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Associative Interactive play Contents for Infant Imagination

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Abstract

Creative thinking appears even before it is expressed in language, and its existence is revealed through emotion, intuition, image and body feeling before logic or linguistics rules work. In this study, Lego is intended to present experimental child interactive content that is applied with a computer vision based on image processing techniques. In the case of infants, the main purpose of this content is the development of hand muscles and the ability to implement imagination. The purpose of the analysis algorithm of the OpenCV library and the image processing using the 'VVVV' that is implemented as a 'Node' in the midst of perceptual changes in image processing technology that are representative of object recognition, and the objective is to use a webcam to film, recognize, derive results that match the analysis and produce interactive content that is completed by the user participating. Research shows what Lego children have made, and children can create things themselves and develop creativity. Furthermore, we expect to be able to infer a diverse and individualistic person's thinking based on more data.

Keywords: *Creative thinking, Lego, Image processing, Computer vision, Interactive.*

1. Introduction

1.1 Purpose of research

Igor Stravinsky said. "The premise of creation is imagination. However, the two should not be confused. A lucky discovery may be necessary before the creation can be accomplished. However, it is creative to fully realize this discovery. What we imagine doesn't necessarily have a concrete form, nor does it have an actuality. So what matters to us is not vague imagination but creative imagination. That alone will enable us to move from the stage of conception to the stage of reality." The development of psychology, semiology and computer calculation ability are brought together, and various input and output devices are appearing experimentally, and accordingly the field of HCI is gradually expanded and developed in various ways that people interact with computers. Promoting imagination in infants is like boosting all creative motivations and potential senses that are hardened through composition and reconstruction. The purpose of this content is to produce multi-sensory stimulating content that is completed through participation through the limited imagination of infants prior to their spoken language and a combination of simple objects.

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Lego commercial is a non-verbal advertisement that seeks to fill the passage with participants' 'imagine' instead of negative advertising that highlights the advantages of existing products. This content is designed and produced in the area of advertising for the purpose of increasing the sense of multiple senses for infants. Once the process of embedding infants' imagination has been completed with a combination of Lego blocks, the proposed content extends the category of imagination by naturally inducing more three-dimensional object combinations, while increasing the immersion and satisfaction of infant participation in the process of inducing expansion into synesthesia, leading to the implementation of images through pattern recognition, interlocking sound playback and animation through hand recognition.

1.2 Research method

Image processing, which recognizes, analyzes, and processes visual information with computer vision, steadily expands the scope of its use in media, and the speed of technological development and environment in which users can interact intuitively with computers without using language is increasing rapidly. This content uses OpenCV's object recognition function to identify a combination of LEGO blocks as image sensing and project related symbols to interact with users and symbols. We also want to communicate with images composed of infant intuition and imaginary simple object combinations. By assembling Lego, users can reproduce the image of reality, experiencing it with a multi-sensory sense, and cheering it on. By using OpenCV to recognize Lego shapes and select and show the graphics associated with VVVV, "imagination" is derived from nonverbal expressions into 'concrete' media communication.

2. Point

2.1 Content Work Flow

Intuition and inwardness appear before thinking. Words and numbers are just means of expression. Existing words and other symbols are secondary. It is not until the image appears first that I am free to need words or symbols.[2] For infants before entering the linguistic world of symbolism, images are pure representations of themselves as images before being incorporated into the system of language rather than merely the result of expressing the results. Rather than inducing this image directly to the image, the workflow of the content focuses on the transformation process of the image and, through the sound interaction, stimulates the infant's imagination and induces movement as well as the multi-sensory expression of the image itself into a process of self-transforming and applauds the process of reaching the result.

2.1.1 User interaction

Users combine a given Lego block to create the shape they want to represent. In this process, the content will experience and realize how the target age group can produce an image that is closest to the image in its most self-conceptions in the form of expressions limited to infants. The user prepares the interaction by placing the reproduced model in front of the webcam.

2.1.2 OpenCV: Object recognition

Using the haarCascade of OpenCV, study the three pre-determined prototype Lego models and make them into a file with the xml extension. Identify which Lego models are available according to the pre-learning

xml file among the information entered through the webcam. It then sends ID of model that is recognized as VVVV.

2.1.3 VVVV and OpenCV: Image recognition, projection

After importing video information through a webcam from VVVV, use the SelectObject node to determine the number of Lego models. The DetectObject node imports the xml file that was created using OpenCV and returns On/Off to the toggle edge node when the LEGO model you learned comes out. Create a Detect Object node for each model and play the image matching the Lego model in real time via the monitor screen according to the value returned.

2.2 Content Implementation

2.2.1 Interactive algorithm

Haar Feature is a way to find the properties of an object by using the difference in brightness between an area and an area in an image. Find the difference in brightness between the areas of the object you are trying to learn through various forms of square shape, as shown in the figure above, and extract the characteristics of the object. The square then combines various shapes, sizes, and locations to go through a large number of learning processes. The characteristic value of an object is calculated as the mean of the pixel values in the bright area of the rectangle minus the mean of the pixel values in the dark area. If you take this difference and cross any boundary value, you judge that there is a similar harr characteristic of an object.

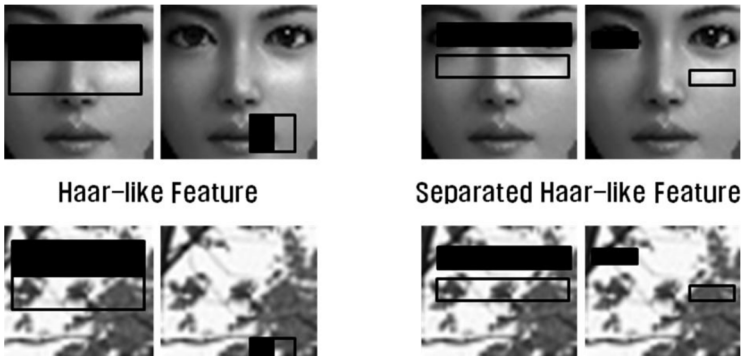


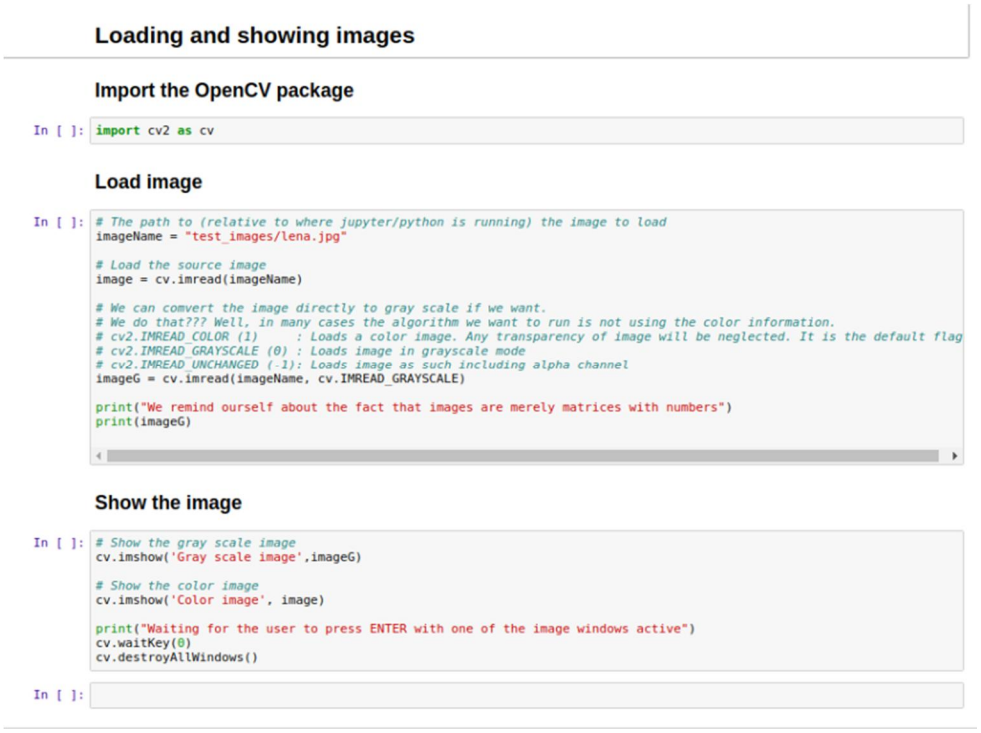
Figure 1. Extraction of Haar Algorithm Features.

2.2.2 Positive Data Cleanup

Learning about an object requires a picture containing the object and location information with the object in the picture. For learning, OpenCV reads text files, so it stores pictures and information in the pictures in advance as text files. The format of the data in the text file is as shown in [Picture Number of Path Objects x coordinate y coordinate width height]. For example, a text file called positives.txt is used to data a list of images required to learn Positives. Like "J:\study\Airplane0.jpg 1 136 68 605 355 J:\study\Airplane1.jpg 1 130 69 655 304 J:\study\Airplane2.jpg 1 134 66 615 364..."

A larger number of target images are required for the more accurate learning of objects. Generally, it is necessary to learn more than 1000 positive images, and to organize the data using a labeling program to hold large amounts of images and their data. The project effectively organized the positive image data by using a

program to store the information of objects in images and videos. The following image shows the process of organizing image data using a program.



Loading and showing images

Import the OpenCV package

In [ ]:
```
import cv2 as cv
```

Load image

In [ ]:
```
# The path to (relative to where jupyter/python is running) the image to load
imageName = "test_images/lena.jpg"

# Load the source image
image = cv.imread(imageName)

# We can convert the image directly to gray scale if we want.
# We do that??? Well, in many cases the algorithm we want to run is not using the color information.
# cv2.IMREAD_COLOR (1)     : Loads a color image. Any transparency of image will be neglected. It is the default flag
# cv2.IMREAD_GRAYSCALE (0) : Loads image in grayscale mode
# cv2.IMREAD_UNCHANGED (-1): Loads image as such including alpha channel
imageG = cv.imread(imageName, cv.IMREAD_GRAYSCALE)

print("We remind ourself about the fact that images are merely matrices with numbers")
print(imageG)
```

Show the image

In [ ]:
```
# Show the gray scale image
cv.imshow('Gray scale image',imageG)

# Show the color image
cv.imshow('Color image', image)

print("Waiting for the user to press ENTER with one of the image windows active")
cv.waitKey(0)
cv.destroyAllWindows()
```

In [ ]:

Figure 2. OpenCV Data Cleanup.

After pre-designating the airplane that the child is likely to create, the program proceeds in the form of finding similar shapes in the next image within the folder, specifying and storing coordinate values. Subsequently, the stored coordinate values were exported to a text file, and then the number of objects and the path to the image were added to create a files of 1,500 positives.txt, containing the positive image information.

2.2.3 Positive Data Cleanup

After organizing the image files for Positive into data, the step is to retrieve the data from the text file and sample them. After reading the values stored in the data in advance, several directions and angles should be studied to create a positive image sample. At this point, the more image samples, the higher the object's recognition rate. This project has taken the post-Positive data cleanup steps using the Cascade Trainer program. First, to extract the positives.txt file to extract the positive sample, then 1500 samples were extracted using the multi expansion method. At this point, the multi-expand method allows the developer of the program to add additional functionality to OpenCV's method, and thus the image list can be entered to create a Positive sample file by creating a modified image for each image. The Positive sample file is saved as *.vec and used for learning in the next step. Figure 5 shows the process of extracting and verifying positive sample files of car models made of Lego using the cascade trainer program. One can see that the car models did not produce flat figures but produced samples in black and white with modified angles.

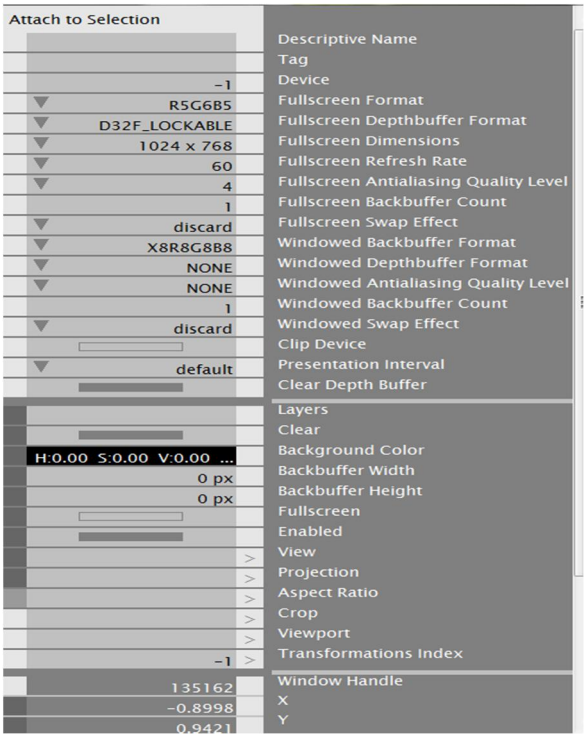


Figure 3. Positive Sample rendering

After creating a Vec file with positive samples, the sample file and the negative image without the object must be compared and learned about the object. At this point, the negative file must exceed the image in the sample to increase object recognition. The negative image should also be stored as a file with the txt extension by dataizing the image information, such as when creating a positive sample. If a positive sample file requires a format such as [number of path objects in a picture x coordinate y coordinate width height], only [path of picture] is designated as there is no object to be recognized. Since the project has 1,500 positive image samples, the negative image has been digitized to more than 2,000 pages, making it a text file.

2.2.4 Haar Training

When you finish digitizing a negative image, you need to learn the characteristics of positive samples by comparing the positive sample file that you created with the negative At the end of this step, you can create an xml file to recognize an object. This project has been studied using the existing Haar Training method. Care should be taken when going through this learning process, such as the negative image should be higher than the positive sample image, and the number of positive samples to be used at each cascade stage rather than the total number of positive samples in npos.

2.3 VVVV

The VVVV program acts as an application to receive XML and real-time webcam images created by OpenCV as input and to select and play a given role.

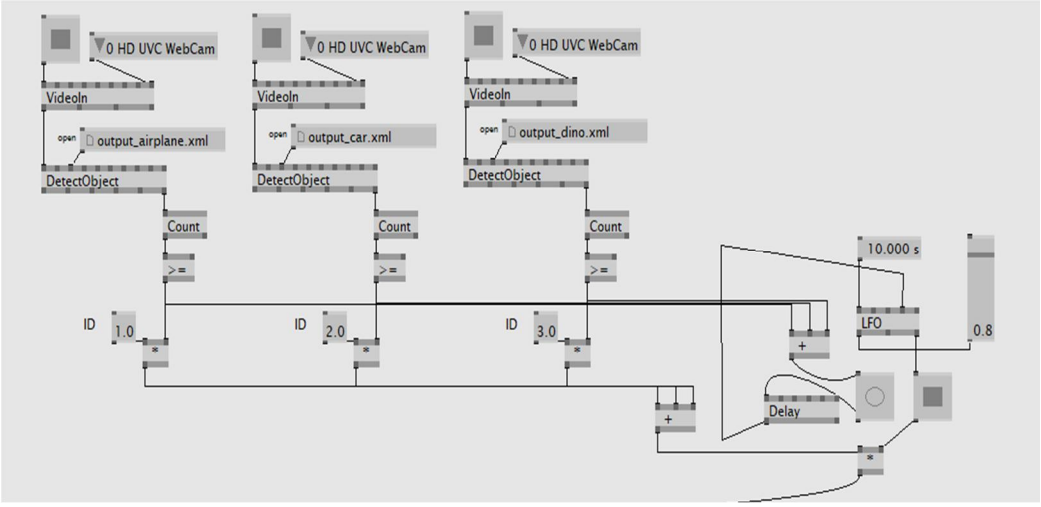


Figure 4. Detect Project Function and 10-second Input Limit Node Map.

DetectObject (FreeFrame) is a node that can take advantage of OpenCV strongly in VVVV In a program utilizing OpenCV, input.xml files, webcams, or prepared images produced by HarrTraining for images are inserted to detect x, y coordinates, and horizontal and vertical area sizes of objects on the image. Specifically, the Objet ID checks how many Harr characteristics of the object are detected and how many objects are contained in the xml in the image. In this project, if the ObjectID value is detected by connecting it to the Count node, the Count is increased and the Signal is passed to the bottom of the Blocker and Blocker on the right. After each count, the '>' node is multiplied by the Boolean and the ID is 1 and the ID is calculated. Blocker on the right is a method that limits the value produced by multiplying the final input by zero each time an image is started to prevent another detected data from interfering while one image is replayed for 10 seconds. If the ObjectID value of the DetectObject is increased to 1 or more, it is passed to the Press box on the lower left side of the LFO and entered as a Reset of the LFO after delay in the delay node and the LFO is initialized each time a new input is entered. If the input is not longer than 10 seconds, the cycle value of the LFO increases to 1 or more, checking the Toggle Box on the bottom right of the LFO, which acts as a gate to pass the input given by the bottom '*' operation without filtering it. If the Toggle box is turned off, the input value entered for 10 seconds will be ignored according to the real-time input. That ID values delivered through the DetectObject node are 1, 2, and 3 integer values, and the images can be selected and played through the operation of '='. Each image was imported into the Filestream for sound and video playback, and videoTexture was used in the Quad node for texturing and playback of the image. And the Play button was connected to the Enable of the Quad to disable the non-playable images, and the Do Seek (right press box of each of the images to be initialized through the Change node when the top input value was changed). The default background image was also included and registered as Layer 1. Then, the uniform scale (size *2) was applied to the quad, and the size of the Render was filled with full screen and grouped together.

2.4 Content Demonstration

Users create objects that they want to create through a given Lego block. Since OpenCV identifies the pattern of objects through the specification rather than color, changes in color do not significantly affect the results of image recognition.

3. Conclusion

We conducted an experimental and interesting project on how we can interact individual concepts with computers through visual perception, and how much more clearly and in what shape we can reproduce them using limited media in the process. Through this project, we can infer children's thoughts, and it helps them to create something by themselves and develop creativity. These analogies help us leap from a world of knowledge to a world of new understanding. Technically, more Positive files are needed to actively utilize OpenCV, and some paid OpenCV Training programs have been developed to detect image features based on images. As these data pile up, we expect computer vision to develop more and more, real-time learning and more object recognition algorithms to develop, and to be able to read out even the unique ideas that are not typical of humans.

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