

porated within scanning systems or copiers, recognizes and authenticates images. The system is first trained off-line with example images. A template is created by recording the image pattern which will be compared against test images subsequently scanned by the system. Training of the system includes generating templates and selecting one or several pairs of anchor lines within the templates which should be identifiable within test images. The anchor lines are typically straight, and desirably long lines; they can be lines within an image pattern, or edges along an image. Each pair contains two lines which are orthogonal to each other in direction. The detector is trained off-line with currency images resulting in a template generated by recording a pattern similar to a test pattern to be sampled. Anchor lines are identified within said template.

During detection the disclosed line detection method is first performed to detect long straight lines. The long lines detected are then grouped into pairs, each of which contain two long lines that are in orthogonal directions. Under the assumption that the detected long line pairs are the anchor line pairs, the test pattern is matched to the templates. FIG. 2A illustrates a sample template. Specifically, the template is first rotated and shifted before matching so that the anchor lines align with the long lines to be detected. This is best illustrated in FIG. 2B where the anchor lines are similar to the template are shown in the upper part of the Figure. A legitimate image pattern is declared to be detected after the template (FIG. 2A) is matched with the anchor lines within the tested image (FIG. 2B), as shown in FIG. 2C, wherein the template (FIG. 2A) is overlaid on top of the test pattern anchor lines of FIG. 2B. The test result may then be determined as positive.

Referring to FIG. 3, system hardware necessary for the image detection system 5 would utilize a scanner 1 for receiving the test image, a microprocessor 2 programmed with the Hough transform to detect an image match by utilizing local edge information to detect lines and curves in scanned images, memory 3 for storing test patterns, and an indicator means 4 to indicate match detection. The detection system 5 facilitates the training of the microprocessor 2 (also referred to as "detector") off-line with sample images which are scanned 1 into said system wherein a template is generated by recording 3 an image pattern of said example notes similar to a test pattern to be detected. Anchor lines within the template would be identified by the microprocessor 2. The microprocessor system be programmed further to allow for the detection of the long lines using the disclosed line detection method and rotation and shifting of the template before matching it to the test pattern so that anchor lines may align with long lines which may be detected within the test pattern. The system 2 would then compare the template, held in memory 3, to the test pattern that is scanned 1 or viewed by an image capturing means to determine whether the anchor lines exist within the test pattern.

While the invention is described with reference to a particular embodiment, this particular embodiment is intended to be illustrative, not limiting. Various modifications may be made without departing from the spirit and scope of the invention as defined in the amended claims. Modifications and alterations will occur to others upon reading and understanding this specification; therefore, it is intended that all such modifications and alterations are included insofar as they come within the scope of the appended claims or equivalents thereof.

What is claimed is:

1. An image detection method using line detection information of collinear sets of detected points, comprising:

training a detector off-line with example images wherein a template is generated by recording an image pattern of said example images similar to a test pattern to be detected;

identifying anchor lines within said template;

detecting long lines from collinear sets of detected points in the test patterns;

rotating and shifting said template before matching said template to said test pattern so that said anchor lines align with the detected long lines enabling detection within said test pattern; and

comparing said template to said test pattern to determine whether said anchor lines exist within said test pattern.

2. The method of claim 1 comprising:

wherein training further comprises generating said templates by selecting at least one pair of anchor lines within said example images which include straight lines within a currency pattern or currency edges, and wherein said at least one pair of anchor lines contain two lines which are orthogonal to each other in direction.

3. The method of claim 2 comprising:

wherein said one or several pairs of anchor lines comprise straight lines within an image pattern.

4. The method of claim 3 comprising:

wherein said one or several pairs of anchor lines comprise straight lines along edges within an image pattern.

5. An image detection system, using line detection information of collinear sets of detected points, comprising:

means for training a detector off-line with example images wherein a template is generated by recording an image pattern of said example images similar to a test pattern to be detected;

means for identifying anchor lines within said template;

means for detecting long lines from collinear sets of detected points in the test patterns;

means for rotating and shifting said template before matching said template to said test pattern so that said anchor lines align with the detected long lines enabling detection within said test pattern; and

means for comparing said template to said test pattern to determine whether said anchor lines exist within said test pattern.

6. An image detection method using line detection information of collinear sets of detected points, comprising:

training a detector off-line with example images wherein a template is generated by recording an image pattern of said example images similar to a test pattern to be detected;

identifying anchor lines within said template;

detecting long lines from collinear sets of detected points in the test patterns using a line detection method as follows:

a) building a 2-D array indexed by (θ, b) wherein a line, represented by an equation:

$$y = x \tan \theta - b$$

is constructed for each detected point $P_i = (x_i, y_i)$ as:

$$b = kx_i - y_i$$

in a kb -plane and wherein $k = \tan \theta$, for $\phi + \Delta < \theta < \phi - \Delta$, wherein ϕ is the edge orientation of the local edge and Δ is a preset parameter determined by the accuracy of the local edge orientation estimation;