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Comparison Between Original and Counterfeit Currency Images

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Abstract: Study of counterfeiting needs to know the methods using in the counterfeiting. Here we are working to compare between original and counterfeit currency and find difference between them, the study takes the Iraqi currency as an example or element to make testing. with applications on many parameters in Iraqi currency design such as type of paper and ink using in printing and the saturation degree of the color in each one of them.

It's very important to remember the penalty in Iraqi law against the counterfeiting and explain that penalties to show the effects on the persons whom working in this field.

The study needs to know the specifications and categories of Iraqi currency for each original and counterfeit to make comparison clear.The investigation system depend on image segmentation; the best way to discovering counterfeit currency is know the value of color to represent a counterfeit of a currency.

Introduction:

Counterfeiting is an imitation of something original and its purpose is to deceive people and to make counterfeit goods for the original goods in order to obtain quick gain effortlessly. Fake goods include fake money, jewelry, watches and medicines perhaps; The counterfeiting of money is the most difficult work at all because of the complexities of money paper from the both sides: the type of the paper used and difficult marks which include the different currencies and even the way of serial numbers version on all paper currencies, where all paper currencies contain unique serial number that can be obtained from some complex calculation operations.

But recently crimes of fraud spread in many countries of the world , due to technological advances in printing operations and also because many people dream to achieve quick and easy gain to lift them out of poverty as well as economic conditions that made them unable to secure a living , the most serious types of fraud :Counterfeiting of coins and paper currencies, which is one of the biggest problems facing the economies of the countries because of its adverse effects on the economy and development [1].

This Crime has negative effects on individuals and communities, and the multiple negative effects of this crime are political, social economic destruction and instilling hatred among individuals. Therefore, the study must have enough knowledge for stopping them by detecting manual faked currency where that knowledge comes from the informing, and by devices that can detect the fake currency by high accuracy [2].

Iraqi legislature addressed fraud in Chapter III of Part V from the Iraqi Penal Code in force No. (111) in 1969 in the part deals with the crimes against the public trust. The paragraphs (280,281,286) of the Iraqi Penal Code included the counterfeit details.

Methods of counterfeiting are now easier with modern technology and evolving with the time. Lately, the fakers use manual and electrical compressors instead of casting which might contain many defects. Some of these methods:

Firstly: Counterfeiting by manual drawing : It is an attempt to mimic the patterns and graphics and decorations on the correct paper where the faker used his ability in drawing. Fakers often used water colors, waxy, oily or colored pens focusing on tradition main colors without attention to the finer decorations. This

method is very difficult if the banknotes to be rigged with large amounts, one of the characteristic of this method are that it can detect counterfeit currency because the paper used is very different from that used in the original currency in the paper thickness and feel of hand.

Secondly: counterfeiting by printing: This method is more widespread and dangerous than the previous method because of its ability to produce large quantities of counterfeit banknotes nicely. In addition the printing is the most trusted way by people.

Thirdly: counterfeiting by color photocopiers : Recently forgery spreads in this way, the seriousness of this way is apparent when the printing is with very high level, where it does not require expertise in fraud and counterfeits large amounts of currency in no time.

Fourthly: printing via computer: Using a laser printer is one of the most serious types of fraud because of its high quality in counterfeiting. It uses snob scanner and filming a fiat currency, and then inserting this picture to a computer, use the color processing program for counterfeit currency and finally printed on any type of printer.

PAPER CURRENCY

The currency is the trade exchange unit. Currency differs from one state to another. It must be a currency that can be divided into parts, not easily damaged. Currency values varied .The U.S. dollar is considered the most popular in the world now. It grades first in the most foreign currency reserves in the countries of the world.

Iraqi dinar is the official currency of Iraq and it is issued by the Central Bank of Iraq. After the U.S. invasion of Iraq, and the fall of Baghdad on April 9, 2003, the Coalition Provisional Authority issued Iraqi dinars from October 15, 2003 to January 15, 2004.

The categories of the Iraqi currency ranged from 50, 250, 5000, 10,000 to 25,000 dinars. The designing of these categories are similar to the designs issued by the Central Bank of Iraq in the seventies and early eighties [1].It has characterized each category of currency with certain specifications and can clarify the specifications of each category, as the table (1.1):

Government in Iraq depends on the local and international sources to print its national currency. The world famous centers in printing currencies are Switzerland. The government has printed currency locally, but the remaining money printed locally is fraud [3].

Table (1.1) Specifications categories of the Iraqi currency

Values of Category	Basic color	Face	Back
Fifty dinars	Violet	Granary in Basra	Palms
Two hundred and fifty dinars	Light Blue	Astrolabe	Moulouya Samarra
Five hundred dinars	Blue and green	Dokan dam	Winged Ox
Thousand dinars	Brown	previous gold dinar	Previously Mustansiriya school
Five thousand dinars	Blue and Purple	Waterfall Galy Ali Begk in northern Iraq	Ukhaydir Fort
Ten thousand dinars	Green	Ibn al-Haytham	Lighthouse Hadba in Mosul
Twenty five thousand dinars	Red	Kurdish farming carrying ears of wheat	King Hammurabi

The Method

This research includes creation some programs that make comparison between original and counterfeit currency by using some function provided by MATLAB environment rely on image processing. The study will see all these steps in flowchart below.

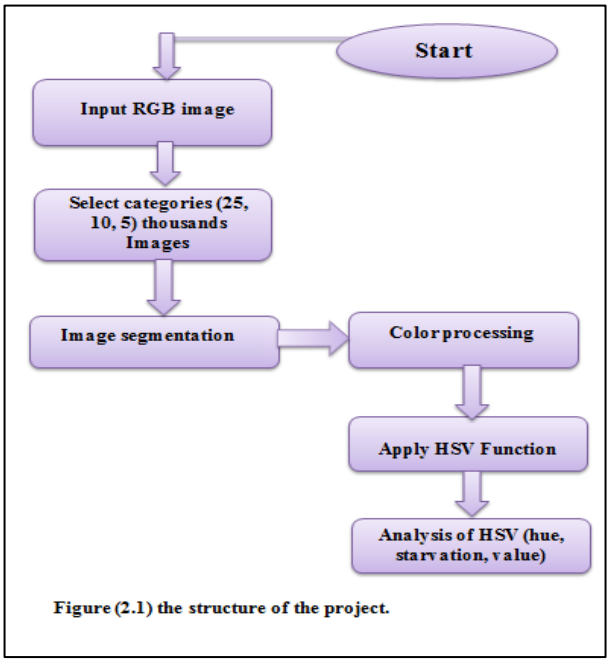
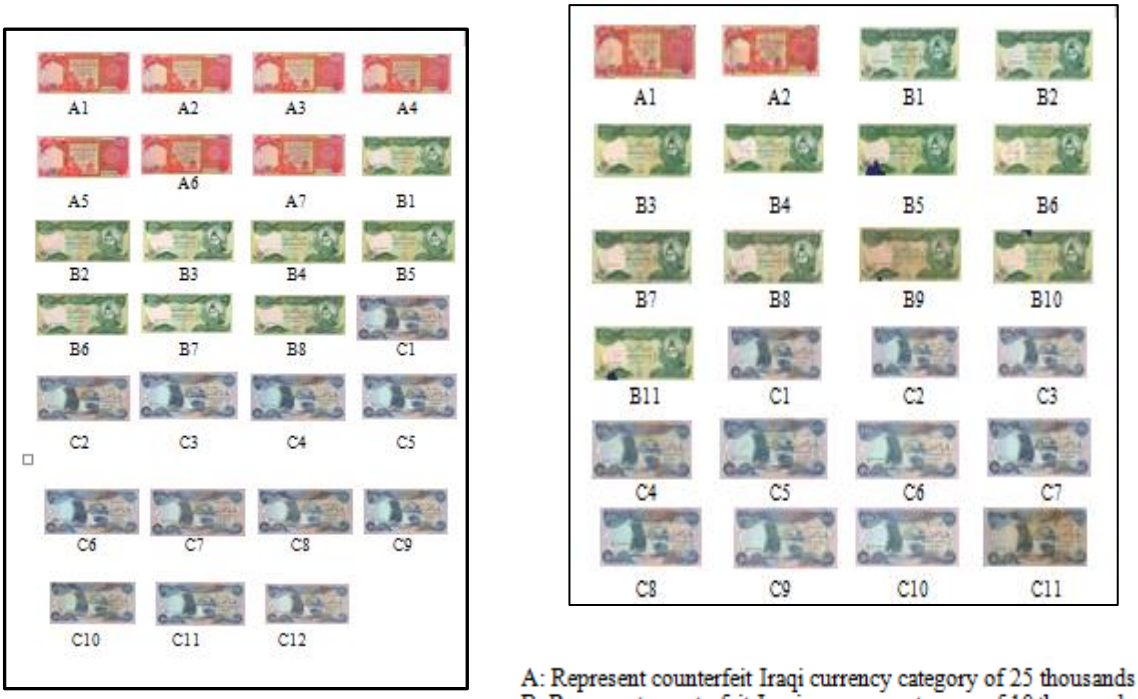


Figure (2.1) the structure of the project.

3.1 The Input images

All images that we used are Iraqi currency (5 Thousands, 10 Thousands, 25 Thousands), but we will focus on (10 Thousands) because it is more counterfeiting.



A: Represent counterfeit Iraqi currency category of 25 thousands
B: Represent counterfeit Iraqi currency category of 10 thousands.
C: Represent counterfeit Iraqi currency category of 5 thousands.

Figure (2.2) represents (a) the original money basic on versions,(b) the counterfeit money basic on categories.

Image segmentation

"image segmentation" refers to a technique used in computer vision for dividing a digital picture into smaller, more manageable pieces. To make an image's representation more intelligible and easier to analyse, segmentation simplifies and/or changes it. The primary purpose of image segmentation is to identify and localise objects and their boundaries within images. Assigning a label to each pixel in an image so that labelled pixels share specific visual properties is the

exact definition of image segmentation.

After an image is segmented, the entire image is covered by a collection of segments or the image's contours are retrieved (for more on this, see edge detection). There are some computed attributes, like colour, intensity, or texture, that all pixels in a particular area have in common. Regarding the same attribute or attributes, neighbouring areas are drastically different [1].

3.3 Color processing

One aspect of colour processing is learning about the physical characteristics of light that cause it to have different hues.

2. The anatomy of the eye and how it perceives colour.

3. The brain's role in vision and how visual signals are translated into colour perception.

Of the electromagnetic spectrum, visible light is a component. In 1931, the Commission International d'Eclairage (CIE), which is in charge of colour standards, established the values for the wavelengths of blue, green, and red. [4]

3.3.1 Color models

A color model is a method for specifying colors in some standard way.

I. RGB

The red, green, and blue light components of the RGB colour model can be combined in different ways to create a wide range of colours. Although the RGB colour model has been used in traditional photography, its primary application is in electronic image detection, representation, and display systems like computers and televisions.

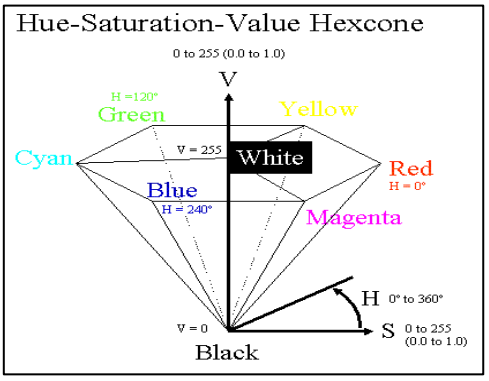
II. HSV

The HSV model depicts Colours in Figure (2.7) according to hue, saturation, and value (brightness). The following are the definitions of these terms:

1. Hue is synonymous with hue, as defined in the Colour Basics section. Using colour has many benefits, including readily apparent tone relationships on the colour wheel. You may effortlessly create a wide range of tones, shades, and tints without changing the hue.

2. The idea of tint in the Colour Basics section is intimately related to saturation; nevertheless, full saturation results in no tint and zero saturation yields white, a shade of grey, or black.

Third, the idea of intensity in Colour Basics directly relates to value.



4. Execution of the programs

This project consists of many interfaces, and within these interfaces many tools are being used that provided by MATLAB (GUIDE) environment.

Figure (3.3) Selection interface

If we start with the figure (3.3) and see the panel on right (image segmentation) it has two buttons (crop1, crop2) each one represents the cropping segment in the selected image, let us see the buttons effect (crop1, crop2), see figure (3.3.1) Observes the button (Hue Starvation Value) that show us the analyze of (H S V)

factors, see figure (3.3.2)shows the analyses of factors
H S V.

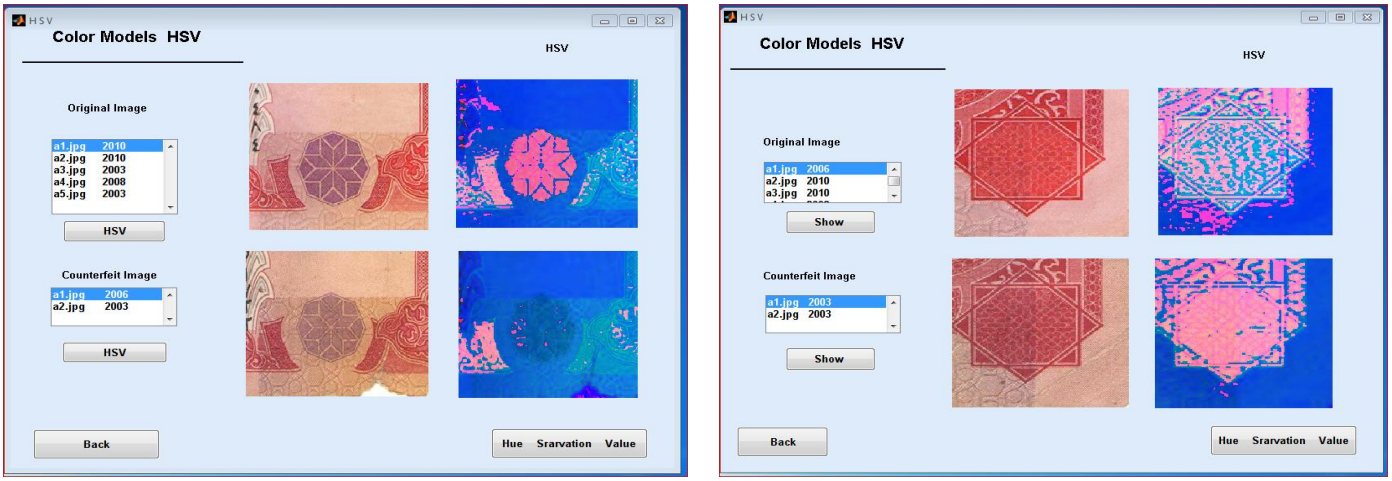


Figure (3.3.1) H S V interface.

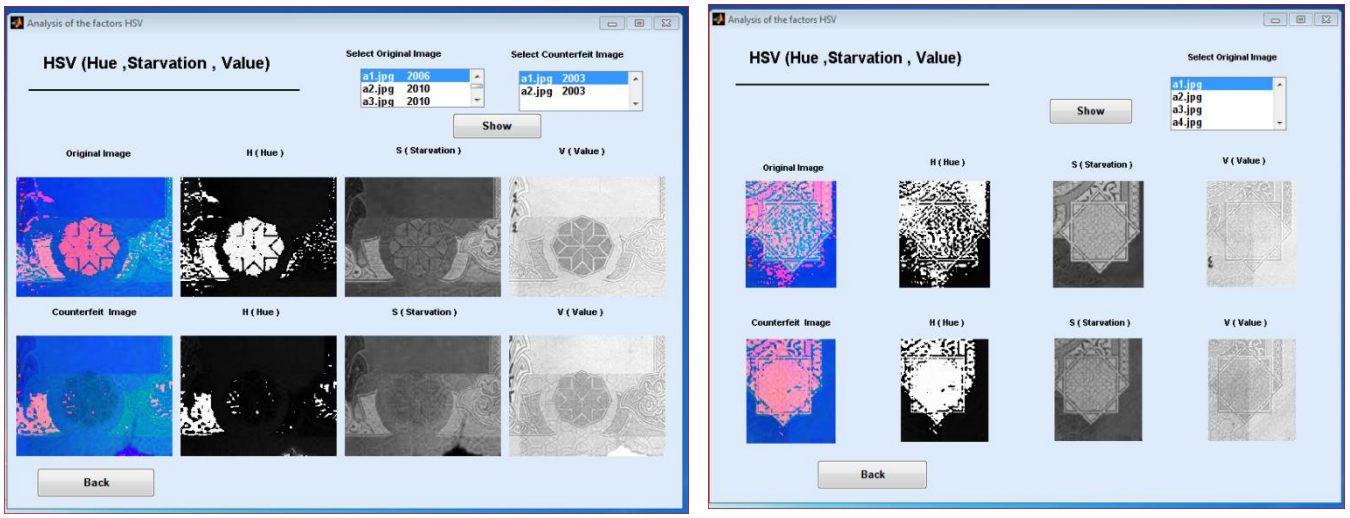


Figure (3.3.2) Analysis of the factors H S V.

All the previous four interfaces have (list box) tool enable us to choose different version currency images to see the difference between original and counterfeit currency. The same thing we see it in figure (3.3.2) when clicked button (crop1), see figure (3.3.2.1).

Note the button (Hue Starvation Value) which show us the analyze of (H S V) factors, see figure (3.3.4) to show the analyses of factors HSV.

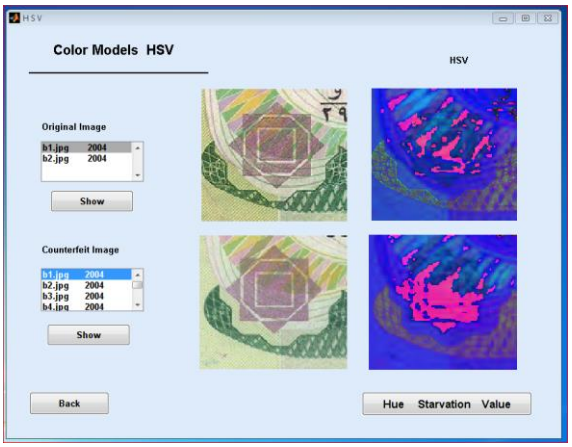


Figure (3.3.3) H S V interface.

When we return to figure (3.3) and clicked the button (crop2) we see the H S V function effect but the difference that see the button (Enlarge Images), see figure (3.3.5) and figure(3.3.6).

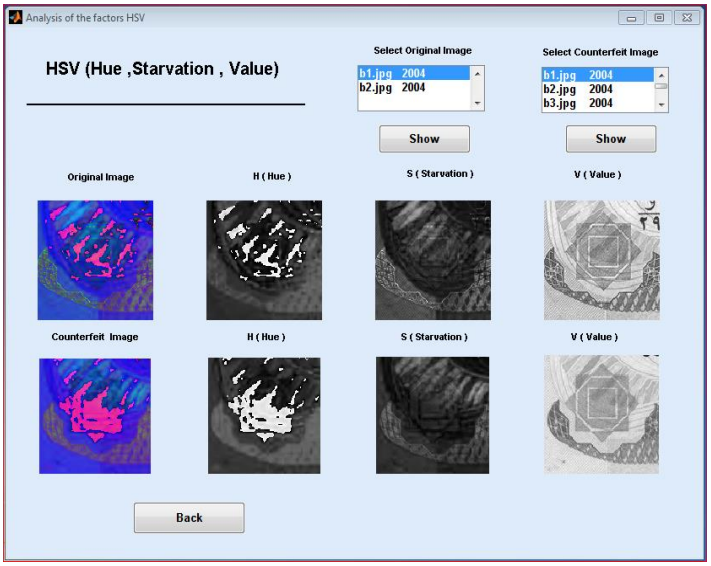


Figure (3.3.4) Analysis of the factors H S V.

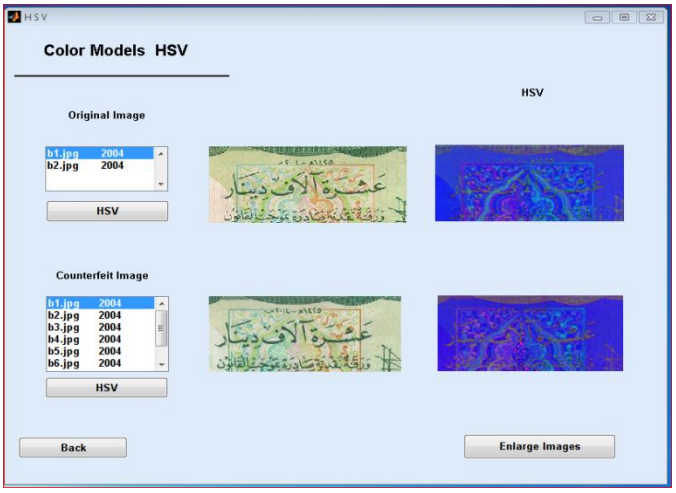


Figure (3.3.5) H S Vinterface

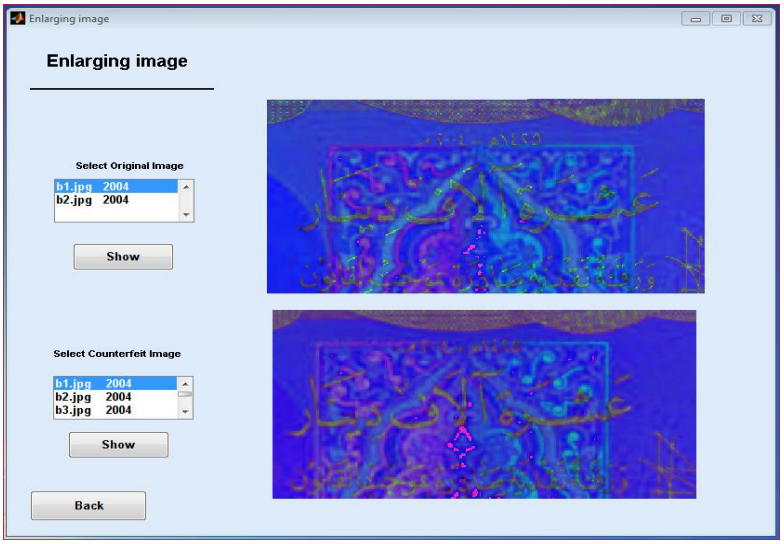


Figure (3.3.6) Enlarging image

This figure shows us the difference between the original and counterfeit image in the font color in the text. In figure (3.3.3) the same thing in buttons and button effective, see figures (3.3.7), (3.3.8), (3.3.9), and (3.3.10).

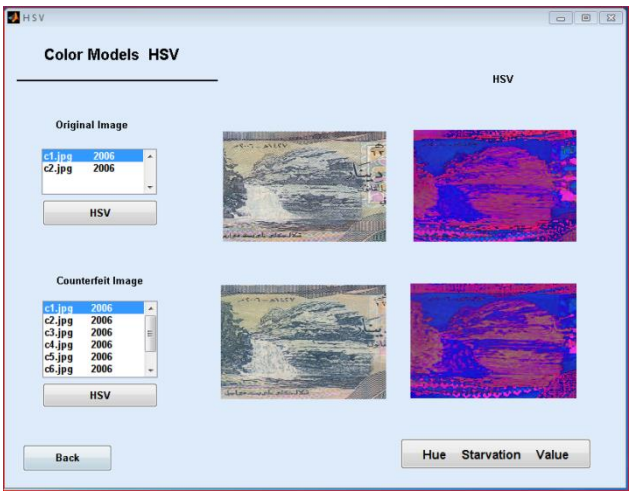


Figure (3.3.7) H S V interface

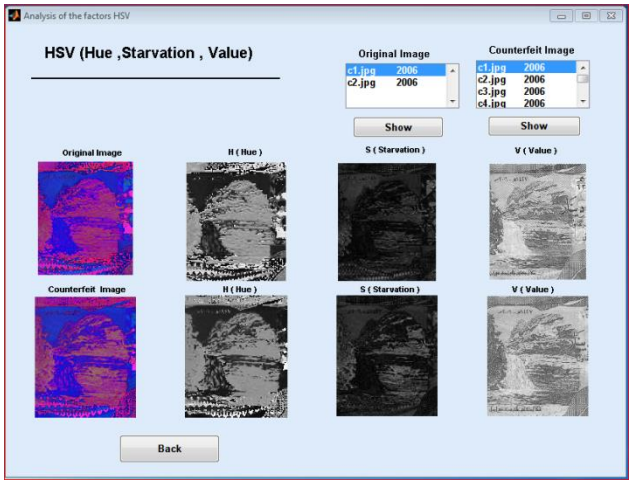


Figure (3.3.8) Analysis of the factors H S V

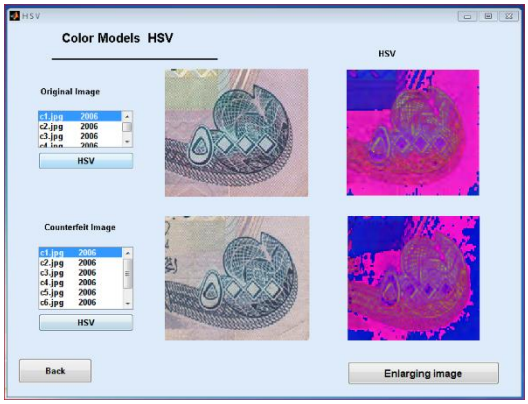


Figure (3.3.9) H S V interface

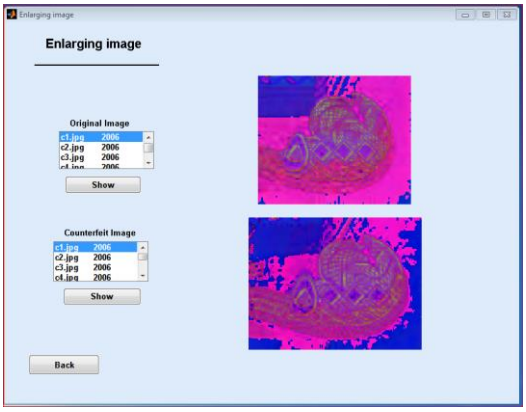


Figure (3.3.10) Enlarging image

CONCLUSION

The algorithm was implemented in MATLAB on27original currency images and 24 counterfeit currency images and make the comparison between them according the version ,comparison implemented by using two factor (color processing and histogram),the more clear results are appear in category(10 Thousands) because it has many of objects, where the least clearness currency is (5 Thousand),and we used another factors such as compression rate and another color space such as (YCBCR and YIQ) but all these factors did not appear clear difference between original and counterfeit currency images.

Future Works

One of the problems faced during the implementation of the algorithm is that the original currencies may be different in most cases; the difference may be in color or dimensions. Another problem is the type of scanner that we used to insert images to the computer, in order to correct these types of problems, we must use constant type of scanner, and make the images have fixed dominations by edit length and width at possible. In future, the best factor must be used is the study of image texture which shows clearly differences and may be avoid us all above problems.

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