

**Information on dissertation submitted for the PhD degree  
of National Research Tomsk State University**

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**Title of the dissertation:** Facial Attribute Editing for Realistic Image Synthesis  
Using Segmentation-Based Differential Activation

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**ABSTRACT OF THE DISSERTATION**

Facial attribute editing is a significant research problem in the field of computer vision. It aims to manipulate specific attributes of facial images (e.g., changing eyebrows, glasses, or age) while generating realistic images and

preserving the rest of the face and background information. However, existing methods have notable limitations: poor preservation of untargeted regions and the introduction of new artifacts. Although these methods have been widely used in virtual makeup trials, movie production, game development, and security systems, their performance in broader and more practical applications still needs improvement.

To address these challenges, we develop a novel facial attribute editing algorithm that integrates additional auxiliary information to enhance the accuracy and naturalness of editing results. Our algorithm, primarily based on deep learning, focuses on comprehensive and accurate feature extraction and segmentation, enabling precise modification of target attributes while maintaining consistency with the other facial and background information.

Building on the analysis of existing deep learning approaches and extensive experimental studies, we propose an innovative method that utilizes segmentation-based differential activation. This approach effectively preserves information unrelated to the edits, improves generation quality, and yields more precise editing results.

The results of the research:

- 1) We developed an improved segmentation-based differential activation module that more accurately identifies the regions to be edited.

- 2) A new method effectively reduces overlap artifacts in manipulation by using a mapping network instead of a generative model. This approach not only improves the quality of image processing but also reduces the number of parameters, thereby improving the efficiency of the system.

- 3) Comparative experiments conducted on the CelebA-HQ dataset show that our method surpasses existing methods in terms of generation quality. Our method demonstrates lower FID and LPIPS values and preserves more image-specific details, making it superior to current state-of-the-art methods.

*Keywords:* facial attribute editing, deep learning, artificial neural network, differential activation, deoverlapping network