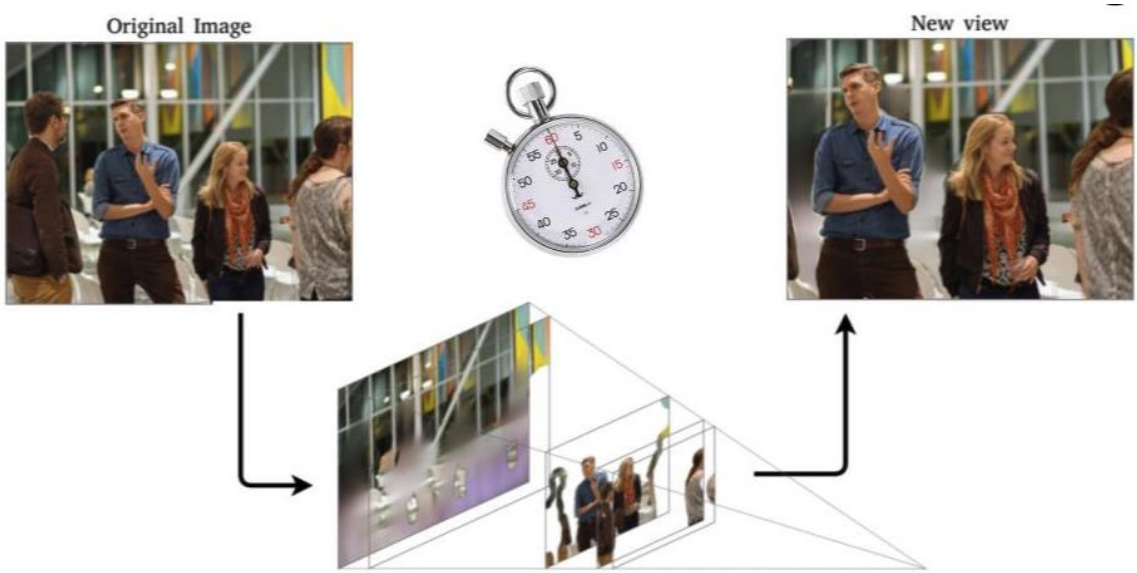
Fast 3D Photos with Multi Plane Image



Background

Given the growing interest in 3D photo and videos, there is a need to propose methods which can perform rendering of novel views from just a single image. Multi-Plane Images (MPI) provide an effective solution for rendering novel views by dividing a scene into multiple depth planes (called layers) as shown in Figure above. These layers store RGB and transparency (alpha) values at various depths, allowing real-time rendering from new viewpoints. **Rendering speed** is crucial for applications such as 3D photo generation and immersive media, where real-time performance is necessary. The number of planes used in the MPI process significantly influences the computational load and, consequently, the rendering time.

Problem Specification

The efficiency of MPI-based rendering depends on the number of planes used. While increasing the number of planes improves visual accuracy, it also raises computational complexity, slowing down the rendering process. This project aims to investigate the relationship between the number of planes and rendering time to identify an optimal configuration that balances speed and visual fidelity. The goal is to find the fastest MPI configuration that maintains acceptable visual quality. Additionally, the project aims to identify other potential scene representations that derive from MPIs, for example T-MPI[3].

Suggested Method

This project will test and compare different configurations of MPI by varying the number of planes (e.g., 8, 16, 32, 64 layers) across multiple setups and resolutions. Rendering time will be measured under different hardware conditions (e.g., using GPUs like RTX 2070, GTX 1080 Ti, and GTX 1070). The focus will be on identifying the configuration that delivers the best balance between speed and performance (e.g., PSNR or visual performance), with results visualized in terms of frames per second

(FPS). For reference one can start with any state-of-the art model, for example AdaMPI[1] to train with different number of layers. Furthermore, The configurations of different tiled planes called T-MPI[3] can then further be tested as an alternative approaches.

Relevant Articles

[1] Han, Y., 2022,. Single-view view synthesis in the wild with learned adaptive multiplane images. In ACM SIGGRAPH 2022 Conference Proceedings (pp. 1-8). (GitHub)

[2] Tucker, R., 2020. Single-view view synthesis with multiplane images. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. (GitHub)

[3] Numair Khan, Tiled multiplane images for practical 3d photography. In Proceedings of the IEEE/CVF International Conference on Computer Vision. (GitHub)

[4] Luvizon, D.C., 2021. Adaptive multiplane image generation from a single internet picture. In Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision.

[5] Mingfang Zhang,. Structural multiplane image: Bridging neural view synthesis and 3d reconstruction. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. (GitHub)

[6] Guo Pu, Sinmpi: Novel view synthesis from a single image with expanded multiplane images. In SIGGRAPH Asia 2023 Conference Papers, pages 1–10, 2023. (GitHub)

Project Draft By: Manu Gond (manu.gond@miun.se) | Emin Zerman (emin.zerman@miun.se)