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**VERIFICATION METHOD FOR  
DETERMINING AREAS WITHIN AN IMAGE  
CORRESPONDING TO MONETARY  
BANKNOTES**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to image processing, and more particularly, to a verification method for determining areas within an image corresponding to monetary banknotes.

2. Description of the Prior Art

Improvements in image duplication systems, which can include digital color copiers, scanners, and small scale printing apparatuses, has also lead to an increase in the illegal reproduction of various items. Counterfeiters nowadays attempt the reproduction of monetary banknotes, currencies, stocks, bonds, and other items for personal gain and profit. The task of discerning between legitimate items and copies becomes increasingly more difficult as printing and reproduction improvements allow copiers to reproduce banknotes that are virtually identical to legitimate ones. Therefore, there is a need to be able to effectively and precisely discern and distinguish counterfeited banknotes from authentic ones.

Banknote detection systems today typically incorporate a scanner or scanning mechanism of sorts. This converts information from a sample banknote into a digital data format representation for image processing. Once converted into digital data, a series of tests and procedures can be performed in order to confirm the validity of the sample banknote. This may include the identification of key features, such as landmarks, holograms, colors, serial numbers and pigments.

An important aspect of counterfeit currency detection prior to identification of key features involves the verification of areas corresponding to the monetary banknote within the scanned image. Often times, the size of the image is greater than that of the banknote. The actual location of banknotes within the image is thus required so that relevant counterfeiting tests can be performed on the confirmed areas, and not on the background image. Additionally, knowing the areas corresponding to the banknote will allow determination of a coordinate system for referencing in further tests.

If the banknote is scanned while imposed on a complicated background, the difficulty associated with distinguishing the actual banknote location increases. Background noise and patterns may further complicate the detection process. This may introduce irregularities, and invalid background objects can be misinterpreted as a banknote location. Variations in the shift, rotation and alignment of banknotes within the image may also complicate identification processes as a set frame of reference cannot be initially implemented.

Without the proper verification of banknote locations within a scanned image, being separated from the background image, optimal conditions for accurate counterfeit currency detection cannot be met.

SUMMARY OF THE INVENTION

One objective of the claimed invention is therefore to provide a verification method for determining areas within an image corresponding to monetary banknotes, to solve the above-mentioned problem.

According to an exemplary embodiment of the claimed invention, a verification method for determining areas within an image corresponding to monetary banknotes is disclosed. The method comprises: dividing the image into a plurality of image sections; generating a banknote boundary map having

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border sections selected from the image sections, the border sections corresponding to a boundary of monetary banknotes within the image; generating a texture decision map having texture sections selected from the image sections, the texture sections having a texture value within a valid range according to a valid monetary banknote; determining a number of objects in the texture decision map by removing texture sections in the texture decision map that correspond to the border sections in the banknote boundary map; calculating a texture property value for each object according to a texture feature map having a texture feature value for each image section; calculating a shape property value for each object; and further removing texture sections from the texture decision map corresponding to objects that do not have the texture property value within a first predetermined range and the shape property value within a second predetermined range.

These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an overview of the verification method for determining areas within an image corresponding to monetary banknotes according to an exemplary embodiment of the present invention.

FIG. 2 illustrates an exemplary embodiment of a scanned image divided into a plurality of image sections according to the method of FIG. 1.

FIG. 3 illustrates the plurality of image sections in an overlapping manner according to another exemplary embodiment of the method of FIG. 1.

FIG. 4 illustrates creation of a banknote boundary map according to the method of FIG. 1.

FIG. 5 illustrates generation of a texture decision map according to the method of FIG. 1.

FIG. 6 illustrates the object determination step according to the method of FIG. 1.

FIG. 7 additionally illustrates the object determination step according to the method of FIG. 1.

FIG. 8 illustrates an example of object removal according to an

embodiment of the present invention.

FIG. 9 illustrates a process flow chart of the verification method for determining areas within an image corresponding to monetary banknotes according to an embodiment of the present invention.

FIG. 10 illustrates a complete step-by-step for the verification method for determining areas within an image corresponding to monetary banknotes according to an embodiment of the present invention.

FIG. 11 illustrates an additional step-by-step for the verification method for determining areas within an image corresponding to monetary banknotes according to an embodiment of the present invention.

DETAILED DESCRIPTION

The present invention described herein provides a verification method for determining areas within an image corresponding to monetary banknotes. The image is provided from a hardware scanner or similar device, where the image contains a sample monetary banknote of a particular currency type. Characteristics derived from the sample monetary banknote is compared with that of known values and/or ranges of