LiteFlowNet: A Lightweight Convolutional Neural Network for Optical Flow Estimation

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1. Introduction

- LiteFlowNet is 30.26 times smaller in the model size and 1.36 times faster in the running speed than FlowNet2.
- Our network innovates the useful elements from conventional methods:
  - Brightness constraint in data fidelity to pyramidal feature extraction.
  - Image warping to feature warping.

2. Network Details

2.1. Cascaded Flow Inference

- We introduce a cascaded flow inference with feature warping and a flow regularization in each pyramid level.

2.2. Flow Regularization

- Desired: A network can smooth flow field and maintain crisp flow boundaries as regularization term in conventional variational methods.
- We introduce a feature-driven local convolution (f-lcon) layer.

- A feature-driven distance metric $D$ is trained to measure local flow variation from pyramidal feature, flow, and occlusion probability map.
- Channel $c$ of a flow patch $f$ is regularized by an adaptive f-lcon filter $g$:

$$g(x, y, c) = \exp(-D(x, y, c)^2)$$

where

$$D(x, y, c) = \sum_{i \in N(x, y)} \exp(-D(x_i, y_i, c)^2).$$

Examples demonstrate the effectiveness of the proposed components.