Weekly Report: Hybrid Multi-Frequency Image Illusion

Week 1

Group 10

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October 4, 2025

1 Introduction

In this work, we plan to produce hybrid images which look different abreast as apart from aggregated element by combining the high-frequency part of one picture with the low-component. High-frequency elements are edges and tiny details. Low-frequency parts make up the whole shape and provide smooth gradation transitions. It displays the relevance of frequency decomposition in image processing and human psychology.

In week 1, we focused on understanding the theory, choosing suitable pictures and setting up the software environment.

2 Conceptual Understanding

Hybrid images are proposed by Oliva, Torralba, and Schyns (2006) based on**spatial frequency decomposition:**:

- **Low-pass filter:** Removes images and retains rough features(done through Gaussian blur).
- **High-pass filter:** Recovers fine details by subtracting the low-pass image of the original.
- **Image combination:** This is the combination of high-frequency details of one image with low-frequency details of the other image. frequency components of one to create the hybrid illusion. Selection of cutoff frequencies and alignment of images should all be done carefully.

Careful selection of cutoff frequencies and proper image alignment are crucial for achieving a clear hybrid effect.

3 Software and Tools Setup

The following tools were set up for the project:

- **Python 3.x** – implementation language.
- **OpenCV** – to read and manipulate images as well as to perform filters.
- **NumPy** – to perform numerical operations.
- **Matplotlib** – to show and plot images.

Simple functions like reading, resizing and displaying images were both achieved. tested to be able to follow hybrid image creation smoothly.

4 Image Selection and Preprocessing

The shortlisting of suitable images must be done according to the following criteria:

- Sharp high and low-frequency components.
- corresponding sizes to align appropriately.
- Supplementary visual information to create a good effect of illusion.

The preprocessing involved resizing, grayscale and manual alignment to guarantee. filtering compatibility.

5 Filtering Techniques Explored

- **Low-pass filtering:** Gaussian blur is employed however, in low-pass in order to retain coarse structures.
- **High-pass filtering:** Obtained in the difference of low-pass image and the original, bulk-cutting and eliminating refinements.

6 Next Week's Plan

1. Finalize image selection.
2. Filter selected images.
3. Test various cutoff frequencies to maximise hybrid effect.
4. Start with the images to make the hybrid image.

7 Conclusion

this week (Week 1) was devoted to theory, selection of the appropriate images, and installation of the software. The project is now prepared to begin making hybrid images in the coming weeks.