UNIVERSIDAD
PANAMERICANA

Image Processing

Combining images using Gaussian and Laplacian pyramids

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Introduction

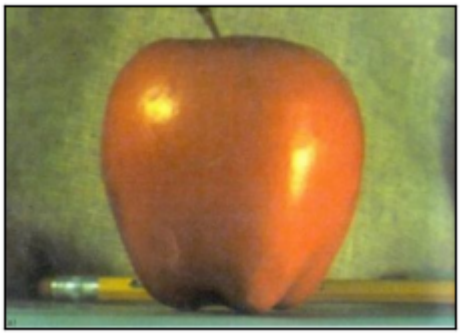
For this project, we want to merge images using a valuable technique known as Gaussian and Laplacian pyramids. The process is to apply a gaussian filter and reduce the images size, and expand the images again once the filters were applied, having a pyramid-shaped stack of images known as the Gaussian pyramid.

Once we have this, we can now subtract both the original and blurred image in order to obtain the Laplacian pyramid, which has information about the borders and more precise details about our image.

Task 1

For this task, we wanted to merge an orange and an apple, having a smooth transition over both images.

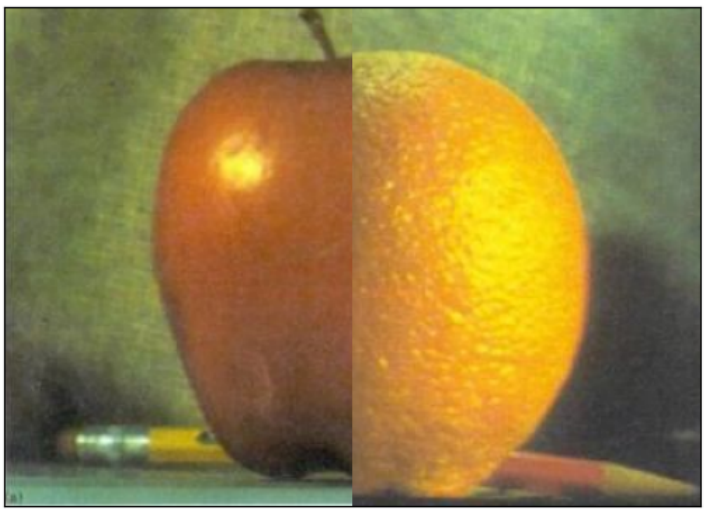
Apple



Orange

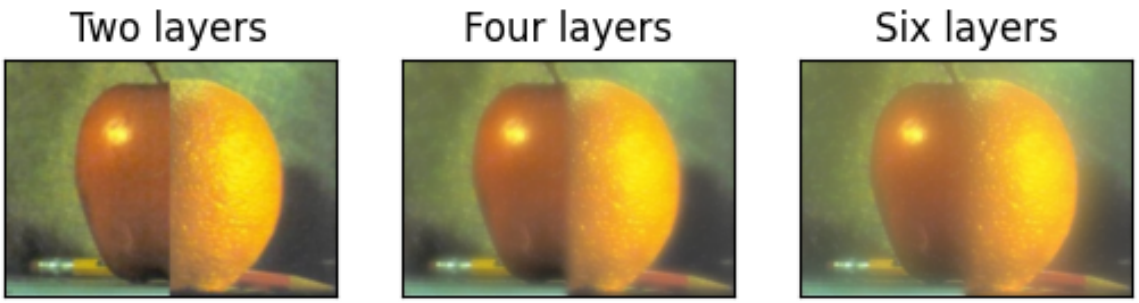
For this particular task, the required transition was to divide both images by the half, and then combine them. One solution was the following.

Combination



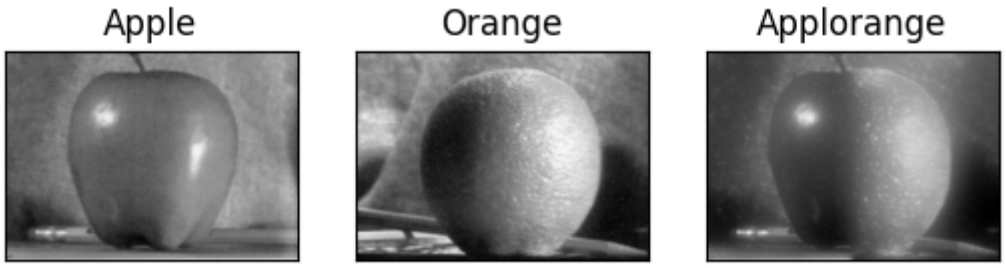
As we can see, the transition feels unnatural and we can clearly see the differences over the colors having a real sharped division.

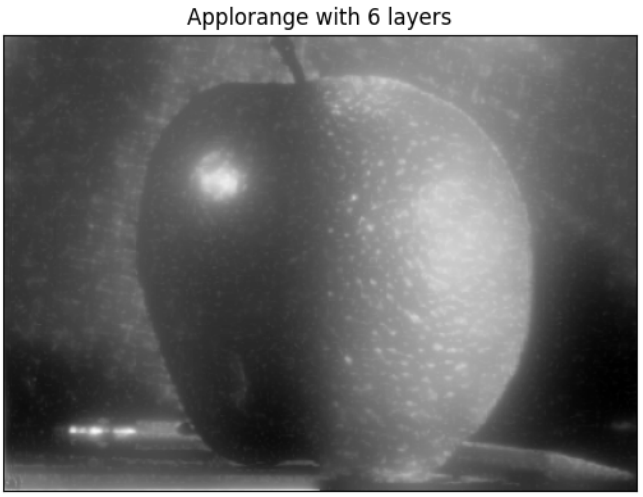
If we apply the Gaussian pyramid over the image, it will apply a blur filter once we pass the image for each layer. That will help us to smooth out over the division of the two images.



As we can see, the more layers we apply over the pyramid, the smoother transition over the pixels we will have.

We can apply this filter also over a gray image, obtaining even a better image as no difference over the color is being shown.



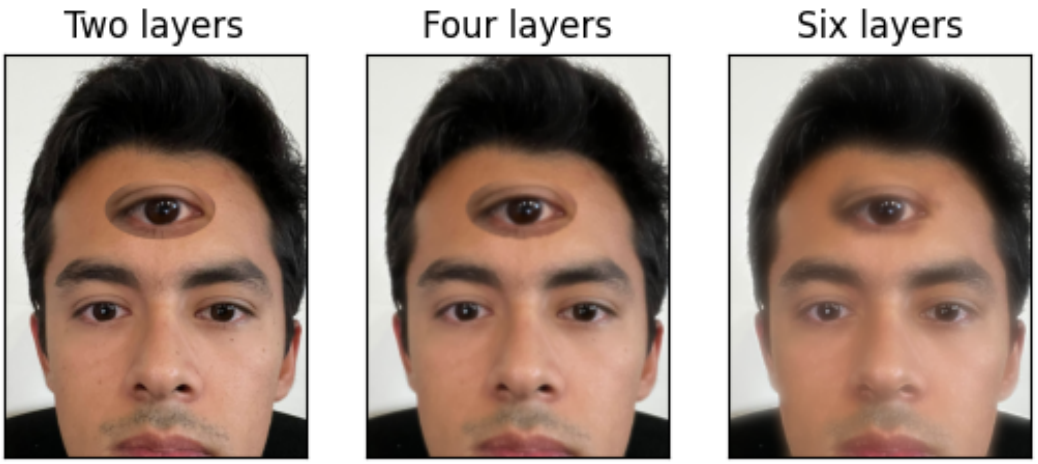


Task 2

For the second task of our activity, we combine an image of a face and an eye, in order to obtain a smooth 3 eyes face.

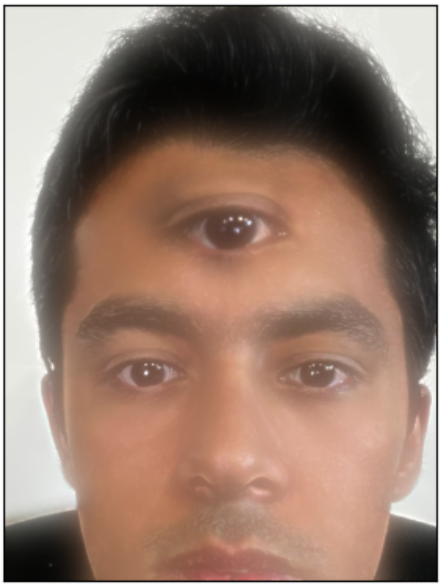
In order to do this, we take two photos, one with the face and other closer to the eye. Once we get this, we apply affine transforms (translation and scale), in order to fix the position so when we apply the mask, the eye covers the forehead over the face image. Once the positions are fixed, we calculated an ellipse shaped mask in order to obtain only the shape of the eye.

Here is the result when we apply the same mask over the Gaussian pyramid. We can observe that the greater the number of layers, the smoother transition we obtain.



Here is the resulting image combining the eye, now we have three eyes on it.

Face with three eyes



Conclusion

We can conclude that the Gaussian pyramid is pretty useful when we want to combine images. Nevertheless, the more layers we use, the lower resolution the image will have. This is because for each new layer we apply on the pyramid, the more information we are losing about the original image. This is why there is a balance between the number of layers and the definitions of the image.

We found that 6 is an optimal number of layers where we don't lose much information, and the resolution is still good. This is our recommendation for the number of layers, as less layers come up to sharper divisions, and more layers come with a big loss of information over the image.