Building Large High-Resolution Autonomous Driving Dataset For Optical Flow Estimation

ITRG MiniProposal

CSC400

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1. Introduction

Optical flow estimation, by definition, it’s pixel-level motion estimation between two consecutive frames in video. As a classical low-level vision task in the field of computer vision, optical flow estimation is often regarded as a feature extraction method over temporal dimension, which is critical for many high-level vision tasks, especially in video understanding, such as video action recognition, object-level tracking, etc.

With the advent of deep learning, many optical flow estimation methods relying on deep feature extraction, emerge. However, all of them is trained on some synthesized datasets (in order to get accurate ground-truth), resulting in a bad result when solving problems in real world videos, such as autonomous driving.

Most current industrial methods choose to other data sources of data to bypass the optical flow estimation problem, such as LiDAR, which however, requires expensive equipment to achieve it.
Our goal is to build a large-sized, real-world based, high-resolution autonomous driving dataset for tackle the optical flow estimation problem in autonomous driving, by just utilizing regular camera to reduce the cost of autonomous cars. To overcome the difficulty of obtaining ground truth, one possible solution is to adapt CycleGAN, an unsupervised generative model to generate optical flow. Other potential unsupervised method can also be our choices.

2. Challenges

Building a large scale dataset is time-consuming and expensive. So our first obstacle is research funding. Second, since current deep learning-based methods on optical flow estimation only work on high-resolution videos, high-resolution camera is necessary and increase the budget further.

Besides, unsupervised learning of optical flow estimation still requires further research. The feasibility of current methods, such as warp, GAN-based model, have not been verified on a large real-world based dataset.

3. Potential Benefits

Despite aforementioned challenges, the potential benefits is promising. In spite of large cost in research, it could possibly cut the cost of manufacturing autonomous cars significantly. It also help other video understanding tasks, in which the patterns of motions may be more various.

4. Research Plan

First, we would purchase some equipment, including high-resolution camera, cars for collecting data, etc. At the same time, we commit to improve the performance on unsupervised learning applied for optical flow estimation. Last, we’ll utilize the collected dataset and unsupervised methods to estimate optical flows, and make a comparison with the baseline model (synthesized data based with supervised learning).
Reference

[3] Sun, Deqing and Roth, Stefan and Black, Michael J, Secrets of optical flow estimation and their principles, CVPR 2010