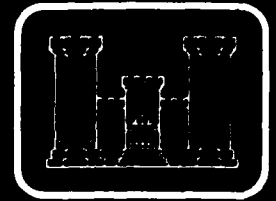
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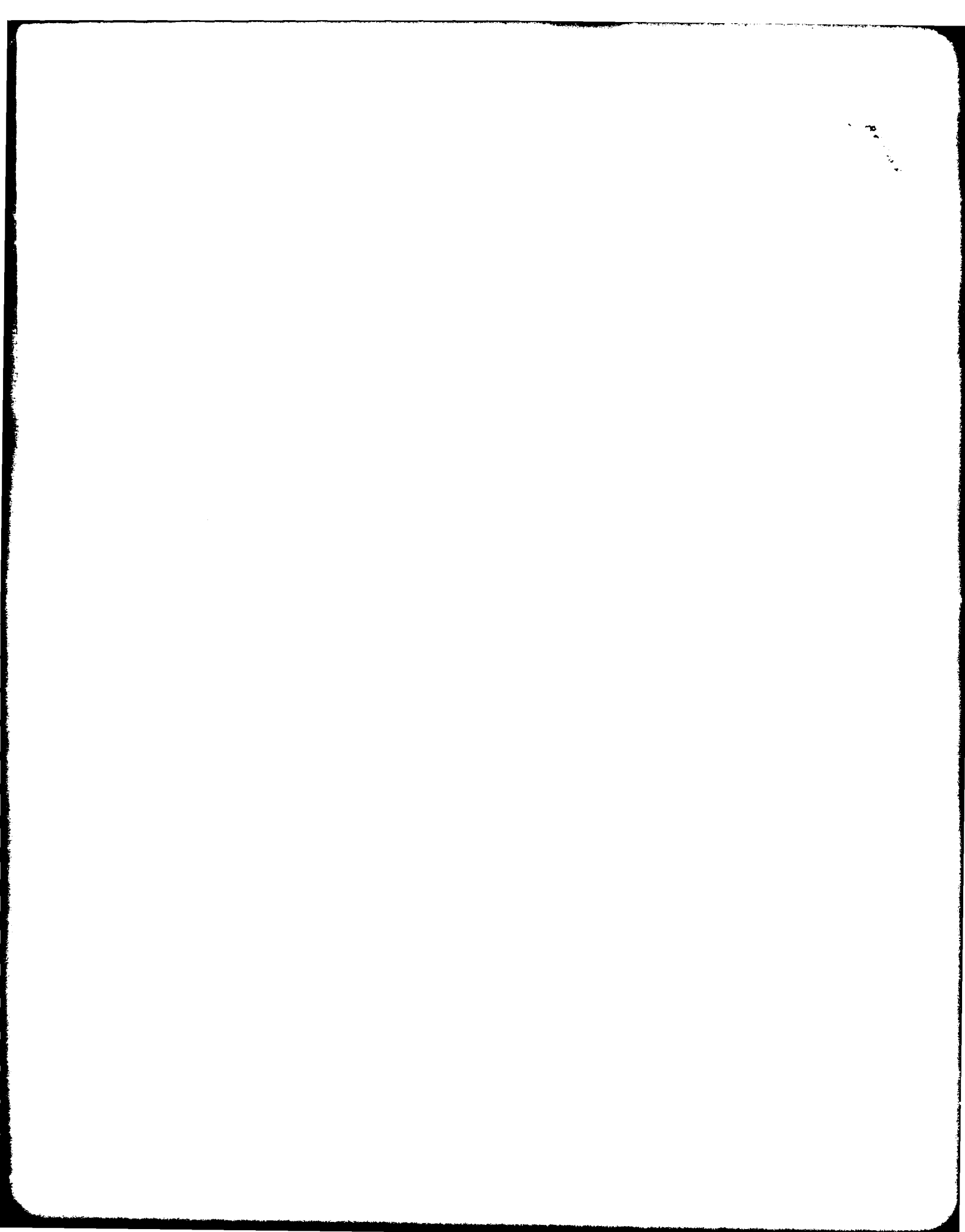


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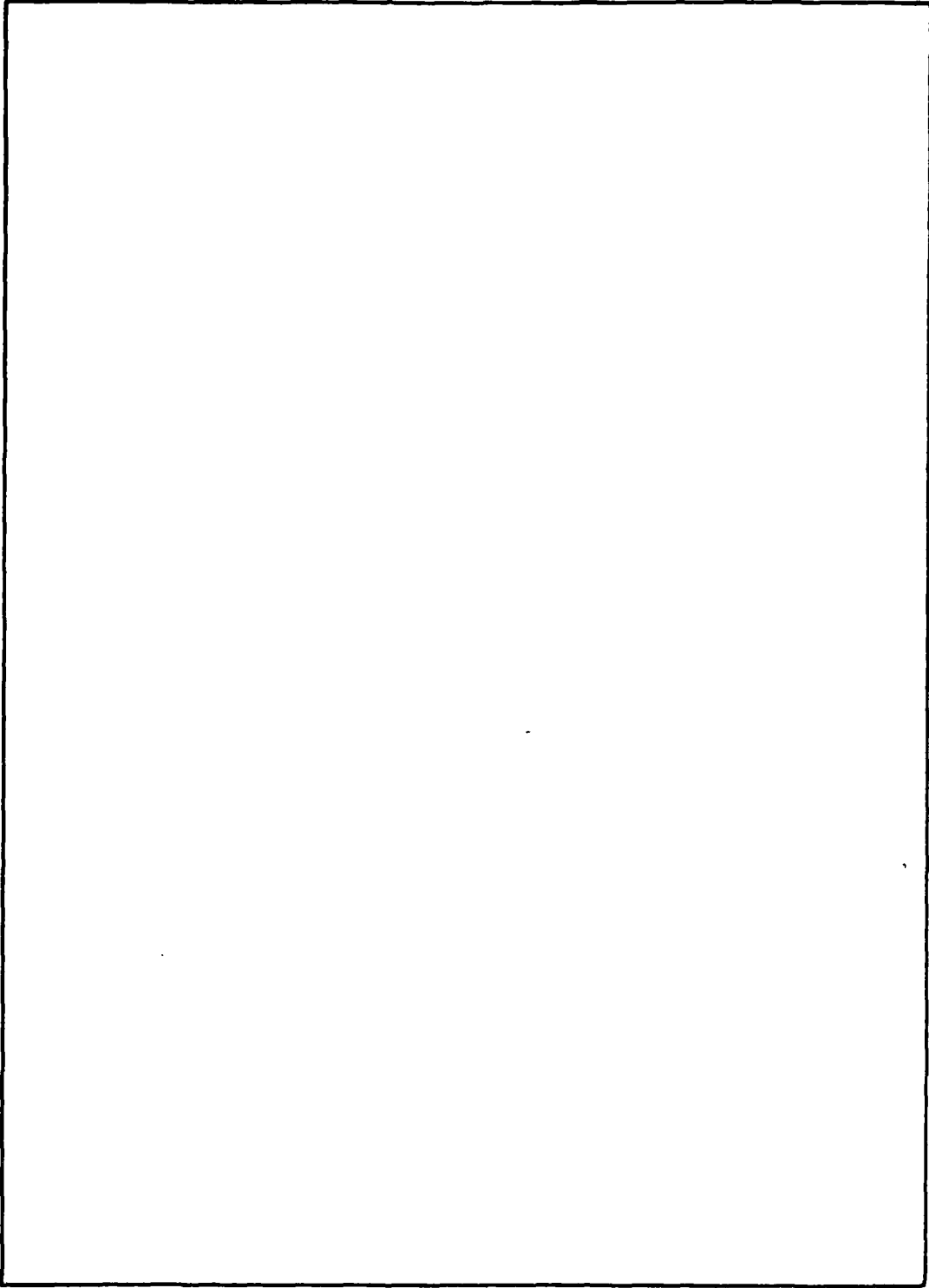
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PREFACE

This work was authorized by U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia under FY-80 DA Project-Task Area Work Unit Number 4A161102B52CB0012 entitled, "Electronic Image Analysis for Feature Extraction."

The work was done under the supervision of Dr. F. Rohde, Team Leader, Center for Theoretical and Applied Physical Sciences; and Mr. M. Crowell, Jr., Director, Research Institute.

COL Daniel L. Lycan, CE and COL Edward K. Wintz, CE were Commanders and Directors and Mr. Robert P. Macchia was Technical Director of the Engineer Topographic Laboratories during the study period.

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DETECTING LINE-ROAD AND ROAD-INTERSECTION PATTERNS AT VARIOUS ANGLES

INTRODUCTION

Since 1979, the U.S. Army Engineer Topographic Laboratories (ETL) has been investigating discrete function technology, particularly Walsh functions, to extract and recognize a selected set of manmade cartographic features, such as road intersections, straight-line roads, and rectangular objects from aerial photographs.^{1,2,3,4}

The Walsh transform was chosen because of its simplicity (Walsh functions are only two-valued, +1 or -1), resulting in simple implementation, and because Walsh functions conform to the selected set of cartographic features.

The technique was investigated by (1) using a 32- by 32-element, solid state sensor array to convert imagery into an electronic signal, which was processed in a minicomputer to yield the Walsh transform of the images;^{5,6,7} and (2) using a prototype image spectrum analyzer (PISA) with a large size plasma discharge device (8.5 by 8.5 inches illuminated area with 512 electrodes each in both X and Y directions) to generate two-dimensional Walsh function patterns and produce 512 by 512 Walsh coefficients in 14 seconds.⁸ The PISA produced successful results for a selected set of targets representing manmade cartographic features of the types stated above.

¹P.F. Chen and W.W. Seemuller, "Signal Signatures of Topographic Features Using Analog Technology," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0185, May 1979, AD-A076 110.

²P.F. Chen and W.W. Seemuller, "Application of Walsh Transforms for Topographic Feature Extraction Using a Sensor Array System," *IEEE Transactions on Instrumentation and Measurement*, pp 52-57, Vol 1M-29, March 1980.

³P.F. Chen and W.W. Seemuller, "Detection of Signal Signatures of Cartographic Features," presented at 1980 Army Science Conference, also published in the *Conference Proceedings*, West Point, NY, June 1980.

⁴P.F. Chen, F.W. Rohde, and W.W. Seemuller, "Prototype Image Spectrum Analyzer (PISA) for Cartographic Feature Extraction," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0204, October 1979, AD-A080 729.

⁵P.F. Chen and W.W. Seemuller, "Signal Signatures of Topographic Features Using Analog Technology," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0185, May 1979, AD-A076 110.

⁶P.F. Chen and W.W. Seemuller, "Application of Walsh Transforms for Topographic Feature Extraction Using a Sensor Array System," *IEEE Transactions on Instrumentation and Measurement*, pp 52-57, Vol 1M-29, March 1980.

⁷P.F. Chen and W.W. Seemuller, "Detection of Signal Signatures of Cartographic Features," presented at 1980 Army Science Conference, also published in the *Conference Proceedings*, West Point, NY, June 1980.

⁸P.F. Chen, F.W. Rohde, and W.W. Seemuller, "Prototype Image Spectrum Analyzer (PISA) for Cartographic Feature Extraction," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0204, October 1979, AD-A080 729.

The sensor array minicomputer system provides a variable image threshold that results in better control of the input images. The cartographic features as described with background scenes and noise were extracted successfully from aerial imagery. Since the sensor array minicomputer system proved superior to the PISA in this application, a classifier was implemented for the former to become a semi-automated cartographic feature extraction and recognition system.⁹

In the referenced research, the objective was to detect road intersections and straight-line roads oriented to have 0, 45, 90, and 135 degree angles with respect to the horizontal axis of the view window only. In this report, a refined scheme is described to extend the Walsh transform processing technique to detect road intersections and straight-line roads at a variety of angles with respect to the axes of the window. The heart of the scheme was implemented as software for an existing experimental system consisting of a solid state sensor array as an opto-electronic converter, a minicomputer as a signal processor, and a computer-controlled translational stage as the imagery holder. Successful extraction and recognition results are presented for a selected set of the stated cartographic features using this experimental system. Finally, conclusions are given.

SYSTEM CONFIGURATION

The present system configuration is shown in figure 1. A 9- by 9-inch aerial transparency, mounted on a stage translatable in both the X and Y directions, is illuminated by a d.c. - powered, white light source. A section of the transparency is then imaged onto a Reticon 32- by 32-element, solid state array sensor. The image is sampled and digitized into 1024 elements at 1024 gray levels and fed into a Hewlett-Packard (HP) 2108 minicomputer. A variable threshold is then applied to the digitized image, reducing it to a two-tone black-and-white image. The white pixels are assigned the value 100, and the black elements are assigned 0. This two-valued image is then transformed to generate a two-dimensional Walsh transform coefficient matrix composed of 32 by 32 elements. The low order, 16 by 16 coefficients are then applied to the software classification algorithm, which will be described later. This algorithm classifies the image into 1 of 16 angles for straight-line roads or into 1 of 4 angles of road intersections, or "not recognized" if the image does not fit either classification.

⁹P.F. Chen and W.W. Seemuller, "Detection of Signal Signatures of Cartographic Features," Presented at 1980 Army Science Conference, also published in the *Conference Proceedings*, West Point, NY, June 1980.

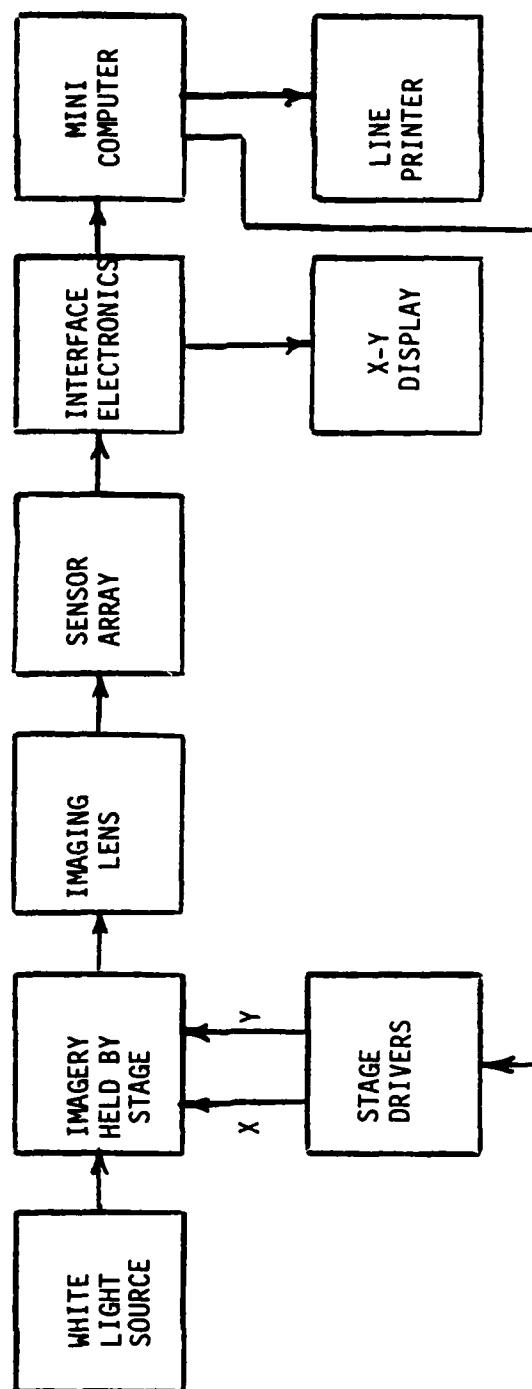


FIGURE 1. System Block Diagram.

SOFTWARE CLASSIFIER

Two arrays are passed to the software classification subroutine: the Walsh transform coefficient matrix (IXFRM) and the post-threshold image matrix. First, line roads are separated from road intersections to form two independent large cases.

To differentiate between line roads and intersections, one must summarize the first 8 rows and 8 columns of the transform matrix, such that

$$C_j = \sum_{i=1}^{16} T(i, j) \quad R_i = \sum_{j=1}^{16} T(i, j)$$

where

$T(i, j)$ is the i th row and j th column element of the Walsh coefficient matrix.

These summations are then used as the first step in differentiating between line roads and intersections by using the formula

$$A = \frac{|C_1 - T(1, 1)|}{|T(1, 1)|}, \quad B = \frac{|R_1 - T(1, 1)|}{|T(1, 1)|}$$

If $A > 0.7$, $B > 0.7$, $C_1 \geq 50$, and $R_1 \geq 50$, then the image is defined as a road intersection.

This test will recognize an intersection for all cases, except one. When an intersection is aligned at 45 degrees to the viewing axis, another test must be made. From the image and Walsh transform of an intersection oriented at 45 degrees, it can be observed that R_1 and C_1 are both rather small in magnitude (both less than 50, which was the minimum value for an image to be classified as an intersection in the last test). However, the sum of diagonal transform coefficients [$T(1, 1) + T(2, 2) + \dots + T(16, 16)$] is a reasonably large quantity.

With the sum of the first five diagonal coefficients defined as

$$D = \sum_{i=j=1}^5 T(i, j).$$

an image is recognized as an "intersection at 45 degrees" if one of the following expressions is met:

$$\text{If } \frac{|T(2, 3)|}{|T(1, 1)|} > 0.35 \text{ AND } \frac{|T(2, 2)|}{|T(1, 1)|} < 0.3 \text{ AND } T(2, 3) + T(1, 1) > 40$$

OR

$$\frac{|T(3, 2)|}{|T(2, 3)|} > 0.35 \text{ AND } \frac{|T(2, 2)|}{|T(1, 1)|} < 0.3 \text{ AND } T(1, 1) + T(3, 2) > 40$$

OR

$$D > 40 \text{ AND } \frac{|T(3, 3)|}{|T(1, 1)|} > 0.35 \text{ AND } \frac{|T(2, 2)|}{|T(1, 1)|} < 0.3;$$

The above tests in combination with a minimum distance classifier will effectively detect 0 and 45 degree angles. However, another test is necessary, and that one is performed in the image domain.

Let

$$C = \sum_{m=1}^{32} A(1, m) \quad D = \sum_{n=1}^{32} A(32, n)$$

where $A(1, m)$ and $A(32, n)$ with $m, n = 1, 2, \dots, 32$ are the 1st and 32nd rows of the input pattern in the image domain. Increment m and n , and compute C and D until $C = D = 300$. Then, if $n > m$, the image is at a 22.55 degree angle, and if $m > n$, it is at 67.5 degrees.

The algorithm for determining the angle of line roads will be discussed next. The image can be divided into four quadrants (see figure 2).

QUADRANTS

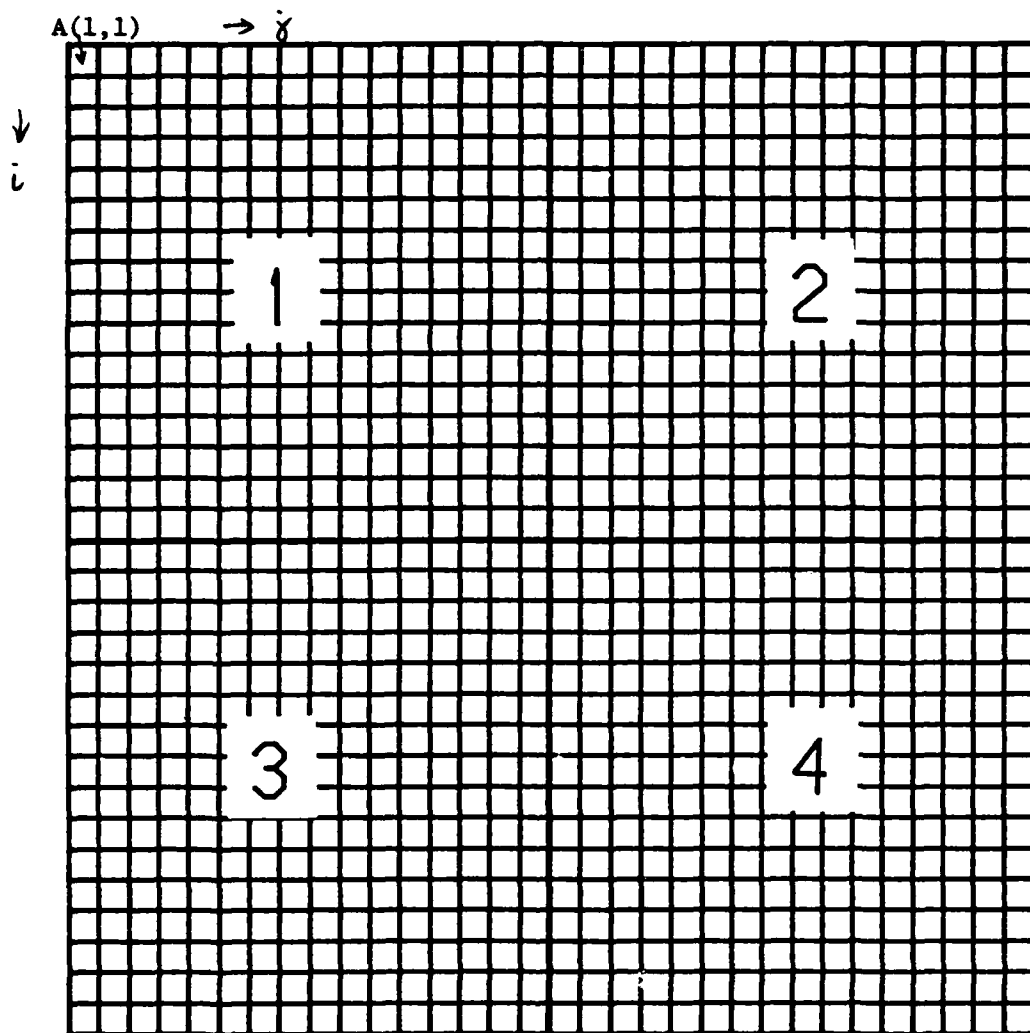


FIGURE 2. Input Image Array Divided Into 4 Quadrants.

Let

$$M_1 = \sum_{i=1}^{16} \sum_{j=1}^{16} A(i,j)$$

$$M_2 = \sum_{i=1}^{16} \sum_{j=17}^{32} A(i,j)$$

$$M_3 = \sum_{i=17}^{32} \sum_{j=1}^{16} A(i,j)$$

$$M_4 = \sum_{i=17}^{32} \sum_{j=17}^{32} A(i,j)$$

where $A(i,j)$ is the input image array.

Several tests are then applied to determine whether the angle of the image lies (a) between 0 and 90 degrees, or (b) between 90 and 180 degrees.

TEST 1

If $M_1 = 0$, and M_2 , M_3 , and M_4 do not equal 0, then the angle is less than 90 degrees.

If $M_2 = 0$, and M_1 , M_3 , and M_4 do not equal 0, then the angle is between 90 and 180 degrees.

If $M_3 = 0$, and M_1 , M_2 , and M_4 do not equal 0, then the angle is between 90 and 180 degrees.

If $M_4 = 0$, and M_1 , M_2 , and M_3 do not equal 0, then the angle is less than 90 degrees.

If the angle of the image falls into one of the above categories, the routine then proceeds to the Minimum Distance Classifier (MDC). Otherwise, it proceeds to TEST 2.

TEST 2

- (A) If $M_1 = M_2 = 0$, and M_3 and M_4 do not equal 0, then compute M_3 and M_4 until $M_3 = M_4 = 1000$, where

I_{M_3} is the net increment of the subscript used for the outer summation to compute M_3 to produce a sum of 1000.

I_{M_4} is similar to I_{M_3} , but for M_4

If $I_{M_3} \geq I_{M_4}$, the angle is less than or equal to 90 degrees.

$I_{M_3} < I_{M_4}$, the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

- (B) If $M_3 = M_4 = 0$, and M_1 and M_2 do not equal 0, then compute M_1 and M_2 until $M_1 = M_2 = 1000$, where I_{M_1} and I_{M_2} are similar to those (A) above.

If $I_{M_1} \geq I_{M_2}$, the angle is less than or equal to 90 degrees.

$I_{M_1} < I_{M_2}$, the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

If neither of the conditions in (A) or (B) were true, then do TEST 3.

TEST 3

- (A) If $M_1 = M_3 = 0$, M_2 and M_4 do not equal 0, then compute M_2 and M_4 until $M_2 = M_4 = 1000$. Let J_{M_2} and J_{M_4} be the net increment of the subscript used to compute M_2 and M_4 respectively.

If $J_{M_2} \geq J_{M_4}$, the angle is less than or equal to 90 degrees.

If $J_{M_2} < J_{M_4}$, the angle is between 90 and 180 degrees.

Proceed to MDC routine.

- (B) If $M_2 = M_4 = 0$, and M_1 and M_3 do not equal 0, then compute M_1 and M_3 until $M_1 = M_3 = 1000$, where J_{M_1} and J_{M_3} are similar to those in (A).

If $J_{M_1} \geq J_{M_3}$, the angle is less than or equal to 90 degrees.

If $J_{M_1} < J_{M_3}$, the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

TEST 4

This test is performed if each of the four quadrants contains at least one white pixel.

If $M_1 = 0$, $M_2 = 0$, $M_3 = 0$, or $M_4 = 0$, then proceed to TEST 5.

If $T(2, 2) < 0$, the image is less than 90 degrees.

If $T(2, 2) > 0$, the image is greater than 90 degrees.

Proceed to the MDC routine.

TEST 5

If M_1 does not equal 0, and $M_2 = M_3 = M_4 = 0$,
then the angle is less than 90 degrees.

If M_4 does not equal 0, and $M_1 = M_2 = M_3 = 0$,
then the angle is less than 90 degrees.

If M_2 does not equal 0, and $M_1 = M_3 = M_4 = 0$,
then the angle is between 90 and 180 degrees.

If M_3 does not equal 0, and $M_1 = M_2 = M_4 = 0$,
then the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

If the image has not passed any of the above tests, then it is classified as "not recognized."

THE MINIMUM DISTANCE CLASSIFIERS (MDC)

Separate minimum distance classifiers (MDC) were designed for both linear-road patterns and road-intersection patterns respectively. The set of linear-line roads consists of 16 classes, and each class represents a linear road oriented at a particular angle with respect to the axes of the inspecting window. Likewise, the set of road intersections consisted of four classes. Assuming that these classes are representable by prototype (or reference) patterns $\underline{z}_1, \underline{z}_2, \dots, \underline{z}_m$, then for linear roads, $m = 16$ and for road intersections, $m = 4$.

The Euclidean distance between an arbitrary pattern vectors $\underline{x}$ and the i th prototype is given by

$$D_i = \|\underline{x} - \underline{z}_i\| = \sqrt{(\underline{x} - \underline{z}_i)^T (\underline{x} - \underline{z}_i)},$$

where

$(\underline{x} - \underline{z}_i)^T$ is the transpose of $(\underline{x} - \underline{z}_i)$.

A minimum distance classifier computes the distance from a pattern $\underline{X}$ of unknown classification to the prototype of each class and assigns the pattern to the class to which it is closest. In other words, $\underline{X}$ is assigned to class "i" if $D_i < D_j$ for all $j \neq i$.

To establish the prototypes $\underline{z}_1, \underline{z}_2, \dots, \underline{z}_m$, one should use the first 8 rows and 8 columns of the summarized Walsh transform coefficients, $R_1, R_2, \dots, R_8, C_1, C_2, \dots, C_8$, as measurement vectors. They are expressed as

$$\underline{z}_i = [R_{1i}, R_{2i}, \dots, R_{8i}, C_{1i}, C_{2i}, \dots, C_{8i}]^T$$

Sixteen prototypes for linear roads having incremental angles of 11.25 degrees (starting at 0 degree with respect to the horizontal axis of the window) were obtained using the above equation. Likewise, four prototypes for road intersections at angles of 0, 22.5, 45.0, and 67.5 degrees with respect to the horizontal axis of the window were computed. These $\underline{z}_i$ were then used to compute D_i and classify the incoming unknown pattern, $\underline{X}$. The complete software package for this method is attached in the appendix.

EXPERIMENTAL RESULTS

Targets representing linear roads and road intersections at various angles with respect to the axes of the window were constructed on a glass plate. The targets were used as input test images. The glass plate was mounted on a computer-controlled translational stage so that the relative position of the images against the surface of the solid state array can be adjusted arbitrarily.

In figures 3 through 18, the original images in spatial domain, the recognition results, and the Walsh transforms for linear roads at a variety of orientation with the window are shown. The experimental results for road intersections having various angles with the axes of the window are shown in figures 19 through 22. Correct recognition was obtained for all cases.

A random translation of these images against the window was also tested. It was discovered that for the well-defined images, such as targets used for this experimentation, no misclassification was obtained. In figures 23 and 24, the typical test results for a linear road and a road intersection translated away from their center position. Again correct recognition was obtained for both cases. Other tests for translation were performed and similar results were obtained.

The detectable angular resolutions for the line roads and the road intersections were found to be 11.25 and 22.5 degrees, respectively. When the test images were corrupted by a large amount of noise, the method failed to produce correct recognition results. The amount of noise may be reduced by thinning techniques. However, the thinning techniques were not tested during the experiments.

CONCLUSIONS

1. Noise-free linear cartographic features, such as roads and road intersections at a variety of angles with the axes of the inspecting window, can be detected using an extended Walsh transform processing technique.
2. Minimum distance classifiers together with some pretesting conditions were found to be very suitable for this application.
3. All the test images (targets) at a variety of angles and also with arbitrary translations were detected and classified correctly.
4. The detectable angular resolutions for linear roads and road intersections were found to be 11.25 and 22.5 degrees, respectively.

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INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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16	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
17	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
18	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 0.00 DEGREE
WED JUN 11 1980 14:22

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12

FIGURE 3. Spatial Signaturc, Recognition Result, and Walsh Transform for Line Road at 0 Degree.

USED JUN 11 1988 14:25

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 11.25 DEGREES
USED JUN 11 1988 14:26

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-2	-7	-4	0	0	0	0	-1	0	0	0	0	0	0	0	0
3	-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	2	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0
5	12	-1	-3	-1	0	-1	0	0	0	0	0	0	0	0	0	0
6	0	-6	1	-1	0	1	0	0	0	0	0	0	0	0	0	0
7	-12	1	3	1	1	0	1	0	0	0	0	0	0	0	0	0
8	0	0	6	-1	1	-1	0	0	0	0	0	0	0	0	0	0
9	0	1	-2	-4	0	0	0	1	0	0	0	0	0	0	0	0
10	0	0	3	0	1	1	0	0	1	0	0	0	0	0	0	0
11	-1	-2	4	0	0	-1	0	0	0	0	0	0	0	0	0	0
12	0	-3	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0
13	5	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	-1	-2	1	-1	0	0	0	0	0	0	0	0	0	0
15	-5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	1	2	-1	1	0	0	0	0	0	0	0	0	0	0

FIGURE 4. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 11.25 Degrees.

[illegible][illegible]

FIGURE 5. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 22.5 Degrees.

1 MED JUN 11 1988 14:27

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 33.75 DEGREES
MED JUN 11 1988 14:28

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	3	-14	-2	-4	2	2	-2	-2	0	0	0	0	0	0	-1	-1
3	0	-4	0	-4	2	0	3	-1	0	0	0	0	0	0	1	0
4	2	-4	0	-4	-2	-4	3	-1	0	0	-1	0	0	-1	1	0
5	-2	-4	-7	-4	2	-4	-2	-1	0	0	1	0	1	-2	-1	-1
6	-1	-4	1	4	4	4	0	1	0	0	0	0	2	0	0	1
7	-3	-2	3	5	-1	1	2	0	0	0	0	-2	0	0	1	0
8	-1	0	-2	0	-2	0	2	0	0	0	-1	0	0	0	0	0
9	0	1	0	-1	0	3	0	1	0	-1	0	1	0	0	0	0
10	0	1	0	0	-4	0	0	0	0	0	0	-1	0	0	0	0
11	1	0	0	4	-1	0	0	0	0	0	0	0	0	0	0	0
12	-1	-2	-3	1	2	-1	-1	0	0	0	0	0	0	-1	0	0
13	-1	2	-3	-2	1	-1	-1	0	0	0	0	0	0	0	0	0
14	0	2	0	2	-1	0	0	1	0	-1	0	0	0	1	0	0
15	-2	-1	1	1	1	-1	0	0	0	0	0	-1	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 6. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 33.75 Degrees.

WED JUN 11 1980 14:29

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 45.00 DEGREE
WED JUN 11 1980 14:29

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	31	1	2	0	2	0	2	0	0	0	0	0	0	0	0	0
2	8	25	-2	-3	0	7	-1	-2	0	1	0	0	0	0	3	0
3	-3	-3	19	0	-2	2	7	0	0	0	-2	0	0	1	3	0
4	0	-2	1	-13	-3	-2	0	-2	0	0	0	3	-2	-1	0	-1
5	-2	0	-2	3	0	0	-1	0	0	0	0	1	3	0	0	0
6	0	7	2	-2	0	-4	0	-1	0	0	0	0	0	-2	0	0
7	-2	-1	7	0	-1	0	0	0	-1	0	0	-1	0	0	1	0
8	0	-2	0	-2	0	-1	0	2	3	0	0	0	0	0	0	0
9	0	0	0	0	0	0	-1	0	3	-3	0	0	0	0	0	0
10	0	1	0	0	0	0	0	-1	0	1	1	0	0	0	0	0
11	0	0	-2	0	1	0	0	0	-1	0	1	0	0	0	0	0
12	0	0	0	0	3	1	0	0	0	0	0	-1	0	0	0	0
13	0	0	0	0	-1	3	0	0	0	0	0	0	1	0	0	0
14	0	3	1	-1	0	-2	0	0	0	-1	0	0	0	-1	0	0
15	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0
16	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0

FIGURE 7. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 45 Degrees.

WED JUN 11 1980 14:30

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 56.25 DEGREES
WED JUN 11 1980 14:30

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	24	-4	-10	-2	-3	0	-4	0	0	0	0	0	-1	1	-2	0
2	0	-20	4	-3	0	-2	4	0	0	0	0	-1	-3	-1	3	0
3	0	4	12	-7	5	-4	-2	0	0	0	-2	3	1	1	0	0
4	0	-6	3	-7	5	-4	-2	0	0	0	1	-2	1	0	0	0
5	0	-1	2	3	3	-4	-1	0	0	0	0	0	2	1	-1	0
6	0	3	-1	-6	3	-1	0	0	0	0	0	0	0	0	0	0
7	0	1	5	-2	-3	-2	2	0	0	-2	0	0	0	0	0	0
8	0	-3	0	-2	2	1	0	0	0	0	2	0	-1	0	1	0
9	0	0	0	0	0	1	-1	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	-1	0	1	1	0	0	0	0	-1	0	0	0	0	0	0
12	0	0	0	1	1	-2	0	0	0	0	0	0	0	-1	0	0
13	0	0	0	1	1	-2	0	0	0	0	0	0	0	0	0	0
14	0	1	0	-3	-2	-1	0	0	0	0	0	0	0	0	0	0
15	0	-1	2	-1	0	0	0	0	0	0	0	0	-2	0	1	0
16	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 8. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 56.25 Degrees.

WED JUN 11 1988 14:31

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 67.59 DEGREES
WED JUN 11 1988 14:31

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	12	0	-12	0	1	0	-2	0	0	-1	0	1	0	1	0	-1
2	0	-11	0	10	-1	0	0	0	0	0	3	0	-3	0	0	0
3	0	0	0	0	-8	0	0	0	-2	-1	3	0	-2	0	0	2
4	0	-1	0	1	0	6	0	-6	1	1	-1	0	-1	0	0	0
5	0	0	0	-1	-1	0	0	1	5	0	-4	0	1	0	-1	0
6	0	1	0	-2	0	3	0	-2	0	-3	0	2	0	0	0	0
7	0	0	0	-1	-3	0	2	0	0	0	0	0	-2	0	1	0
8	0	-2	0	0	1	0	0	-1	0	-1	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	-1	0	0	0	0	0	-1	0	0	0
12	0	0	0	0	0	0	0	0	2	-1	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
14	0	0	0	0	-1	0	1	0	0	0	0	1	0	0	0	0
15	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

FIGURE 9. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 67.5 Degrees.

WED JUN 11 1988 14:31

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 78.75 DEGREES

WED JUN 11 1988 14:32

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	14	1	-14	-1	11	0	-11	0	1	-1	-1	1	3	0	-3	0
2	0	0	0	0	1	-6	-1	6	3	2	-3	-2	1	0	-1	0
3	0	-1	0	1	-2	-2	2	-5	0	5	0	-2	0	2	0	0
4	0	-3	0	3	1	-1	1	0	1	0	-1	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	-1	0
6	0	0	0	0	0	1	0	-1	0	0	0	0	0	-1	0	1
7	0	0	0	0	-1	1	1	0	-1	0	1	0	0	0	0	0
8	0	-2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 10. Spatial Signature, Recognition Results, and Walsh Transform for Line Road at 78.75 Degrees.

WED JUN 11 1988 14:32

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 90.00 DEGREES

WED JUN 11 1988 14:33

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	16	-2	-16	2	16	-2	-16	2	0	2	-9	-2	0	2	-9	-2
2	-1	-1	1	1	-1	-1	1	1	1	-1	-1	1	1	-1	-1	1
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 11. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 90 Degrees.

MED JUN 11 1988 14:33																																	
INPUT																																	
	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	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

LINE ROAD AT 101.25 DEGREES
MED JUN 11 1988 14:34

TRANSFORM																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	13	-12	-13	12	4	-2	-4	2	-3	4	3	-4	1	0	-1	0
2	0	0	-2	7	-5	7	-5	4	-2	-4	2	1	0	-1	0	0
3	0	1	0	-1	0	2	0	-2	1	-1	-3	1	0	0	-1	0
4	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 12. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 101.25 Degrees.

WED JUN 11 1980 14:34

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 112.50 DEGREES

WED JUN 11 1980 14:34

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	14	-1	-14	0	3	1	-4	0	-1	0	1	0	1	0	-2	0
2	0	11	0	-11	1	1	-1	0	-4	0	4	0	3	1	2	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	2	0	-2	0	-6	0	5	-1	-1	1	2	0	0	0	0
5	0	0	0	-1	0	1	0	4	0	-3	0	0	0	-1	0	0
6	-1	0	2	0	-3	0	3	0	2	0	-1	0	-1	0	0	0
7	0	2	0	-1	-3	0	1	0	0	0	-1	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 13. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 112.5 Degrees.

WED JUN 11 1980 14:35

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 123.75 DEGREES
WED JUN 11 1980 14:35

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	14	-4	-4	-2	-1	2	-2	0	-1	0	0	1	0	1	-1	0
2	0	11	-4	-3	-5	-5	-2	1	1	-2	0	1	2	-1	-1	0
3	0	3	4	-9	-4	-1	2	-2	-2	0	0	4	-1	0	1	0
4	0	4	-5	2	-4	0	6	-1	-1	-1	5	-1	-1	0	0	0
5	0	-2	0	2	1	-6	1	2	-2	4	0	-1	0	-1	0	0
6	0	-2	0	2	-5	0	-3	3	-1	0	-1	-1	0	0	0	0
7	0	1	2	-2	-1	0	2	-2	1	0	-2	1	0	0	0	0
8	0	0	1	0	-2	0	0	1	0	0	0	-1	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 14. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 123.75 Degrees.

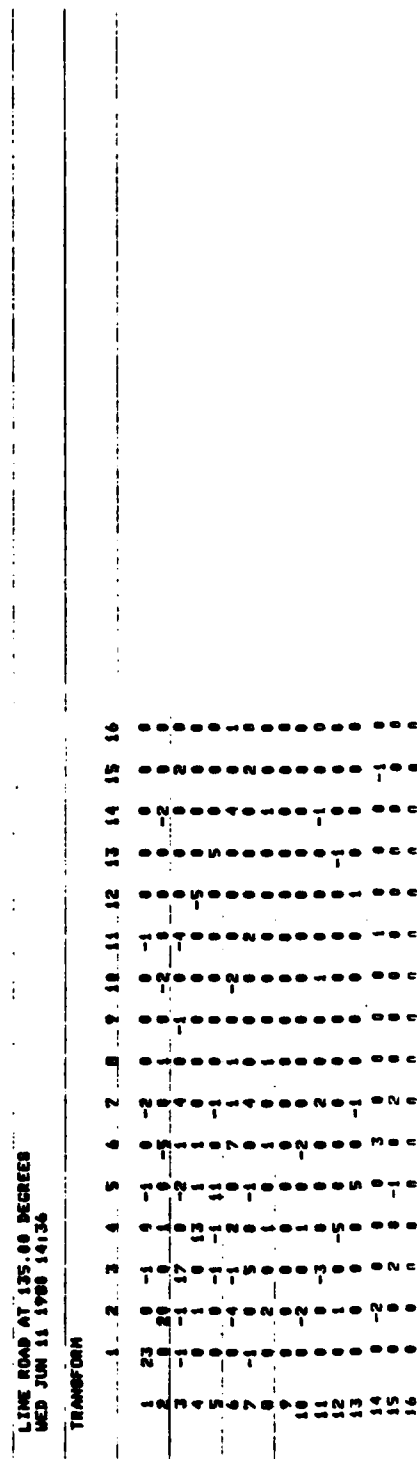
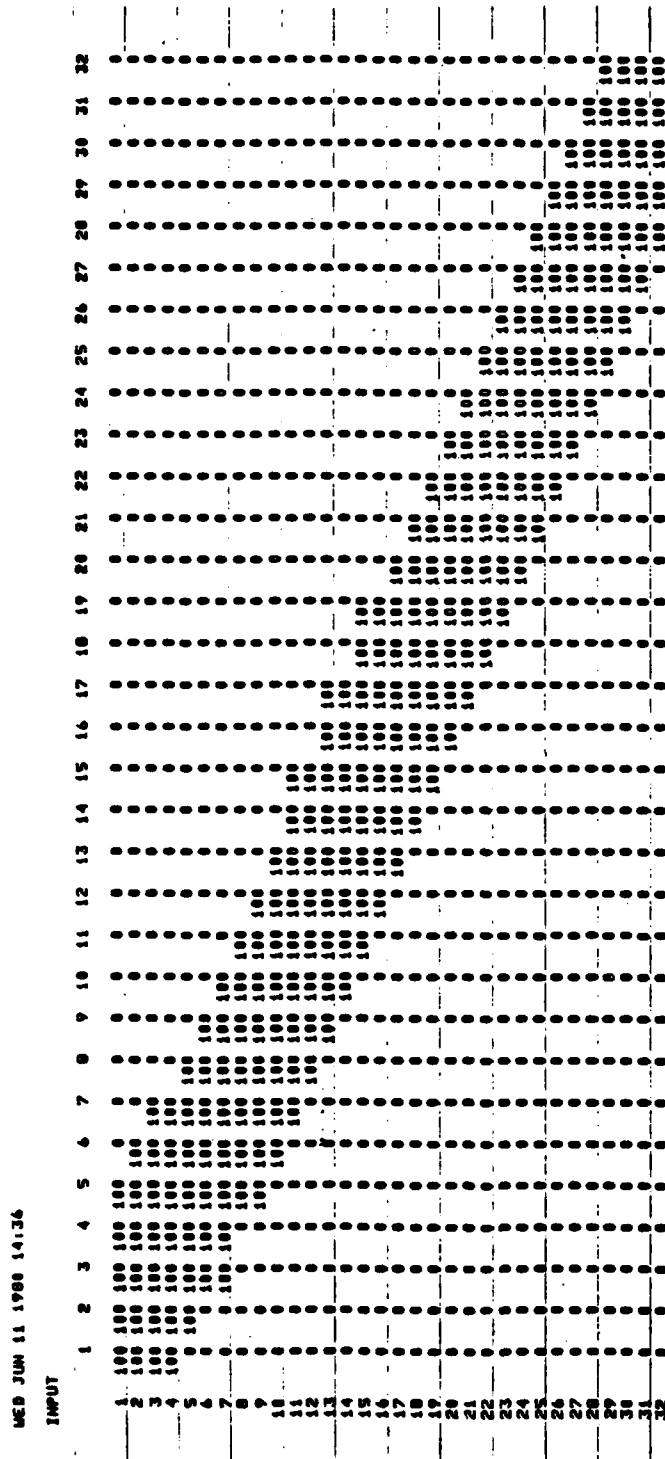


FIGURE 15. Spatial Signature, Recognition Results, and Walsh Transform for Line Road at 135 Degrees.

WED JUN 11 1988 14:37

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 146.25 DEGREES
WED JUN 11 1988 14:37

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-1	13	2	2	-1	-2	1	2	0	-1	0	0	0	0	0	0
3	-7	-3	9	-2	3	0	4	-1	0	0	0	0	0	0	0	0
4	-1	-4	-4	6	2	6	-1	1	0	0	0	0	0	0	0	0
5	-3	2	-9	-3	4	-2	-3	-1	0	0	0	0	0	0	0	0
6	0	0	-1	-7	-4	2	0	0	0	0	0	0	0	0	0	0
7	-3	-1	3	3	-5	0	1	-1	0	0	0	0	0	0	0	0
8	0	0	0	1	0	0	1	-3	-2	0	0	0	0	0	0	0
9	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	-1	0	2	3	0	1	-1	0	0	0	0	0	0	0	0
11	0	0	-1	1	-3	-1	0	-1	0	0	0	0	0	0	0	0
12	0	1	1	-4	-1	-1	-1	0	-1	0	0	0	0	0	0	0
13	-1	1	-4	-1	1	-1	0	0	0	0	0	0	0	0	0	0
14	0	-2	0	-2	-1	0	0	0	0	0	0	0	0	0	0	0
15	-1	0	1	0	1	-1	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 16. Spatial Signature, Recognition Result, and Walsh Transform
for Line Road at 146.25 Degrees.

WED JUN 11 1988 14:37

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
11	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
12	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
13	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 157.50 DEGREES
WED JUN 11 1988 14:38

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-1	10	1	2	0	-1	1	0	0	0	0	0	0	0	0	0
3	-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	8	-10	-2	-1	0	2	-2	0	0	0	0	0	0	0	0	0
5	2	2	0	0	0	0	-1	0	0	0	0	0	0	0	0	0
6	1	0	2	-5	-2	-2	1	-1	0	0	0	0	0	0	0	0
7	-2	-2	7	3	3	2	2	1	0	0	0	0	0	0	0	0
8	0	0	0	-1	5	3	1	0	0	0	0	0	0	0	0	0
9	-1	0	-2	-4	-1	2	0	0	0	0	0	0	0	0	0	0
10	0	-3	-3	0	-1	2	0	0	0	0	0	0	0	0	0	0
11	1	0	2	3	-3	0	1	0	0	0	0	0	0	0	0	0
12	0	3	2	0	0	-2	0	-1	0	0	0	0	0	0	0	0
13	0	1	-2	0	0	0	-1	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-1	-1	2	0	0	-1	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 17. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 157.5 Degrees.

MED JUN 11 1988 14:38

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 168.75 DEGREES

MED JUN 11 1988 14:39

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-6	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0
3	-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	6	-8	-1	-3	0	0	0	0	0	0	0	0	0	0	0	0
5	10	4	-2	2	0	0	0	0	0	0	0	0	0	0	0	0
6	-1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0
7	-10	-4	2	-2	0	0	0	0	0	0	0	0	0	0	0	0
8	1	-3	-4	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	3	-4	0	0	0	0	0	0	0	0	0	0	0	0	0
10	2	-3	0	-2	0	0	0	0	0	0	0	0	0	0	0	0
11	9	-5	2	-1	0	0	0	0	0	0	0	0	0	0	0	0
12	-2	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0
13	4	2	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0
14	0	0	-1	1	0	0	0	0	0	0	0	0	0	0	0	0
15	-4	-2	1	0	1	0	0	0	0	0	0	0	0	0	0	0
16	0	0	1	1	-1	0	0	0	0	0	0	0	0	0	0	0

FIGURE 18. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 168.75 Degrees.

WED JUN 11 1988 14142

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INTERSECTION AT 0.00 DEGREES
WED JUN 11 1988 14143

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	40	0	-21	-2	16	0	-16	0	0	-2	0	2	0	-3	0	0
2	0	-2	3	1	-1	3	1	-2	3	0	-2	0	0	-2	0	2
3	-15	3	-3	0	5	-1	-4	0	0	0	0	0	0	0	0	0
4	-3	1	0	-1	1	0	3	0	0	0	0	0	0	0	0	0
5	13	0	4	-1	-3	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7	-13	1	-4	1	3	0	-3	0	0	0	0	0	0	0	0	0
8	0	-1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
9	2	2	3	0	0	-1	1	0	0	0	0	0	0	0	0	0
10	-3	1	0	0	0	-1	0	0	0	0	0	0	0	0	0	0
11	-2	-3	-2	0	0	1	0	0	0	0	0	0	0	0	0	0
12	3	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
13	5	0	1	1	-1	0	1	0	0	0	0	0	0	0	0	0
14	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-5	0	-1	-1	1	1	-1	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 19. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 0 Degrees.

INPUT

[illegible]

INTERSECTION AT 45.00 DEGREES
WED JUN 11 1980 14:14

TRANSFORM

[illegible]

FIGURE 21. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 45 Degrees.

WED JUN 11 1980 14:49

INPUT

	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
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INTERSECTION AT 67.58 DEGREES
WED JUN 11 1980 14:49

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	29	-7	-9	6	-2	4	-2	-1	0	0	1	-2	0	1	-1	0
2	18	2	-3	0	-7	1	2	-2	-1	0	3	-1	-2	0	0	0
3	-12	0	4	-4	-1	7	0	-1	2	-1	0	0	0	2	1	0
4	-1	-15	5	0	-4	5	2	-1	0	0	0	0	-2	3	1	1
5	-2	1	-4	-4	-1	2	-4	-1	-1	0	1	0	0	0	0	0
6	-1	-3	0	0	0	-2	-1	0	2	-1	-2	2	3	-2	-2	0
7	0	0	0	-1	-1	0	1	0	0	-1	-2	3	0	-1	1	0
8	-1	0	0	1	5	-3	0	1	1	0	0	0	0	0	0	-1
9	-2	1	1	0	4	0	0	0	0	0	0	0	1	0	1	0
10	0	-2	1	1	0	3	0	1	0	0	0	0	0	2	0	0
11	4	0	0	1	-2	0	0	1	0	-1	0	-2	0	1	0	0
12	0	5	0	0	2	-2	0	0	0	0	-1	0	1	0	0	0
13	0	0	-2	-2	0	1	0	0	-1	0	0	0	0	0	0	0
14	-1	1	0	-3	0	-1	0	1	0	-1	0	0	0	0	-1	0
15	-1	0	2	0	-1	0	-1	0	1	0	0	1	-1	0	0	0
16	0	-1	0	0	0	-1	0	-1	1	0	0	0	0	0	0	-1

FIGURE 22. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 67.5 Degrees.

INPUT

LINE ROAD AT 11.25 DEGREES
WED JUN 11 1980 1414Z

TRANSFORM

1

FIGURE 23. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 11.25 Degrees, and Translated to the Top of Window.

APPENDIX
SUBROUTINE MATCH

FTN4,L

```
      SUBROUTINE MATCH (IXFRM,CONS,LUOT,INBUF)
      DIMENSION IXFRM(1024),CONS(20,16),COLM(16),INBUF(1024)
      ITOT=0
      DO 20 J=1,8
      ISUM=0
      DO 10 I=1,16
10    ISUM=ISUM+IABS(IXFRM((I-1)*16+J))
      COLM(J)=ISUM
20    ITOT=ITOT+ISUM
      DO 28 J=9,16
      ISUM=0
      DO 26 I=1,16
26    ISUM=ISUM+IABS(IXFRM((J-9)*16+I))
      COLM(J)=ISUM
28    ITOT=ITOT+ISUM
C
C SEE IF INTERSECTION
C
      A=ABS(COLM(1)-IXFRM(1))/IABS(IXFRM(1))
      B=ABS(COLM(9)-IXFRM(1))/IABS(IXFRM(1))
      IF (A.GT.0.7 .AND. B.GT.0.7 .AND. COLM(1).GE.50.
      * .AND. (COLM(9).GE.50)) GOTO 800
C
C COMPUTE DIAGONAL
C
      IDIAG=0
      DO 900 I=1,5
900   IDIAG=IDIAG+IXFRM((I-1)*16+I)
      AT1=IABS(IXFRM(19))
      AT2=IABS(IXFRM(18))
      AT3=IABS(IXFRM(34))
      AT4=IABS(IXFRM(35))
      AT5=IABS(IXFRM(1))
      IF (((AT1/AT5).GT.0.35 .AND. (AT2/AT5).LT.0.3 .AND.
      * (AT5+AT1).GT.40)
      *.OR. ((AT3/AT1).GT.0.35 .AND. (AT2/AT5).LT.0.3 .AND. (AT5+AT3)
      *.GT.40) .OR. (IDIAG.GT.40 .AND. (AT4/AT5).GT.0.35 .AND.
      *(AT2/AT5).LT.0.3)) GOTO 810
C
C
C COMPUTE QUADRANTS TO DETERMINE IF ANGLE IS LESS THAN 90 DEGREES
C OR IF IT IS BETWEEN 90 AND 180 DEGREES
C
C
      M1=0
      M2=0
      DO 120 I=0,15
      DO 100 J=1,16
100   M1=M1+INBUF(I*32+J)
      DO 110 J=17,32
110   M2=M2+INBUF(I*32+J)
120  CONTINUE
      M3=0
      M4=0
```

```

        DO 150 I=16,31
        DO 130 J=1,16
130     M3=M3+INBUF(I*32+J)
        DO 140 J=17,32
140     M4=M4+INBUF(I*32+J)
150     CONTINUE
C
C TEST ONE
C
        K=0
        IF (M2.NE.0 .AND. M3.NE.0 .AND. ((M1.EQ.0 .AND. M4.NE.0) .OR.
*(M4.EQ.0 .AND. M1.NE.0))) K=1
        IF (M1.NE.0 .AND. M4.NE.0 .AND. ((M2.EQ.0 .AND. M3.NE.0) .OR.
*(M3.EQ.0 .AND. M2.NE.0))) K=8
        IF (K .NE. 0) GOTO 29
C
C TEST TWO
C
        IF (M1.NE.0 .OR. M2.NE.0 .OR. M3.EQ.0 .OR. M4.EQ.0) GOTO 300
        M3=0
        M4=0
        DO 210 I1=16,31
        DO 200 J1=1,16
        M3=M3+INBUF(I1*32+J1)
        IF (M3 .GE. 1000) GOTO 220
200     CONTINUE
210     CONTINUE
220     DO 240 I2=16,31
        DO 230 J2=17,32
        M4=M4+INBUF(I2*32+J2)
        IF (M4 .GE. 1000) GOTO 250
230     CONTINUE
240     CONTINUE
250     M3=I1*32+J1
        M4=I2*32+J2-16
        K=8
        IF (M3 .GE. M4) K=1
        GOTO 29
300     IF (M3.NE.0 .OR. M4.NE.0 .OR. M1.EQ.0 .OR. M2.EQ.0) GOTO 400
        M1=0
        M2=0
        DO 320 I1=0,15
        DO 310 J1=1,16
        M1=M1+INBUF(I1*32+J1)
        IF (M1 .GE. 1000) GOTO 325
310     CONTINUE
320     CONTINUE
325     DO 340 I2=0,15
        DO 330 J2=17,32
        M2=M2+INBUF(I2*32+J2)
        IF (M2 .GE. 1000) GOTO 350
330     CONTINUE
340     CONTINUE
350     GOTO 250
C

```

C TEST THREE

C

```
400 IF (M1.NE.0 .OR. M3.NE.0 .OR. M2.EQ.0 .OR. M4.EQ.0) GOTO 500
    M2=0
    M4=0
    DO 420 I1=17,32
    DO 410 J1=0,15
    M2=M2+INBUF(J1*32+I1)
    IF (M2 .GE. 1000) GOTO 430
410 CONTINUE
420 CONTINUE
430 DO 450 I2=17,32
    DO 440 J2=16,31
    M4=M4+INBUF(J2*32+I2)
    IF (M4 .GE. 1000) GOTO 460
440 CONTINUE
450 CONTINUE
460 GOTO 250
500 IF (M2.NE.0 .OR. M4.NE.0 .OR. M1.EQ.0 .OR. M3.EQ.0) GOTO 600
    M1=0
    M3=0
    DO 520 I1=1,16
    DO 510 J1=0,15
    M1=M1+INBUF(J1*32+I1)
    IF (M1 .GE. 1000) GOTO 530
510 CONTINUE
520 CONTINUE
530 DO 550 I2=1,16
    DO 540 J2=16,31
    M3=M3+INBUF(J2*32+I2)
    IF (M3 .GE. 1000) GOTO 560
540 CONTINUE
550 CONTINUE
560 GOTO 250
```

C

C TEST FOUR

C

```
600 IF (M1.EQ.0 .OR. M2.EQ.0 .OR. M3.EQ.0 .OR. M4.EQ.0) GOTO 700
620 IF (IXFRM(18) .LE. 0) K=1
    IF (IXFRM(18) .GT. 0) K=8
    GOTO 29
```

C

C TEST FIVE

C

```
700 IF (M2.EQ.0 .AND. M3.EQ.0 .AND. ((M1.NE.0 .AND. M4.EQ.0) .OR.
    *(M4.NE.0 .AND. M1.EQ.0))) K=1
    IF (M1.EQ.0 .AND. M4.EQ.0 .AND. ((M2.NE.0 .AND. M3.EQ.0) .OR.
    *(M3.NE.0 .AND. M2.EQ.0))) K=8
    IF (K .NE. 0) GOTO 29
    WRITE (1,710)
710 FORMAT (' IMAGE DOES NOT FIT ANY TESTS')
    RETURN
```

C

C ROAD INTERSECTIONS

C

```

      810 MINNUM=19
          GOTO 65
      800 K=17
C
C FIND CLOSEST MATCH
C
      29 AMIN=1000.
          L=3
          IF (K.EQ.1 .OR. K.EQ.8) L=8
          DO 40 I=K,K+L
              DIF=0.
              IF (I .EQ. 19) GOTO 40
              DO 30 J=1,16
      30 DIF=DIF+(COLM(J)/ITOT-CONS(I,J))*2
              IF (DIF .GE. AMIN) GOTO 40
              AMIN=DIF
              MINNUM=I
      40 CONTINUE
          IF (MINNUM .GT. 16) GOTO 60
          IF (MINNUM .LT. 8) ANGLE=MINNUM*11.25
          IF (MINNUM .EQ. 8) ANGLE=0.
          IF (MINNUM .GT. 8) ANGLE=(MINNUM-1)*11.25
          WRITE (LUOT,50) ANGLE
      50 FORMAT (' LINE ROAD AT ',F6.2,' DEGREES')
          RETURN
      60 IF (MINNUM.EQ.17) GOTO 65
          C=0
          D=0
          DO 62 I=1,32
              C=C+INBUF(I)
              D=D+INBUF(992+I)
              IF (C.EQ.300 .OR. D.EQ.300) GOTO 63
      62 CONTINUE
      63 MINNUM=18
          IF (D .GT. C) MINNUM=20
      65 ANGLE=(MINNUM-17)*22.5
          WRITE (LUOT,70) ANGLE
      70 FORMAT (' INTERSECTION AT ',F6.2,' DEGREES')
          RETURN
          END
          END$

```

