

3D-Reconstruction of Human Tissue with Artificial Intelligence

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Introduction

Cancer is one of the leading causes of death worldwide. In Switzerland alone, it accounts for 29.5% of deaths for men and 22.5% for women, being the most common cause of death for men between 45 and 84 years old and women between 25 and 84 [1]. Early detection and treatment are key elements in increasing survival rates. Artificial intelligence could be the solution to this challenging task by providing healthcare professionals with precious information that would improve the treatment. The aim of this project was to evaluate a new method based on polarimetry that requires a 3D reconstruction and compare it against a photogrammetry-based method on selected metrics.

Materials and methods

Metashape and Colmap were used as a photogrammetry approach and NeRF, DietNeRF and Instant-NGP were used as an artificial intelligence approach. Different metrics were employed to compare, such as the number of pictures needed, the processing time and the quality of reconstruction.

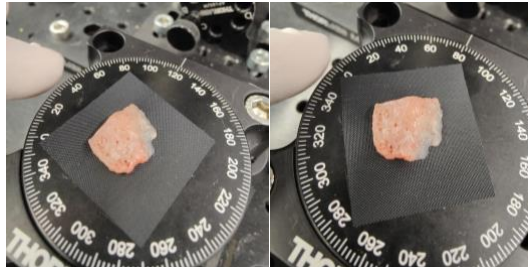


Fig. 1 Example pictures taken from one dataset

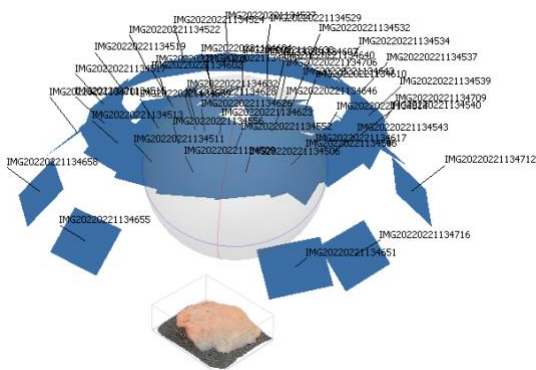


Fig. 2 Visualization of a scene associated with 46 camera poses

Results

The artificial intelligence-based approaches that were studied excelled in the tasks of synthesizing novel views and rendering a scene. While promising, the quality of the 3d reconstruction was not up to par with the photogrammetry approach when the scene was transformed into a polygon mesh to be usable for our case study.



Fig. 2 Picture of the scene before and after meshing

Discussion and outlook

The results could be greatly improved by using a different meshing algorithm than the one given by default. Another way to improve the income would be to enhance the quality of the dataset by tweaking the preprocessing of the images. Background removal and specular reflection reduction are two techniques that could help.

References

[1] Federal Statistical O-ce. Cancer. <https://www.bfs.admin.ch/bfs/en/home/statistics/health/state-health/diseases/cancer.html>. Accessed: 2022-06-05.

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