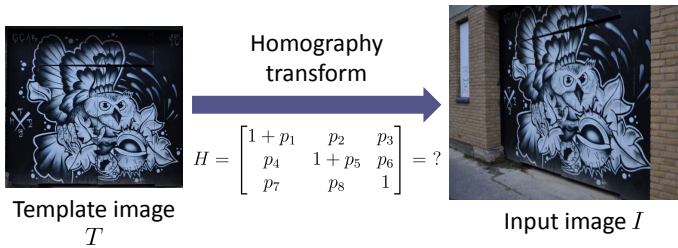


CLKN: Cascaded Lucas-Kanade Networks for Image Alignment

Che-Han Chang Chun-Nan Chou Edward Y. Chang
HTC Research

Homography Estimation



Lucas-Kanade Algorithm

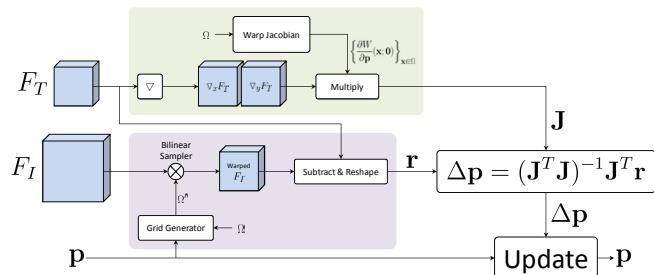
Goal: minimize $E(\mathbf{p}) = \frac{1}{2} \sum_{\mathbf{x}} \|T(\mathbf{x}) - I(W(\mathbf{x}; \mathbf{p}))\|^2$

Iterate:

- (1) Compute Gauss-Newton step $\Delta \mathbf{p}$
- (2) Update warp parameters \mathbf{p}

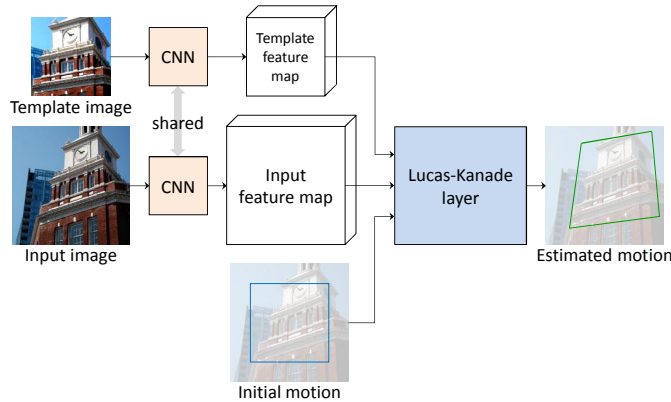
Until convergence

Lucas-Kanade Layer



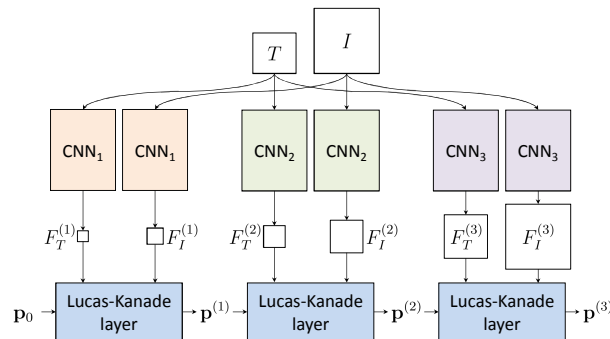
Lucas-Kanade Network

Idea: learning good features for Lucas-Kanade algorithm

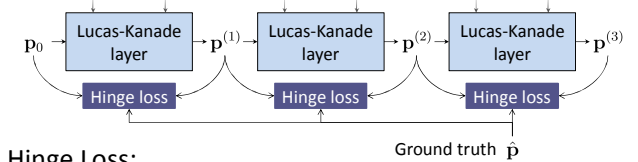


Cascaded Lucas-Kanade Network

Idea: feature learning with coarse-to-fine strategy



Loss Function



Hinge Loss:

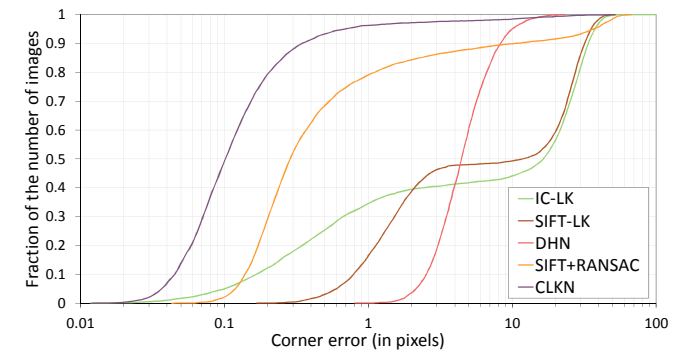
$$L(\mathbf{p}^{(i-1)}, \mathbf{p}^{(i)}, \hat{\mathbf{p}}) = \max(0, 1 + \delta + d(\mathbf{p}^{(i)}, \hat{\mathbf{p}}) - d(\mathbf{p}^{(i-1)}, \hat{\mathbf{p}}))$$

Experiments

Synthetic training/validation/testing sets from COCO images



Cumulative error distributions:



[1] S. Baker and I. Matthews. Lucas-Kanade 20 years on: A unifying framework. IJCV, 2004.
[2] D. DeTone, T. Malisiewicz, and A. Rabinovich. Deep image homography estimation. RSS Workshop on Limits and Potentials of Deep Learning in Robotics.