Hybrid and Blended Images

Luisa F. Borbn R.
Universidad de los Andes
Departamento de Ingeniera Biomdica
lf.borbon@uniandes.edu.co

Juan Camilo Martinez
Universidad de los Andes
Departamento de Ingeniera Industrial
jc.martinez10@uniandes.edu.co

Abstract

This article had the intention of applying the concepts of Gaussian an Laplacian pyramids, in order to create hybrid and blended images. The images used were taken by the authors using smartphone cameras and processed with the GIMP editing software to align them correctly. The hybrid image was created by adding the result of a high pass filter that was applied to one image and the low pass filter applied to the other. A Gaussian pyramid was used in order to visualize change of perception experienced by the viewer as he distances from the image. After that, the blended image reconstruction was created by using the last level of the Gaussian pyramid and adding by iterations the different levels of the Laplacian Pyramids. In conclusion, Hybrid images showed to be an interesting way of creating a multiscale visual effect, in which the selection of the Kernel parameters result being crucial and the method used to created the blended image may have further applications in saving or restoring images with less initial information.

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

1. Introduction

The hybrid images technique was first published by Oliva, Torralba and Schyns in 2006. This technique establishes that an image can have different interpretations depending on its viewing distance. This visual effect occurs because the perceptual mechanisms of the vision, interpret the image in different ways according to the coarse and fine information available [1].

In this sense, an hybrid image is made by joining a low-pass filtered image with another high-pass filtered image. The low frequencies of an image can be obtained by filtering it using a Gaussian Kernel and the high frequencies result form subtracting the original image with its low frequencies [2]. To see the perpetual illusion easily, a pyramid representation can be made using Gaussian or Laplacian Kernels. Other application of this representation are the blended images; in which to images blend smoothly together by applying iterative Laplacian an Gaussian Pyramids.

In this work, the hybrid and blended images techniques were applied in two images of faces belonging to the authors. 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 tree stages followed in the methodology of the project are described in the following section. This report was based on the indications of the course IBIO4490 - Computer Vision at Los Andes University. The environment used to developed the code was Spyder, with Python as its corresponding programming language.

2.1. Image Selection

The images used in this project were obtained by using self-portraits or "selfies" of the authors captured with two different smartphone cameras. The images as they were captured are shown in figure 1. Then, using the GIMP image editing software, images were cropped and resized to 954x1080 pixels as shown in the figure 2. During the cropping procedure, the second image color was corrected (higher color temperature, higher contrast) and the images were moved until the eyes and other facial features were aligned.

2.2. Hybrid Image

To make the hybrid image, the second author image was chosen to provide the high frequency details, while the first author image would provide the low frequency background. This order was selected by analyzing the features of the images and experimenting in the GIMP software to visualize possible results.

The OpenCV library was used to produce the hybrid image, applying a Gaussian filter to blur the images and obtain its low frequencies. Then, by subtracting the original image with its low frequencies, the Laplacian equivalent of

the foreground image was obtained. Furthermore, the value of the the different parameters of the kernel were found experimentally, by changing them until the multiscale effect was visible. Finally, a Gaussian pyramid was applied in order to visualize the effect and verify the procedure worked correctly. The principal code applied to create the hybrid image is shown next, where d is the dimension of the Gaussian Kernel and s1, s2 are the standard deviation, found empirically.

```
G1 = cv2.GaussianBlur(img1, (d, d), s1)
G2 = cv2.GaussianBlur(img2, (d, d), s2)
dif = cv2.absdiff(img2, G2)
sum = cv2.add(G1, dif)
```

2.3. Blended image

To create the blended image, the same images were used, but changing their dimensions to 512x512. This change in the size of the images was made in order to avoid problems in the reconstruction of the image, because if its dimensions are not a power of two, the approximate size of the image can change and the blending process can get more complicated. After this, Gaussian and Laplacian pyramids were applied to the images, and the last level (lower resolution) of both images was concatenated. Then, the image was reconstructed by adding the Laplacian Pyramid level to its corresponding Gaussian Pyramid response, until the original size of the image was obtained.

3. Results

We manage to create the hybrid image by filtering with a Gaussian Kernel of dimension 85 and an standard deviation of 20 and 25 respectively. The result of the hybrid image obtained by merging the filtered images is shown in figure 3. In order to visualize the effect of the multiscale representation we applied a four level Gaussian Pyramid in the hybrid result, as shown in figure 4. The pyramids were build using different iterations to observe the effect of as low frequencies become more prominent. Finally, we obtained the blended image as it is shown in figure 5.

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.

Additionally, the selection of the Kernel parameters result being crucial in the result of the hybrid image. Depending on the image features and desired outcome, this parameters needed to be changed and adjusted. In the other hand, using the Gaussian and Laplacian Pyramids lead to the construction of the blended image with satisfaction. This reconstruction may have further applications in saving and restoring images using less information and computing processing.

References

[1] A. Oliva. Hybrid images. [online] http://cvcl.mit.edu/publications/OlivaTorralb$_{H}ybrid_{S}iggraph06.pdf$.

[2] J. Tompkin. Image filtering and hybrid images. [online] http://cs.brown.edu/courses/cs143/proj1/.

5. Images

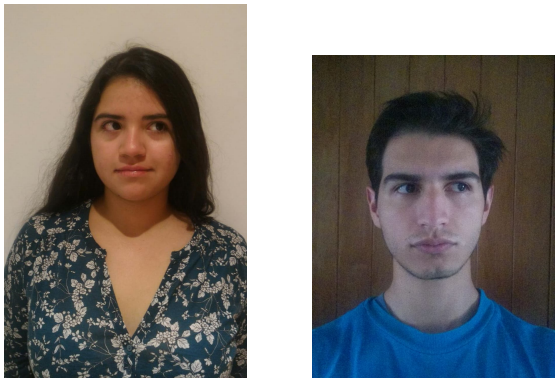

Figure 1. Original images. On the left, the image (720x1280) shows the first author facing forward and looking to a side in an indoor, artificial lighting environment. The image on the right (960x1280) shows second author in a similar pose, albeit with a colder, natural light.

Figure 2. Modified images. Image on the right was chosen to provide the high frequency details of the hybrid image, while image on the left would provide the low frequency background.

Figure 3. Resulting hybrid image.

Figure 4. Image Pyramid.

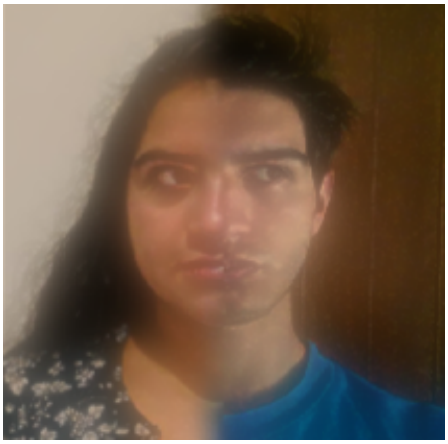

Figure 5. Blended Image