Colour-Based Recognition For Shape Matching Game

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Abstract. Colour provides significant information for object recognition. Colour-based recognition is the use of colour model for creating a full range of colour from set of primary colour called colour space. The features or interest points are depend on the detector, be corners, blobs, T-junctions. In order to have the desirable transformation, some of the issue that taken account which are the lighting condition since the colour a staple feature. The method in image processing operations such as filtering and morphology method varied for the choice of colour space. In order to develop the colour-based recognition for shape matching game using OpenCV, several steps have been done are by studying the issues, the game development and the evaluation of the project. Based on the result, this project has developed the colour-based recognition for shape matching game using OpenCV.

Keywords: Object recognition, color recognition, morphological tansformation, interactive learning.

1   Introduction

Nowadays, children's learning process using computer-based had been a powerful resource in learning environment as it offer an effective venue for improving children understanding. Today technology offers a useful ways in progress of children's interactions in school and to combine fun with learning. Interactive learning using object recognition is essential for helping children to understand the letters and object shapes better by engaging with the computer vision technology. Children can gain knowledge and build a better visual perceptual process skill through interactive environments. Learning in interactive environments are very beneficial for children as they will be more inclined to be interested and active in the learning process. Children also will be given an opportunity to construct their own knowledge base develop multiple capabilities better. Interactive learning using object recognition can become an adaptive application which develops a fun experience when learning shapes (Louis *et al.*, 2010).

In computer vision, to represent the image into something that is more meaning full and easier to analyse the image segmentation process will simplify the or change the image by partitioning a digital image into multiple segments. Image segmentation is a crucial step before performing high-level task in object recognition but there is no single standard approach to segmentation by the existing image segmentation techniques classified by the approaches of the thresholding techniques, boundary-based techniques, region-based techniques, clustering techniques and hybrid techniques (Huang *et al.*, 2010).

The main objectives of this project To study the issues in colour-based recognition

using OpenCV, To develop a shape matching game with colour-based recognition using OpenCV, and evaluate the colour-based recognition in shape matching game. The project significance using this application is very useful for the recognition of coloured objects playing as it is important role in the image interpretation of computer vision. . Colour is one of the important features for computer vision systems in task to understand the visual data. In perspective of computer vision, the method of transformation play a really significant influence on performance The colour-based recognition for 2D game encourage as fun pressure-free way, which make it less intimidating which help the kids develop a better understanding that in order to succeed, they must meet the goal by the following objectives. Furthermore, this project is an interactive ways to play as it encourages the critical thinking to capture the children attention while practicing skills.

This paper is organized as follows: In Section 1, will present the introduction of this paper. Then, Section 2 explains some Literature Review. While in Section 3, we provide the project methodology that used in this project. Next, we discuss the implementation results in Section 4. In section 5, we present the discussion of the results that are obtained in our experiments and finally, Section 6 provides the conclusion of this research.

2   Literature Review

OpenCV are structured in several components which contains the basic image processing and higher-level computer vision algorithms. The other components the file reference includes many recognition technique which contains the defuct areas in embedded Hidden Markov Model for face recognition and experimental algorithms in background or foreground segmentation (Bradski *et al.*, 2008).

The use of colour model in colour recognition for creating a full range of colour from set of primary colour is called as colour space. The reason use of the colour space is to enhance the determination of colour in some standard. Colour captured in computer vision is basically based on Red, Blue and Green (RGB) colour space. The captured image or video are assigned in 8-bit, unsigned integer, RGB format in 3 matrices of RGB with the integer values range from 0 to 255. The HSV colour space is also made out of 3 matrices; Hue, Saturation and Value. The used of HSV colour space contribute to better embodiment of the image location in video segmentation (Qu *et al.*, 2013).

The often used group of object recognition methods are the local feature-based. They are built on the notion of by limit the set of data for processing and also provide invariance to different transformations. The local feature detection finds anchor points in the image of local region are defined by the differences in intensity or texture. These intensity or texture changes are found by running a kernel over the target image; a kernel is a region of pixel computations computing the amount of gradient change it the derivative within this region. These features or interest points can, depending on the detector, be corners, blobs, T-junctions, and these should be the ideal case identifiable after the image has transformed in different ways.

A contour is presented using coefficient vector of a fixed polynomial's order and give the inexact contour descriptor. Then, the "Band matching" is applied after the contour detection, which is another methodology involved. An ensemble of static width that

predicted the shape is placed on the contour image in order to distinguish the shape to provide more vulnerability towards localization and convoluted the calculation (Sahasni *et al.*, 2015).

3   Project Methodology

This section discussed about the project methodology which explain details about the concepts and gameplay, the prototype development, the integration and evaluation of this project. There are two section in the concepts and gameplay which are the matching concept and the game world level. The matching concept is details out to describe the gameplay used in order to develop the colour-based recognition for shape matching game in interactive way based on the same concept used in other game. The game level also explained on the general idea of application works in the game world section. In the prototype development section, the project game flow is shown to make the matching game concepts works and what tools and engine is used for developing the project. The last section is discussed about the integration process of colours recognition game with webcam computer platform and the evaluation process.
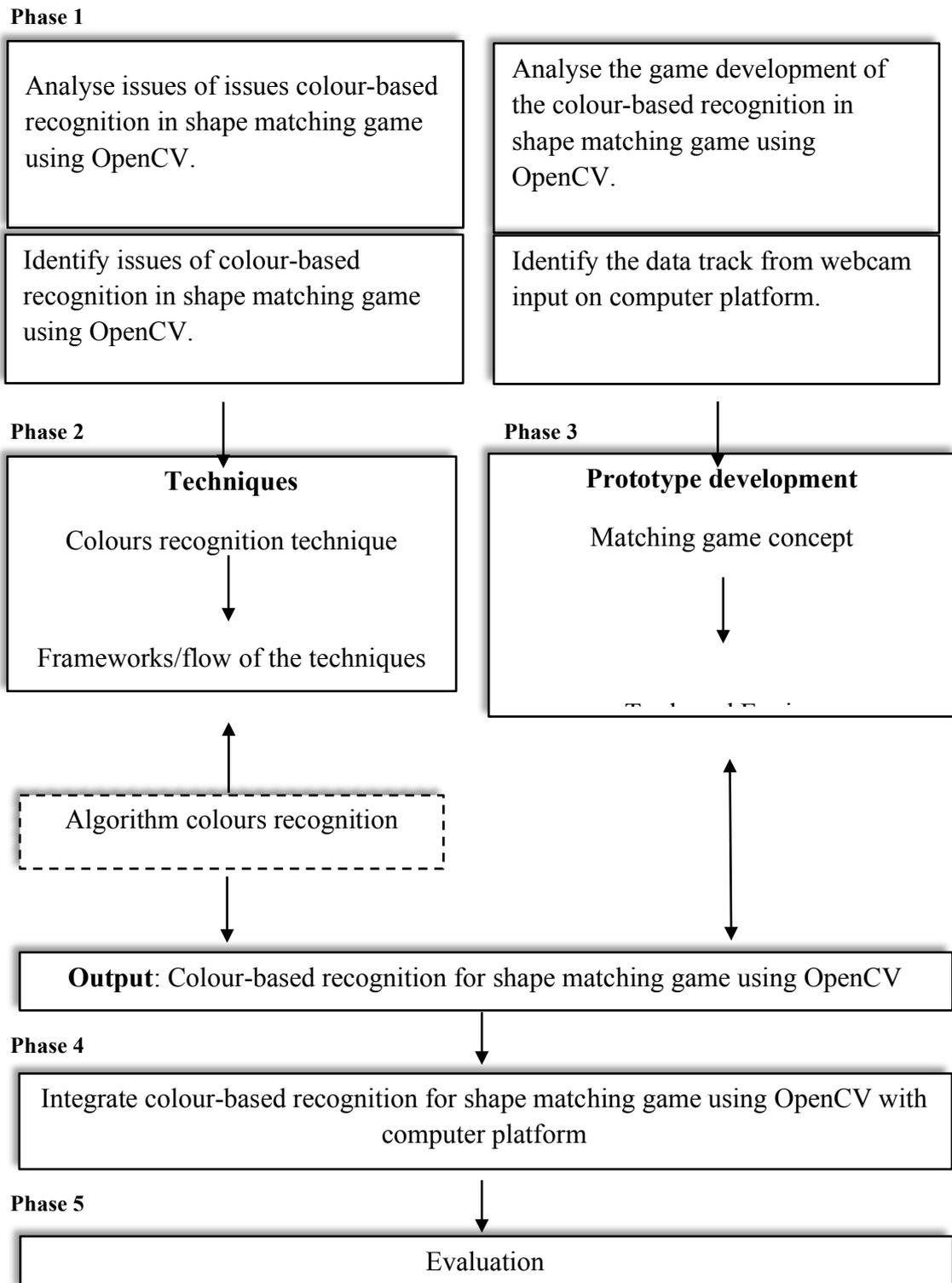
Phase 1

Analyse issues of issues colour-based recognition in shape matching game using OpenCV.	Analyse the game development of the colour-based recognition in shape matching game using OpenCV.
Identify issues of colour-based recognition in shape matching game using OpenCV.	Identify the data track from webcam input on computer platform.

Phase 2

Phase 3

Techniques

Colours recognition technique

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Frameworks/flow of the techniques

Prototype development

Matching game concept

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Algorithm colours recognition

Output: Colour-based recognition for shape matching game using OpenCV

Phase 4

Integrate colour-based recognition for shape matching game using OpenCV with computer platform

Phase 5

Evaluation

Figure 1. The Project Methodology

4 Implementation and Results

The main concept of this game is to learn the basic colours. The type of colour are the red, green and blue. The tools involve in the games are the shape block with red, green, and blue colour. The process used for tracking the colours are using OpenCV libraries. The image segmentation used in detection of the colour is by using the colour space. The use of the colour space help when facing problem with different lighting condition while doing colour segmentation. The image frame from the video is first to be read from the camera in OpenCV and then the conversation process into a different colour space occurs. The colour space that used for this project is the HSV colour space. The particular which in this scope are using the red, green, and blue colour range were find to use the value for applying the threshold for segmentation.

The technique that usually suitable to use in colour space are basically in RGB colour space for colour segmentation. However, the HSV colour space contribute to more distinct feature in colour segmentation thus it is a better used in colour space. The capture image from the camera is converted from BGR to HSV image.

Morphological transformation are some simple operations based on the image shape which normally perform on binary image. The morphology function needs input from the original image and the structuring element or kernel which decides the nature of the operation. Morphological transformation used to eliminate the unnecessary noise after thresholding the image. Two basic morphological operators are Erosion and Dilation. It variant form like Opening and Closing, Gradient also include in part of the process.

Contours is a curve joining of all the continuous points along the boundary having the same colour or intensity. The contours are a useful technique for shape analysis and object detection and recognition. The process function use a binary image for a better accuracy that is after using the threshold and canny edge detection the image process. In OpenCV 3.2, the findContours() returns a modified image as the first of three return parameters. The function is to finding the white object from the black background.
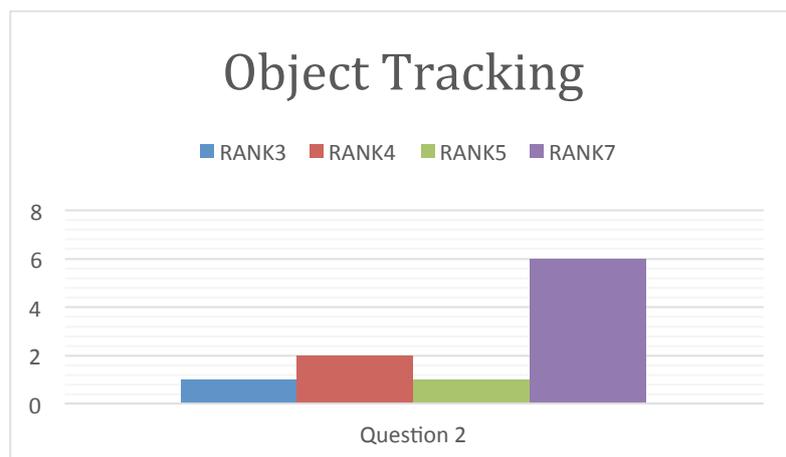

Figure 2. The Colour Tracking Bar Chart

Based on the Figure 2, about 70% above the normal value of the users know how to track the colour object from the camera. From the observation, most of the user know

how to let the camera track the object. However, three out of ten users which are the non-novice perform the task differently. The users somehow move the object out of the camera view to track object. Some also move the object till the screen and touch with screen panel. During the interaction between the camera tracking and the user's object sometimes show a lag, thus it interfere the time tracking of the require object. The lacking is due to the lighting condition and the environment condition which are also contribute to the game limitation factor. Based on the observation, the camera also track the user's clothes colour instead of the object. This is because, the tracking process also a hindered by these factor when the user wear cloth with any striking colour of red, green or blue or the background has the same factor from it. The users might misunderstand that the camera view is the same as the screen view.

5   Discussion

Every game project have some limitations at some stage. There are several limitation have been identified in the process of the project development. First of all, the object recognition task was limited to identify only the colours. The object recognition is not a trivial task even when using the high level libraries however the process of setup for the environment requires thorough steps to ensure the process work smoothly. A great deal of effort went in reading up on OpenCV while studying computer vision theory to acquire a better understanding for the project limitations.

Lighting conditions and the environment also must take into account, and cannot be reliable under some circumstances because colour is still a staple feature that is often used during the process of fixation. Tracking process can be hindered by these factor when the user wear cloth with any striking colour of red, green or blue or the background has the same factor from it. Besides colour, contour and shape are the other process in object recognition. With only one feature, the system may find more than one seeking object. Binding two or more features can limit the number of the desire object and provide much more precise results. However, the process may require a better devices that have a fast speed of processing.

The application is not integrated with the other devices such as mobile platform, but where intended for the stand-alone Windows operating system computer. The used of build in Web Camera tracking process may interfere with the background noise apart from tracking the require object.

6   Conclusion

In developing fine work product software, there will be some limitations that each product had to overcome. The recommendations and limitations has been discussed earlier are to explain that there will always a possibilities to have an improvements to the final product software with a better and satisfying outcome. The recommendations to overcome all the limitations identified to improve the game. This shows that there are limitless possibilities to further improve the game using the current technology, given the time, ideas and requirements to produce software with better and satisfying outcome.

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