ECE501 - Digital Image Processing

Weekly Report: Hybrid Multi-Frequency Image Illusion

Week 1

Group 10

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1. Overview of the past Weeks

Week 1 was theory and image selection, software preparation, and filtering techniques so that the following week, we can be ready to create hybrid images.
Week 2, we successfully created hybrid image generation through the application of Gaussian filters, image alignment and frequency mixture which proved theory and showed perceptual illusions.

2. Work Completed During the Week

During week3 , we planned to perform quantity analysis on results and research about which measure we provide good analysis of given result in test.

- First we conducted research regarding which test wwould be appropriate for our use case like MSE or SSIM(Structural Similarity Index) or Frequency specturm correlation or Edge Preservation Ratio (EPR).
- We first collected some sample pair of images for experimentation.
- Also, for application of analysis, we studied different image filtering parameters, gaussian blur standard deviation, kernel size, high pass cut-off frequency.
- We tried different variation on changing some parameters to see its effectiveness and identify factors contributing to image degradation or loss in illusion quality.
- Taking all of above things in consideration, we set new parameters regarding the same.

3. Key Observations and Insights

- Our current set of code produces satisfactory results at both far and near distance.
- Our current output and results show good balance between overlap of two images i.e. high pass and low pass filtered images.
- Our current work, lacks for wide range of dataset to give same effective results, so we will try to improve further by analysis.

4. Challenges Faced During Quantitative Measurement and Analysis

During the quantitative evaluation of hybrid image performance, several practical challenges were encountered:

1. **Sensitivity to alignment errors:** Slight distortions between the two images have a strong impact on pixel-level similarity values, leading to erroneously high values of errors.
2. **Lighting and contrast inconsistency:** The distribution of brightness or intensity differed between the images, and this was the source of inconsistency in the metrics calculated even in those cases where the visual illusion was effective.
3. **Subjective–objective mismatch:** Quantitative measures are not necessarily consistent with perceptual quality and hybrid images even which are more pleasing to the human eye may have a lower PSNR or SSIM.

5. Work Planned for Next Week

The following week i.e. 4 the group will then be directed towards testing the methodology to enhance the performance and visual adaptability of the hybrid image model on the quantitative level conducted this week, and also explore scope to improve image illusion further

6. Conclusion

The work completed this week has made our understanding deeper regarding the methods of image illusion of hybrid nature and given useful quantitative knowledge of the existing

limitations at present. The results indicate that hybrid illusion production requires a good control of frequency accuracy.

Prepared by: Group 10

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