

Hybrid Images

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Abstract: Two separate images were acquired with smartphone cameras and then processed using the GIMP editing software and the OpenCV python library to produce a hybrid image. Considering a pyramid representation, a high pass filter was applied to one of the images while a low pass filter was applied to the other. The hybrid image was obtained from combining the processed images with an opacity change for the first image.

Keywords: hybrid images, high pass filter, low pass filter, pyramid representation

1.. Introduction

Aude Oliva and Philippe Schyns established that an image could be interpreted in different ways according to the coarse and fine information available [1]. This gave way to the refinement of the hybrid images technique, where static images have different interpretations depending on viewing distance. In this work, the technique is applied to two images of faces belonging to different subjects. The methodology used is described on section 2, while results and conclusions can be found on sections 3 and 4, respectively.

2.. Materials and methods

The images used in this project were obtained by using self-portraits or "selfies" of the authors captured using two different smartphone cameras. The images as they were captured are shown in the figure:

Image 1.a (720x1280) shows author 1 facing forward and looking to a side in an indoor, artificial lighting environment. Image 1.b (960x1280) shows author 2 in a similar pose, albeit with a colder, natural light.

Using the GIMP image editing software, images were cropped and resized to 954x1080 pixels, and the image showing author 2 was color corrected (higher color temperature, higher contrast) to show a similar lighting to that

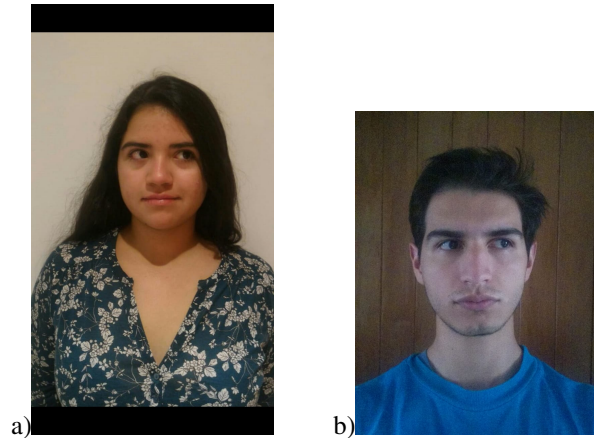


Figura 1. Original images

of image 1.a. During the cropping procedure, image 1.a was scaled and translated until the eyes and some facial features were aligned with image 1.b.

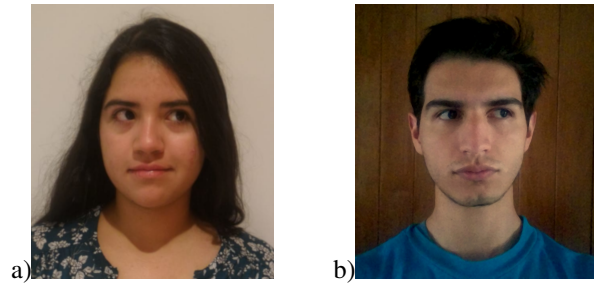


Figura 2. Modified images

Image 2.b was chosen to provide the high frequency details of the hybrid image, while image 2.a would provide the low frequency background.

The OpenCV library was used to produce the pyramids and the blended images, including the final hybrid image. Initially, images were read from the preprocessed .png

files.

```
img1=cv2.imread('./luisa.png')  
img2=cv2.imread('./juancamilo.png')
```

Gaussian filters were applied to blur the background image (2.a) and to obtain the Laplacian equivalent of the foreground image (2.b).

```
img1Gauss = cv2.GaussianBlur(img1, (  
    Dim, Dim), sigma1)  
img2Gauss = cv2.GaussianBlur(img2, (  
    Dim, Dim), sigma2)  
img2diff = cv2.absdiff(img2, img2Gauss  
)
```

3.. Results

The final hybrid image was obtained by merging the filtered images.

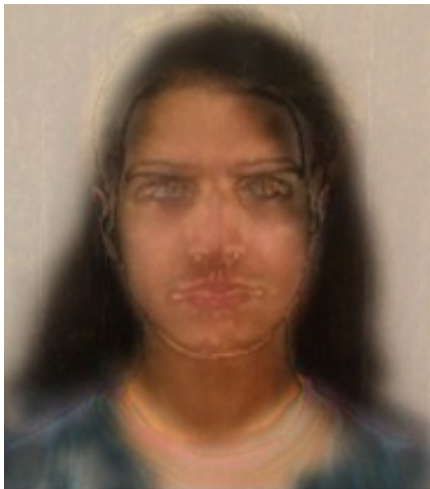


Figura 3. Resulting hybrid image.

Where the values of the foreground image were added to incorporate it into the final result.

```
imgsum = cv2.add(img1Gauss, img2diff,  
    cv2.NORM_L1)
```

The pyramids were constructed using different passes to observe the effect of low passes become more prominent.

Finally, pyramid blending is shown on the next figure.

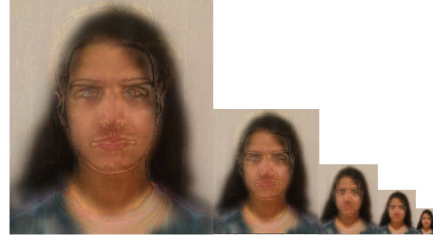


Figura 4. Image Pyramid.

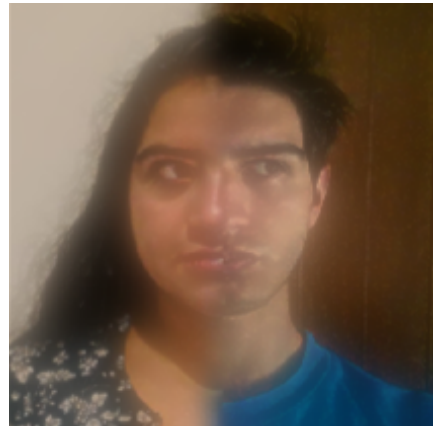


Figura 5. Pyramid blending

4.. Conclusions

A hybrid image was constructed using the fine and coarse information of two images. The resulting picture is interpreted in a similar way to the foreground image when observed from a close distance; while the background image dominates when the picture is observed from far away. In other words, one face is visible from up close, and a different face becomes visible at a further distance. In this sense, Hybrid images are presented as an interesting way of creating images that change in function of the scale at which it is seen. [1] A. Oliva, A. Torralba, P.G. Schyns (2006). Hybrid Images. ACM Transactions on Graphics, ACM Siggraph, 25-3, 527-530.

Referencias

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<http://cvcl.mit.edu/publications/OlivaTorralbaHybridSiggraph06.pdf>. 1