Device, Method and Recording Medium for Video Inspection

Patent No.6,408,089(U.S.), Japanese Patent No.2 2,898,269

It is known that images containing periodic patterns, such as striping, checker, concentric, radial, or swirl patterns having high contrast, may induce seizures in photosensitive viewers. To detect images (video frames) containing such patterns, an inspector either has to visually check the actual video on a display device (a monitor) or to visually check the display of a waveform monitor.

The present invention relates to a device for monitoring images for specific types of patterns by analyzing video such as television pictures, and the object of this invention is to provide a device, a method, and a recording medium for video inspection capable of automatically detecting images displayed in high contrast with patterns of specific forms contained in video pictures. Some examples of these patterns are shown in FIGS 1A-1D.

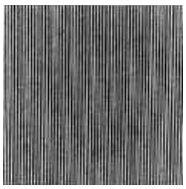

Figure1: A

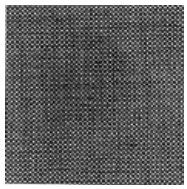

Figure1: B

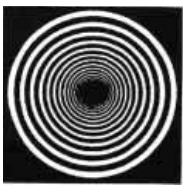

Figure1: C

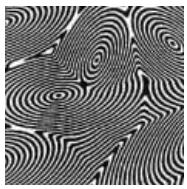

Figure1: D

The inventor(s) of this invention have found that, when performing frequency analysis, for example, by using a Fast Fourier Transformation (FFT), there is an acute peak in that portion at a spatial frequency (first condition). The inventors also have found that a high contrast image is characterized by a large alternating current energy (second condition). Based on these findings, the entire image is divided into small blocks, and it is determined whether the image in each block satisfies the two conditions described above. Thereafter, the image will be judged to belong to the specified class of images if the ratio between the area occupied by the blocks satisfying both the first and second conditions as described above and the area of the entire image exceed predefined values.

The system architecture of the video inspection device using the video inspection method described above is shown in FIG. 2. In this figure, reference numeral (1) indicates an analog / digital (A / D) converter for analog to digital conversion. Frame buffer (2) temporarily stores one frame of image data. A contrast detector (3) analyzes the image data to determine whether or not its contrast is within an allowable tolerance range. A frequency analyzer (4) analyzes the frequency within each block according to the image data stored in frame buffer (2) if the result from contrast detector (3) is out of range. A peak seeker (5) determines whether or not the peak indicated by the frequency analysis results of each block falls within into a predefined frequency band, characterizing the class of image patterns to be detected. Based on the results of each block obtained from the peak seeker (5), a decision circuit (6) sums areas (or the number) of blocks containing an acute peak to compute the ratio between the summed area and the screen size. If this ratio is out of range, the image represented by the image data in the frame buffer (2) is determined to belong to the class images to be detected. The result output circuit (7) outputs the result from the decision circuit (6). The frame delay (8) delays the input video signal so as to synchronize it with the image processing system which consists of circuits from (1) through (6). Reference numeral 9 indicates a substitute pattern for replacement. Nonvolatile memory such as read-only memory (ROM) may be used for the substitute pattern generator (9). A switch (10) outputs image signals of the image pattern generated by the substitute pattern generator (9), instead of outputting video signals derived from the frame delay (8), i.e., the image to be inspected, in the case which the decision circuit (6) detects one of the patterns exemplified in FIGS. 1A-1D, in order to replace patterns such as are shown in FIGS. 1A-1D contained in the video signal with a replacement image pattern. When the signal from the decision circuit (6) indicating the presence of one of the sought class of patterns is not generated, video signals from the frame delay (8) will be output. Thus, these potentially harmful image patterns are automatically checked without human attendance, allowing faster and quicker inspection than the prior art by human inspections and no deviation of inspection accuracy due to personal error of variation. It should be noted that the system as mentioned above may be alternatively embodied by using, for example, an image processor or a personal computer.

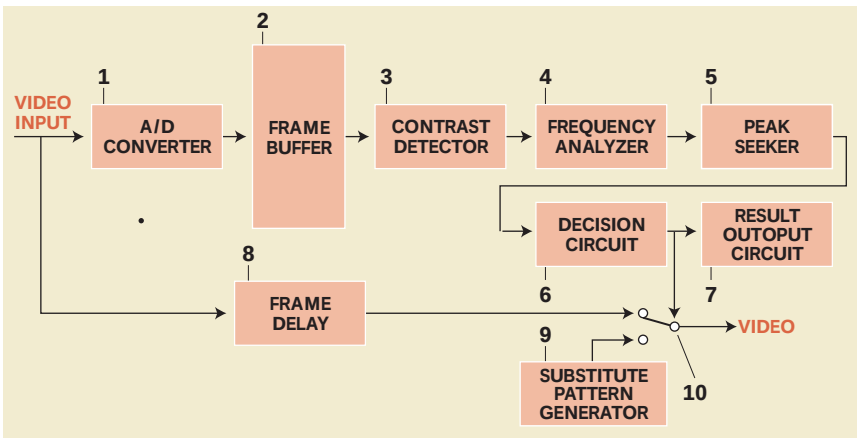

Figure2