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# Master's Thesis Review

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**Title:** Hairstyle Transfer between Portrait Images
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The thesis presents a method for transferring hairstyles between face images that are not necessarily geometrically or photometrically aligned. The problem is solved by proposing a neural network architecture with two encoders (for hair and face inputs), a mapping network, and finally a fixed StyleGAN2 generator [1] to render the output. The network was trained in an autoencoder fashion using synthetic data only, without any manual annotation. High resolution $1024 \times 1024$ images are produced. Applications of the method include 'virtual hairdresser' that enables switching a haircut on the face image from an image of a different person, or editing the hairstyle in the latent space (e.g., changing hair colour or curliness), and adding hairs to renderings of the popular 3D morphable model [2]. The method was extensively evaluated. Hairstyle transfer fidelity was measured using the learned hair similarity metric. A photorealism of the output was assessed with a user study, which concludes that the images generated by the proposed hairstyle transfer method are not distinguishable from images generated by the state-of-the-art StyleGAN2 face image generator. Qualitative analysis shows several results including a favourable comparison with other state-of-the-art methods.

The problem is certainly not trivial. It is a regular research problem and Adéla handled it very well. The content of the thesis was submitted to a conference [3]. The thesis extends the conference submission by a more detailed explanation and by presenting additional results and novel experiments.

Adéla worked on her thesis systematically. We were meeting regularly, usually on a weekly basis. Adéla was always well prepared, having her experiments well documented and meticulously organized. Adéla was very active in asking valid questions and proposing own solutions to the difficulties she faced. Adéla reads easily scientific papers. She is indisputably competent in recent deep machine learning techniques. She is both strong in theory and skillful in the implementation. She was working hard devoting many hours to the project. She was also immensely patient and was not discouraged by initial imperfect attempts. This is a personal quality that is especially important for the research.

I have been working with Adéla for about four years. I was her bachelor thesis advisor as well. Although her bachelor thesis (on face image superresolution) was defended as A-excellent, I can clearly confirm that Adéla still made significant professional progress afterwards. I believe she is now a competent engineer and a promising researcher.

It was a pleasure for me to work with Adéla. I believe Adéla presented outstanding thesis and therefore I suggest assessment

A – excellent.

Ing. Jan Čech, Ph.D.
Thesis Advisor

## References

[1] T. Karras, S. Laine, M. Aittala, J. Hellsten, J. Lehtinen, and T. Aila, "Analyzing and improving the image quality of StyleGAN," in *Proc. IEEE CVPR*, 2020.

[2] V. Blanz and T. Vetter, "A morphable model for the synthesis of 3D faces," in *Proc. SIGGRAPH*, 1999.

[3] A. Šubrtová, J. Čech, and V. Franc, "Hairstyle transfer between face images," in *Proc. IEEE International Conference on Automatic Face and Gesture Recognition*, 2021, in Review.