[0094] As the right hand image of FIG. **13** shows, although the general area corresponding to the monetary banknote is identified, a considerable amount of noise and background irregularities have been identified as well. Also, there may be holes in bill region and background noise around the bill. Therefore, additional embodiments may include further refinements to the binary color decision map.

[0095] In order to further "clean up" the background effects and noise that may be associated with the color binary decision map, a further level of color post processing **1400** can additionally be applied. This step is illustrated in FIG. **14**. As shown in FIG. **14**, color post processing **1400** comprises object separation **1402**, noise removal **1404**, and hole filling **1406**. Different permutations or order of utilization of these steps may additionally be used throughout different embodiments of the present invention, as long as they do not alter the goals or teachings of the present invention.

[0096] All three of these sub steps will be further clarified below.

[0097] Object Separation **1402**

[0098] The first described step of color post processing **1400** involves object separation **1402**. This is performed in order to condition the color process map. Objects are separated using a flood filling algorithm. Although there are many different flood-fill algorithms, one preferred embodiment uses a basic 8-neighbor flood-fill algorithm with 3 iterations. However other embodiments may use other algorithms, bearing that the goals and teachings of the present invention are maintained.

[0099] An object separation algorithm is first used to label each isolated object in the color binary decision map. This is illustrated with reference to FIG. **15**, showing various stages of the object separation algorithm. Initially, the background is labeled with a first label value **1510**, as shown in **15** (*a*). An image scan is then performed, in both vertical and horizontal directions. If a block is met (probable area) during the image scan, it is labeled with a second label value **1520**. As shown in **15** (*a*), two objects are encountered in this step, both being labeled with the second label value **1520**. Image scanning then continues, however this time, when each object with a second label value **1520** is encountered, it is flood filled and then labeled with a new label value. As shown in **15** (*b*), the top object having a second label value has been encountered, and re-labeled with a third label value **1530**. Each encountered object having a second label value is thus flood filled and re-labeled with an incrementing label value (fourth, fifth . . . etc . . .) until there are no more remaining objects with the second label value **1520**. In FIG. **15** (*c*), the bottom object with the second label value has been encountered, and thus re-labeled with the fourth label value **1540**. When completed, each different object, along with the background, is labeled with a different label value. As illustrated in FIG. **15**, there are two identified objects (third label value **1530**, fourth label value **1540**) along with the background (first label value **1510**).

[0100] Noise Removal **1404**

[0101] Noise removal **1404** is used to remove noises according to the region area criterion. This step is then performed to reduce background noises surrounding probable areas. As noise removal algorithms are commonly known by those within the art, further discussion will be omitted for brevity.

[0102] Hole Filling **1406**

[0103] Hole filling **1406** can then be performed following noise removal **1404**. A hole-filling algorithm is applied to improve the color binary decision map by ensuring enclosed objects are uniform in value. The hole-filling algorithm is used in conjunction with the flood-filling algorithm, such as that described in object separation **1402**. Hole filling **1406** is illustrated in FIG. **16**. From the binary decision map, probable areas and non-probable areas (background or hole objects) are labeled as a first hole label and a second hole label (identified by gray and black colors) respectively, as shown in FIG. **16**(*a*). Then, the hole labels of probable areas and non-probable areas are flipped (ie, black becomes gray, and gray becomes black) as in FIG. **16**(*b*). The background is then labeled with a third hole label using a flood fill algorithm (indicated by the white color in FIG. **16**(*c*)). The first hole labels, now corresponding to the holes within the probable areas, are then changed to the second hole labels, as shown in FIG. **16**(*d*) to match the probable areas. In this way, the holes are filled. Finally, the second hole labels are changed back to the first hole labels (black to gray) to identify probable areas, and the third hole labels are changed to the second hole labels (white to black) as illustrated in FIG. **16**(*e*).

[0104] Therefore, a combination of both flood filling and hole filling is used in order to further refine the color binary decision map and to accurately identify and separate objects, which may correspond to the monetary banknotes.

[0105] FIG. **17** illustrates various stages of color processing during generation of the color binary decision map. The original image in **17** (*a*) includes the monetary banknote to be detected, imposed onto a background image. Upon initially generating the color binary decision map (according to FIG. **11**), the probable sections corresponding to the monetary banknote is roughly identified in **17** (*b*). However there appears to be excess noise from the background image, as well as holes within certain areas of the banknote. Color post processing **1400** can then applied to further clarify the color binary decision map, including object separation **1402** in **17**(*c*), and hole filling **1406** in **17**(*d*). The result produces a more refined color binary decision map to clearly define probable sections corresponding to the monetary banknote.

[0106] Texture Decision Map Generation **130**

[0107] Texture decision map generation **130** of FIG. **1** produces a binary texture decision map based on the scanned image divided into feature sections. Texture values for each feature section of the scanned image are first determined, then compared to texture values of a valid monetary banknote. Texture sections are then selected from the feature sections if they have texture values within a valid range of a valid monetary banknote.

[0108] FIG. **18** illustrates an exemplary diagram of the texture decision map **1820** generated from a scanned image **1810**. Upon performing the general process described above, texture sections **1830** are identified accordingly from the image sections of the scanned image **1810**. As described above, the texture sections are feature sections having texture values with a valid range according to the valid monetary banknote.

[0109] The texture values utilized in discerning the texture sections **1830** can vary according to a number of embodiments. One embodiment may involve utilizing gray levels as the texture value, and comparing gray levels of feature sections to gray levels of a valid monetary banknote to