Warsaw University of Technology

FACULTY OF ELECTRONICS AND INFORMATION TECHNOLOGY

PhD Thesis

in the discipline of Information and Communication Technology

Few-Shot Human Neural Rendering with Partial Information

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WARSZAWA 2025

Acknowledgements

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Few-Shot Human Neural Rendering with Partial Information

Abstract

This thesis presents a series of publications that contribute novel approaches to human neural rendering from a partial information. We focus on recently introduced learnable from data radiance fields, namely, Neural Radiance Fields (NeRFs) and 3D Gaussian Splatting (3DGS). We analyze how these models build an underlying 3D representation from 2D images, and ways that the representation can be conditioned to produce high-quality renderings of humans. We specifically propose several new methods that enable controlling neural radiance fields outputs with simple and interpretable inputs from a partial training information, and extend this approach to work in a few-shot learning setting.

In the first part of the thesis, we give an overview of the field of neural radiance fields. We discuss the limitations of the existing approaches and introduce our contribution to controllable neural radiance fields. Our approach incorportes partial, sparse information given at the training time and leverages smoothness of neural networks to enable high-quality and controllable human images.

We then move towards discussing the core limitation of controllable neural radiance fields which rely on the availability of high quality data annotations for multi-view videos. We propose a novel approach to train neural radiance fields in a few-shot, multi-view regime by learning an internal representation of subject's deformation templates which are mixed smoothly at the inference time. We show that such an approach significantly improves the image quality metrics over the chosen baselines and opens up new possibilities for human rendering from a few images.

Finally, we show that those approaches can be imbued with an ability to adapt their computational requirements at inference time while training the model once. We introduce a new fine-to-coarse strategy to leraning 3D Gaussian Splatting which upsamples a latent 2D grid storing Gaussians' latent representation. Our approach achieves comparable results while being deployable to any comptation device with a minimal loss of quality.

Keywords: Neural Rendering, Neural Radiance Fields, Few-Shot Learning, Human Rendering, Partial Information

Renderowanie Ludzi z Kilku Próbek z Użyciem Częściowej Informacji

Streszczenie

To jest streszczenie. To jest trochę za krótkie, jako że powinno zająć całą stronę.

Słowa kluczowe: A, B, C

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Appendix 3

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Appendix 4

Dowód nieskończoności urojonej

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