

## Traffic signs recognition using cuckoo search algorithm and Curvelet transform with image processing methods

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### Abstract:

Compliance with traffic signs is one of the most important things to follow to avoid traffic accidents as well as compliance with traffic rules in terms of parking, speed control, and other traffic signs. Progress in different areas, such as self-propelled car manufacturing or the production of devices that help the visually impaired, require values to find a way to determine traffic signals with high precision in this research, The first step is to take a picture of the traffic sign and apply some digital image processing techniques to increase image contrast and eliminate noise in the image, the second step resize of origin image , the third step convert color to(YCbCr, HSB) or stay on RGB, the fourth step image is disassembled using curvelet transform and get coefficients , and the last step using cuckoo search algorithm to recognition signs traffics , the MATLAB (2011b) program was used to implement the proposed algorithm . After applying this method to a set of traffic the percentage of discrimination of traffic signs was yellow 93%, green 94%, blue 94.5%, red 96%.

**Keywords:** :Image processing , Curvelet transform, Cuckoo search algorithm ,Traffic signs.

## 1.Introduction.

Traffic sign is a board in which the driver of the vehicle or the people passing by it must comply with the conditions that must be complied with when using the road such as determining the speed of the vehicle or lack of parking of the car or the passage of bicycles and other signs, each of which is highly important[2][6][13].a high percentage of traffic accidents up to 90% due to lack of interest in traffic signals such as failure to comply with the speed prescribed[5][14]. the process of distinguishing the traffic mark has become of paramount importance, especially with the start of thinking about the production of cars self-movement, where the field began to

take a great place in research, especially in the late nineties of the last century [11].in this paper Provide a way to distinguish the traffic signs by using coefficients transform, principle component analysis and cuckoo search algorithm and applied the suggest algorithm on 600 traffic signs with different type and color. the section of the research into a group of paragraphs in each paragraph was explained part of the research, section one explained a general idea about traffic signs and the idea of driving self-movement, section two explained a set of previous working papers presented by a group of researchers in the same field of research section three explained a set of traffic signs , section four explained cuckoo search algorithm , section five presented suggest algorithm , section six shown the result and analysis of result and the last section presented conclusions.

## 2. Related work

In (2016) a group of researchers presented a proposed method to distinguish the traffic signs of Iraq country, has been using discreet wavelet transform and Cuckoo search algorithm , the algorithm was applied to red and blue traffic signs [11].

Many researchers have proposed ways to distinguish India's traffic signs. In 2017, a group

of researchers presented a way to distinguish traffic signs based on neural networks. [3] .

Others went on to present a way in which real-time traffic signs By putting a camera that captures video in front of the car and then detecting and distinguishing the mark has been used BRISK descriptor to extract invariant features to traffic sign detection [10].

Pritika Priy and a group of researchers went on to distinguish traffic signs through three phases first : detects, classifies and the last step recognizes the traffic sign and using HSV color space After the system has marked the traffic signs, the vehicle driver is alerted by a voice called traffic signs[12].

A group of researchers have introduced methods to distinguish traffic signs in Indonesia, where a research in (2018) based on the system conversion color from RGB to NRGB and then extract the characteristics and then apply SVM classifier[4]

In the study presented in this paper, it relied on curvelet transform in the extraction of basic characteristics, which was not addressed in the previous study also relied on the genetic algorithm (cuckoo search algorithm)

## 3.Traffic Signs

There are many traffic signs, each of which has a specific indication, such as warning signs such as the existence of a ditch or a high slope, including a guide indicating traffic priorities, etc. Figure 1 shows a set of traffic signs [1][11].

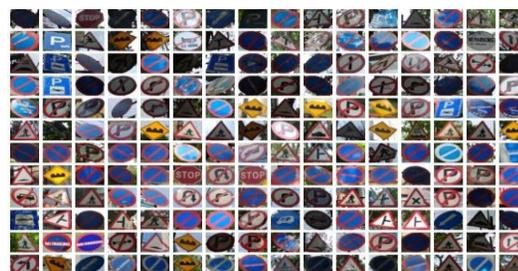


Figure 1: Traffic signs

#### 4. Curvelet Transform

In 1999 presented curvelet transform by Donoho and Candes , These transform give a multi-resolution analysis , Through this analysis he can overcome the drawback of wavelet transform .[8]the edges represent more accurate images than other transforms , there are many advantages for curve let transform on wavelet transform, the representation of the edges in the image is better than wavelet , figure (2) shown different to represent curve by using curvelet transform and wavelet transform [7][9].

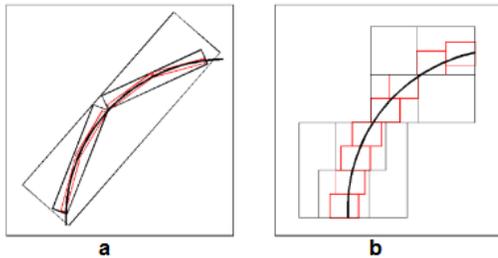


Figure 2(a): t curve by CT (b) curve by WT

#### 5. cuckoo search algorithm

This algorithm was provided y Deb and Yang in 2009 , an algorithm that simulates the behavior of the cuckoo bird in its search for eggs[16], this algorithm has several advantages , the most important of which are a few parameter , easy and speed in implementation [11][15]. Figure (3) shown flowchart of cuckoo search algorithm

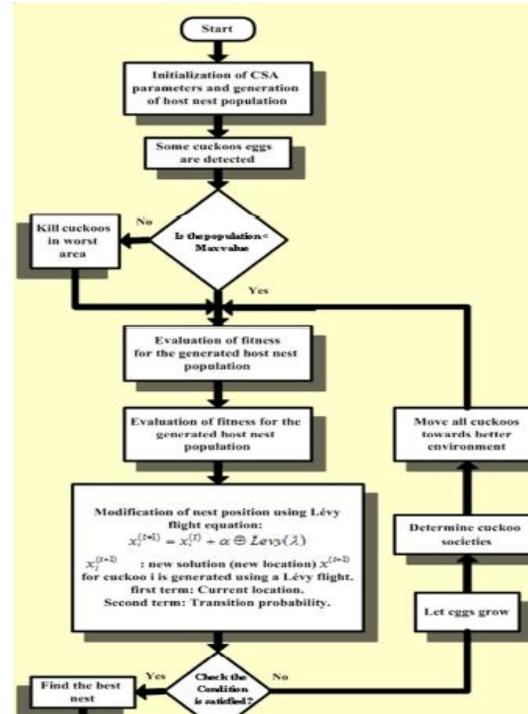


Figure 3: flow chart of cuckoo search

#### 6. Implement suggest algorithm

In this paragraph we will discuss the suggest algorithm steps , figure (4) shoe flow chart of suggest algorithm:

**Create dataset:** create dataset of traffic sings image in Syria and Istanbul.

**Read image :** take a picture of the traffic signs ,take picture at different angles and different

**Preprocessing:** in this step the image noises removed used Gaussian filter.

**Select color space :**in this step can select on e color space ( RGB ,HSB ,YCbCr)

**select size of image:** resize of image to (200\*200 , 400\*400,600\*600)

**Detected and segment:** detect the traffic signs after being segment traffic signs from the origin image .using color segmentation methods

**Curve let transform :** traffic signs image decomposition by CT to obtain on coefficient .

**Cuckoo search algorithm:** applied CSA to recognition traffic signs

**Measure efficiency of algorithm:**

$$N . \text{ correct recognition} = CR/CD * 100\%$$

When

CR: number of correct traffic signs recognition

CD: number of traffic signs detection

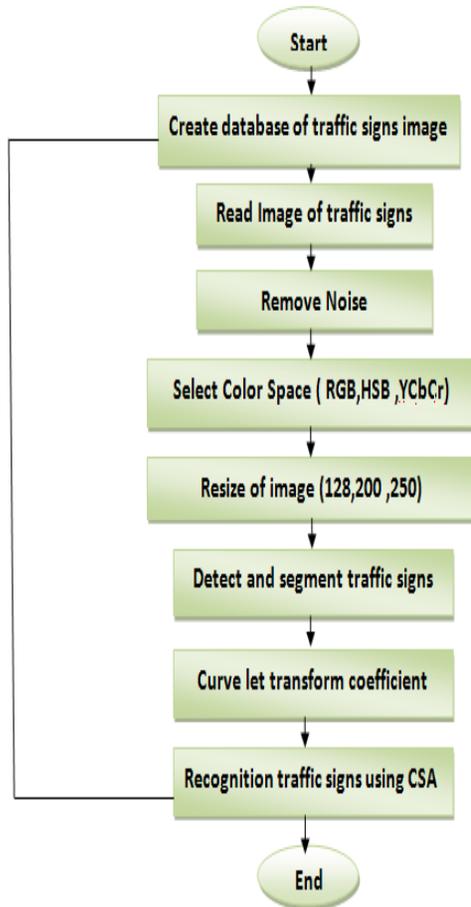


Figure 4: flow chart suggest algorithm

Figure (5,6,7,8) shown applying suggest algorithm on four color traffic sings

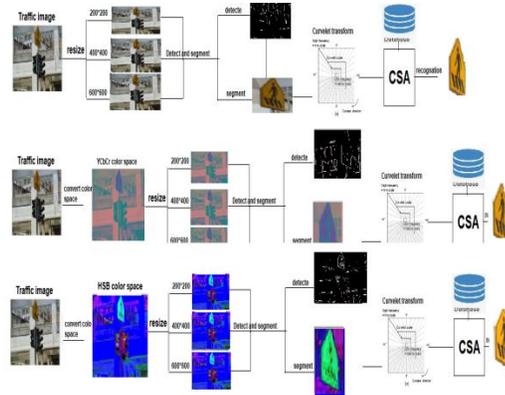


Figure 5: yellow traffic signs

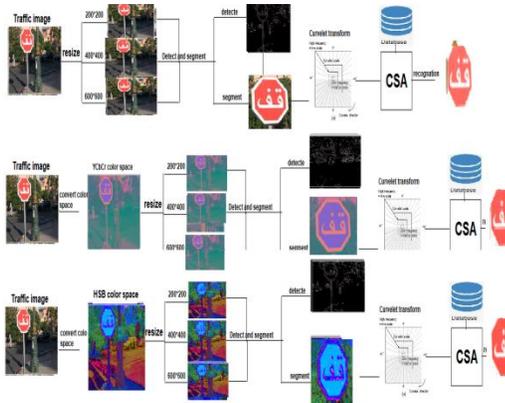


Figure 6: Red traffic signs

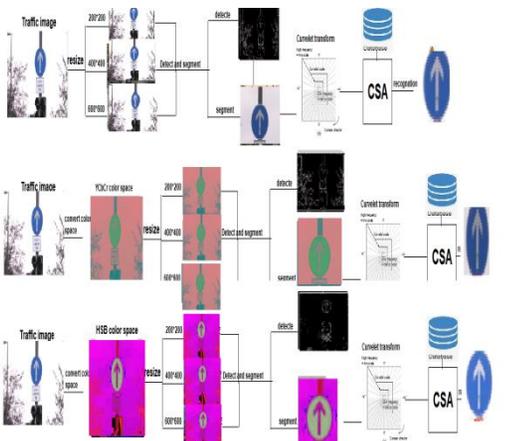


Figure 6: Blue traffic signs

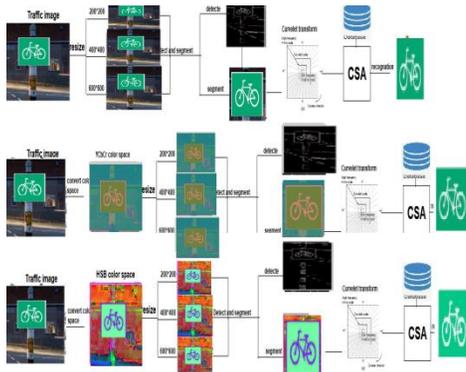


Figure 7: Green traffic signs

### 7.Result

After the applying of the proposed algorithm on the images of traffic signs of different colors, where the study of the four colors of traffic signs are red, yellow, green and blue and study the effect of the chromatic system on the efficiency of the algorithm where the impact was using three color systems: RGB , YcbCr and HSB , figure (8,9,10) shown the result of applying algorithm .

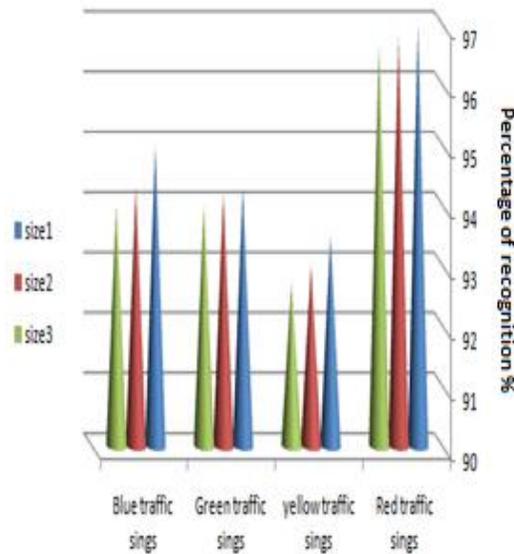


Figure 8:result on RGB color space

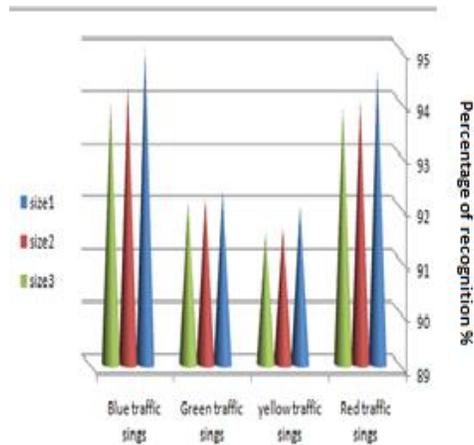


Figure 9:result on YCbCr color space

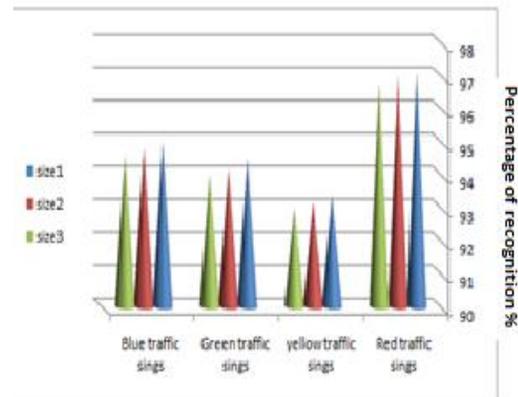
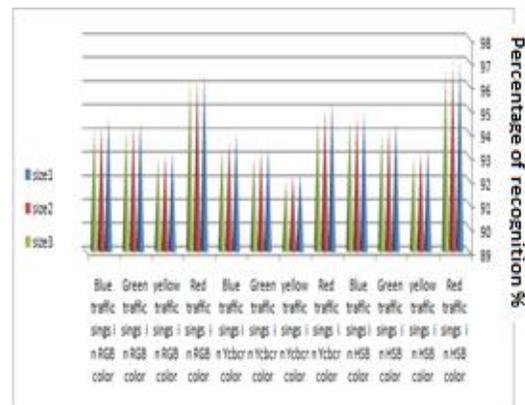


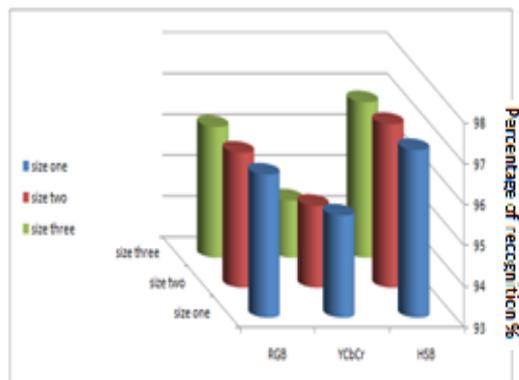
Figure 10:result on HSB color space

The size of the image has a small effect because the size of the characteristics that will be relied upon is very important. It is clear from Figure (8) that the smaller size image gives higher recognition .



**Figure 11: effect size of image on suggest algorithm**

The color systems used have given different results according to the method of color representation (Figure 12). The system (HSB) was the best in reaching the highest recognition

**Figure 12: effect size of image on suggest algorithm**

## 8. conclusion

very important to know traffic signs, each of which has a different meaning than the other. With the development of technology and the emergence of self-propelled vehicles, it is important to find a way to help these compounds to know these irrigated signs, In this research, a method was proposed to distinguish traffic signals based on curvelet transformations and cuckoo search algorithm Where the percentage of discrimination of traffic signs from one color to another different as the highest denominator to distinguish are for signs of traffic in red and then blue and then green and less is yellow where the proportion was about 96% of the red color, while the rest of the color was the proportion less .The proposed method was studied on different color systems where RGB, YCbCr, and HSB were used best results obtained when using the HSB color system.The efficiency of the algorithm was also measured in terms of image size. Figure (12) showed that the smaller the image used, the better the results were with a few differences with the results of the other sizes

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تمييز العلامات المرورية باستخدام خوارزمية بحث الوقواق و تحويلات الكيرفليت مع طرائق معالجة الصور

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#### المستخلص:

يعد الامتثال لإشارات المرور أحد أهم الأشياء التي يجب إتباعها لتجنب حوادث المرور بالإضافة إلى إتباع قواعد المرور من حيث وقوف السيارات والتحكم في السرعة المركبة وغيرها من العلامات المرورية الأخرى. إن التقدم في مجالات التكنولوجيا ، مثل صناعة السيارات ذاتية الدفع أو إنتاج الأجهزة التي تساعد المعاقين بصرياً ، قدم في هذا البحث طريقة لتمييز الإشارات المرورية بدقة عالية ، الخطوة الأولى هي التقاط صورة لعلامة المرور وتطبيق بعض تقنيات معالجة الصور الرقمية لزيادة تباين الصورة والقضاء على الضوضاء في الصورة ، والخطوة الثانية إعادة تحجيم الصورة ، الخطوة الثالثة تحويل اللون إلى (YcbCr) ، (HSB) أو البقاء على RGB ، يتم تفكيك صورة باستخدام تحويل curvelet والحصول على المعاملات ، والخطوة الأخيرة باستخدام خوارزمية بحث الوقواق يتم التعرف على علامة المرور. تم استخدام برنامج الماتلاب 2011b في تنفيذ الطريقة المقترحة بعد تطبيق هذه الطريقة على مجموعة من العلامات ، كانت النسبة المنوية للتمييز في إشارات المرور صفراء 93% ، والأخضر 94% ، والأزرق 94.5% ، والأحمر 96%.

الكلمات المفتاحية: معالجة الصور الرقمية ، خوارزمية بحث الوقواق ، العلامات المرورية ، تحويلات الكيرفليت .