Posudek diplomové práce

Matematicko-fyzikální fakulta Univerzity Karlovy

Autor práce Bc. Štěpán Hojdar
Název práce Using neural networks to generate realistic skies
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Studijní program Informatika   **Studijní obor** Počítačová grafika a vývoj počítačových her

Autor posudku doc. Ing. Jaroslav Křivánek, Ph.D.   **Role** Vedoucí
Pracoviště KSVI

Text posudku:

The thesis addresses a new problem of data-driven generative modelling of images of cloudy skydomes. Inspired by the recent advances in generative neural networks, the thesis investigates applicability of such approaches to model the highly varying space of skydome images. Any data-driven modeling approach, of course, requires example data, which is why a substantial part of the thesis deals with the acquisition and processing of real skydome images. This involed testing various hardware and software setups, and assessing the pros and const of the various approaches with respect to the goal of acquiring tens of thousands of the skydome images necessary for neural network training. The result of this part of the thesis is the development of an acquisition and data processing protocol, which was, and is still being used to acquire what will probably become the most extensive skydome dataset ever taken.

In the second part of the thesis, the candidate investigates the use of progressively growing generative adversarial networks (GANs) for generative modeling of skydome images. Since a skydome is naturally supported by a hemisphere, while neural networks are designed to accept square images, various hemisphere-square mappings are investigated. Similarly, while skydome images feature an extremely high dynamic range of luminances, neural networks can only handle fairly low-dynamic range images. Various dynamic range reduction approaches were therefore investigated. A series of experiments, probing various aspects of the chosen neural network, are then presented. These experiments show that the network has sufficient capacity to model (overfit to) any one skydome image, or even a full timelapse sequence. However, the ability of the network to model the vast variety of possibly skydome appearances remains limited. The candidate then provides a list of possible directions for future research that could be followed to yield a high-quality skydome image generator.

In summary, the candidate has taken some fundamental steps in the direction of skydome modeling, showing the viability of generative adversarial networks as a tool for this purpose. Along the way, he has developed a data acquisition and processing pipeline. The resulting work shows the candidate's capability to independently tackle and open-ended research task, and I recommend the thesis for defense.

Práci doporučuji k obhajobě.

Práci navrhuji na zvláštní ocenění.

Pokud práci navrhujete na zvláštní ocenění (cena děkana apod.), prosím uveďte zde stručné zdůvodnění (vzniklé publikace, významnost tématu, inovativnost práce apod.).

Datum 20. August 2019   **Podpis**