This paper describes how to create hybrid images in detail. Generally speaking, a hybrid image is composed of low spatial frequency of one image and high spatial frequency of another image. This generated hybrid image will display image contents that are a function of view distance. If people view the image from a long distance away, they will see the image with low spatial frequency. On the other hand, people will see image with high spatial frequency if they view the image closely.

This beautiful design of hybrid image takes advantage of the perceptual mechanisms of human vision system. Human’s vision analysis tends to unfold from global to local perception. Basically, people tend to see low spatial frequency components of an image when they view the image for a short time. While if they see the image for a long time, they will then see the fine details with high spatial frequency. That’s the reason why low spatial frequency components could dominate early visual processing, while high spatial frequency components dominates late visual processing. According to this principle, when we stand far from the image, our eyes tend to receive information from low spatial frequency components because they are the ones that take a shorter time for our vision system to process. As we stand closer to the image, now we have more time for our vision system to process information, hence we see the fine details, which are the high spatial frequency components.

In order to generate a hybrid image composed of high and low spatial frequency components, we can utilize different image filters. We can use a low pass filter to generate a low spatial frequency image, and a high pass filter for a high spatial frequency image. For example, a Gaussian filter can be used for generating a low spatial frequency image, while a Laplacian filter is fit for generating a high spatial frequency image.

Based on these principles, I generated my own hybrid image.

Besides the frequency issues, this paper also claims that other factors could impact image understanding. For example, if a viewer receives a task of identifying one particular component from an image, he/she will interpret that image regardless of the spatial frequency of that particular component. More interestingly, this viewer tends not to be aware of other frequencies when he/she selects that particular spatial frequency.

This design of hybrid image has the potential to be utilized in a lot of applications. For example, it can be used to design private fonts that require some extent of user privacy. It can also be used to show changing faces with differences in viewing distances. Still, a lot of great potentials of hybrid images have not been fully defined, and these things will definitely benefit the development of the whole computer vision field.