Hybrid images

Pablo Andrés Uriza Antorveza
Universidad de Los Andes
pa.uriza274@uniandes.edu.co

Maria Fernanda Roa
Universidad de Los Andes
mf.roa@uniandes.edu.co

1. Original images

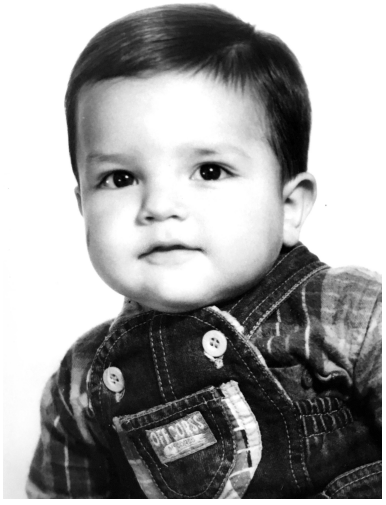
The images selected for this work correspond to grayscale portraits of babies, as seen in Figure 2. This images where taken from printed pictures scanned. We cropped each image to 512×512 pixels. The second image angle, shown in Figure 1b, was adjusted in order to match the head angle of the baby in the first image.

1.1. Hybrid image

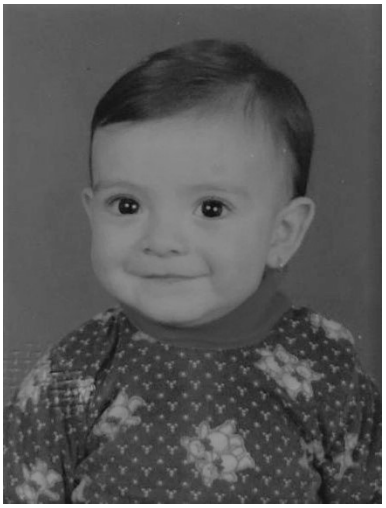
A hybrid image can be formed by the addition of two images. One of them needs to be passed through a low-pass filter, while the other should be processed using a high-pass filter. This operation will retain the coarsest information in the former image and the finest details in the latter. According to Shapiro [1] the Gaussian filter can be considered as a low-pass filter. Consequently, a subtraction of the original image with itself after applying a low-pass filter equals the operation of a high-pass filter. The Gaussian filter implementation of `scikit-image`'s `gaussian` depends only on the σ parameter corresponding to the standard deviation of a Gaussian distribution.

The image was constructed with the image of baby 2a as the image passed through a low-pass filter, and the image of baby 2b as the image passed through a high-pass filter. We made ablation experiments in order to find the best value of sigma. The selection of this value was made according to qualitative results. The best result obtained is shown in the Figure 3.

The visual effect of distance in a hybrid image can be simulated using a pyramid down operation. When the image is in a higher scale (similar to being close to the image), we will see the high-pass filtered image as edges and other fine details. However, when the image is in a lower scale (similar to being far from the image), we will see the low-pass filtered image. Figure 4 shows 6 levels of a Gaussian pyramid with $\sigma = 1$ showing the effect discussed before.



(a)



(b)

Figure 1: Original images

1.2. Blended image

Another method to merge images in a seamlessly way is to perform a a image blend by pyramid reconstruction. For example, if two images are cropped, cut in halves, aligned and joined, sharp edges will be present along the joint. By applying the pyramid reconstruction with the help of the Gaussian and Laplacian pyramids, the two halves will mix smoothly one into the other.

(a)

(b)

Figure 2: Modified images rescaled to 512×512 pixels.

Figure 3: Hybrid image result.

This operation consists of the calculation of the Laplacian pyramid for each image and the concatenation of their respective levels from the lowest to the highest, with a a pyramid up operation in order to add to the immediate upper level. This creates a continuous transition between images.

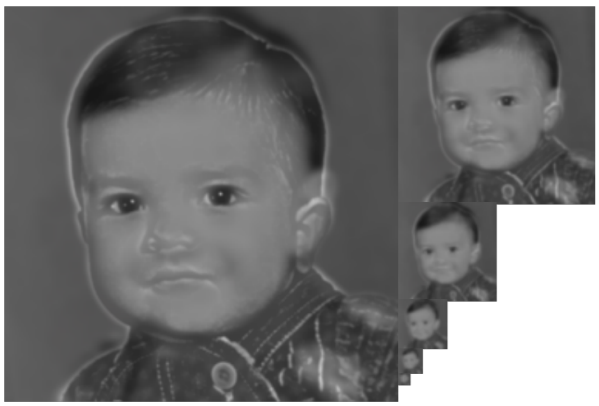


Figure 4: Pyramid showing six levels to simulate the visual effect of the distance from the hybrid image.

This method was applied to the two images and the result can be seen in Figure **??**. Here we can find the baby 2b on the left half of the image and the baby 2a on the right half. The image shows a higher percentage of baby 2b as the faces of the babies were not centered nor in an angle parallel to the central line of the image. The edges of the images are blended, this can be evidenced by comparing the blended image with the image shown in Figure 6. The latter was achieved by concatenating the original images halves.

References

[1] Linda Shapiro. *Computer vision and image processing*. Academic Press, 1992.

Figure 5: Example of original images concatenation with sharp edges.

Figure 6: Blended image result with smooth edges