Master's Project WT 2021/22

Research Group Computer Graphics Systems
Prof. Dr. Jürgen Döllner
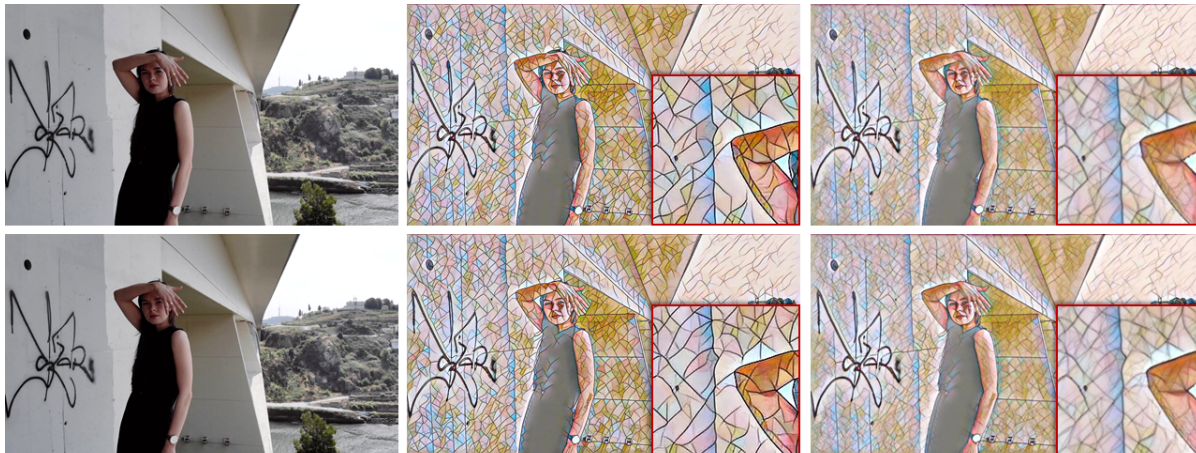
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Consistent Filtering of Video Streams

| Input video frames | Inconsistent results of per-frame processing | Consistent output frames |

Background

The stylization of videos is an unsolved problem in Computer Science: stylizing individual images of an image sequence result into conspicuous artifacts easily perceivable by the human visual system. This project addresses this problem.

Previously at the Computer Graphics Systems group, we have researched methods to extend the application of image-based filters to videos using two different techniques: (a) flow-based warping and (b) temporal denoising. As part of flow-based warping, we have also developed a solution for real-time estimation of optic flow using Convolutional Neural Networks (CNN). At present, both of these operate independently in a non- real-time and non-interactive way.

In this master project we aim to combine the ideas of flow-based warping and temporal denoising into a robust framework for consistent filtering of video streams, which works in real-time, is interactive, and provides improved consistency controls to the end-user. Moreover, we explore advanced techniques for temporal denoising that do not require pre-processing steps. The project will be based on technologies such as C++, Python, CUDA, Pytorch, Tensorflow, Qt, and more.

Description

This project's aim is to develop a framework that enables the application of any image-based filter to video streams in a consistent manner. Specific objectives will be discussed and detailed with the participants, but will be along the following high-level objectives:

- Application of state-of-the-art CNN-based optic flow models for per-frame video processing;
- Development of temporal denoising approach applicable on a per-frame basis;
- Enabling real-time throughput and interactivity for video streams;
- Providing both local and global consistency controls to end-users;
- Performing qualitative and quantitative evaluations and comparisons with existing approaches.

The master's project refers to current research and software projects of the Computer Graphics Systems group. It is especially suited for further research in the context of a master's thesis or a future doctoral thesis. Further, the master's project can lay a foundation for working as a student assistant or software developer at our research partners.

Contact

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