A NOVEL MONOCULAR DISPARITY ESTIMATION NETWORK WITH DOMAIN TRANSFORMATION AND AMBIGUITY LEARNING

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CONTRIBUTIONS

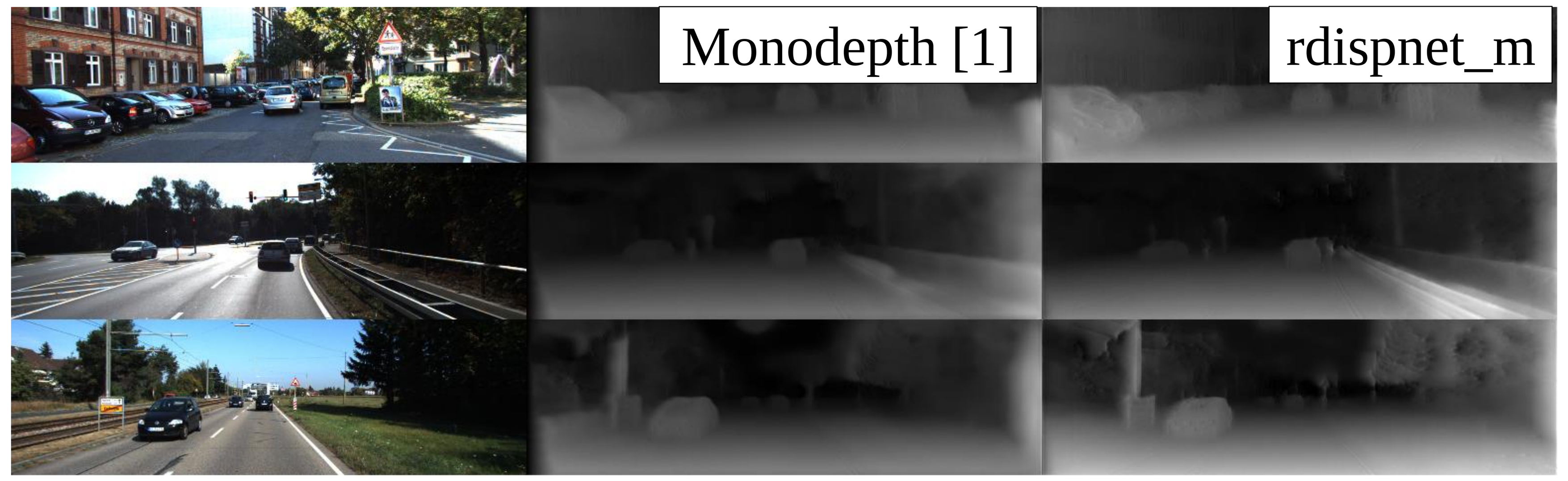
Our novel network architecture outperforms the unsupervised monocular baseline [1] by:

- Accounting for ambiguities (occluded, complex or cluttered image areas)
- Efficient fusion between encoder (left domain) and decoder (left-right domain) features via rectangular 5x3 convolutions and domain transformation blocks
- Full disparity estimation in a single pass
- 50% parameter reduction

TAKING INTO ACCOUNT AMBIGUITIES

The network predicts the ambiguity masks for both left and right disparities. The ambiguity masks weight most terms of the total loss function consisting of photometric reconstruction (l1 + SSIM), edge preserving smoothness, perceptual, ambiguity penalty, and left-right consistency terms: $l_s = a_{rec} l_{rec} + a_{ds} \frac{0.1}{2^{s-1}} l_{ds} + a_p l_p + a_a l_a + a_{lr} l_{lr}$

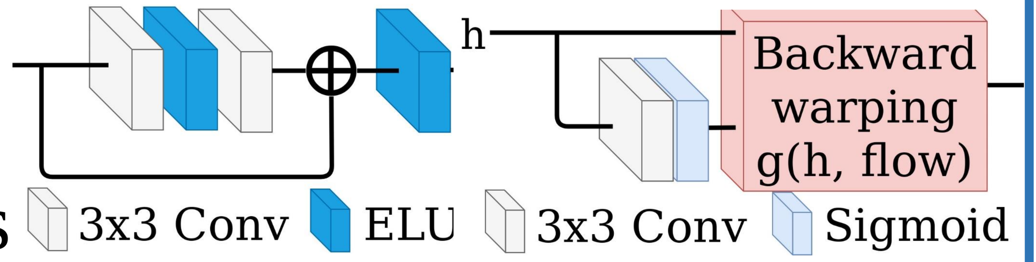
FULL DISPARITY ESTIMATION IN A SINGLE PASS



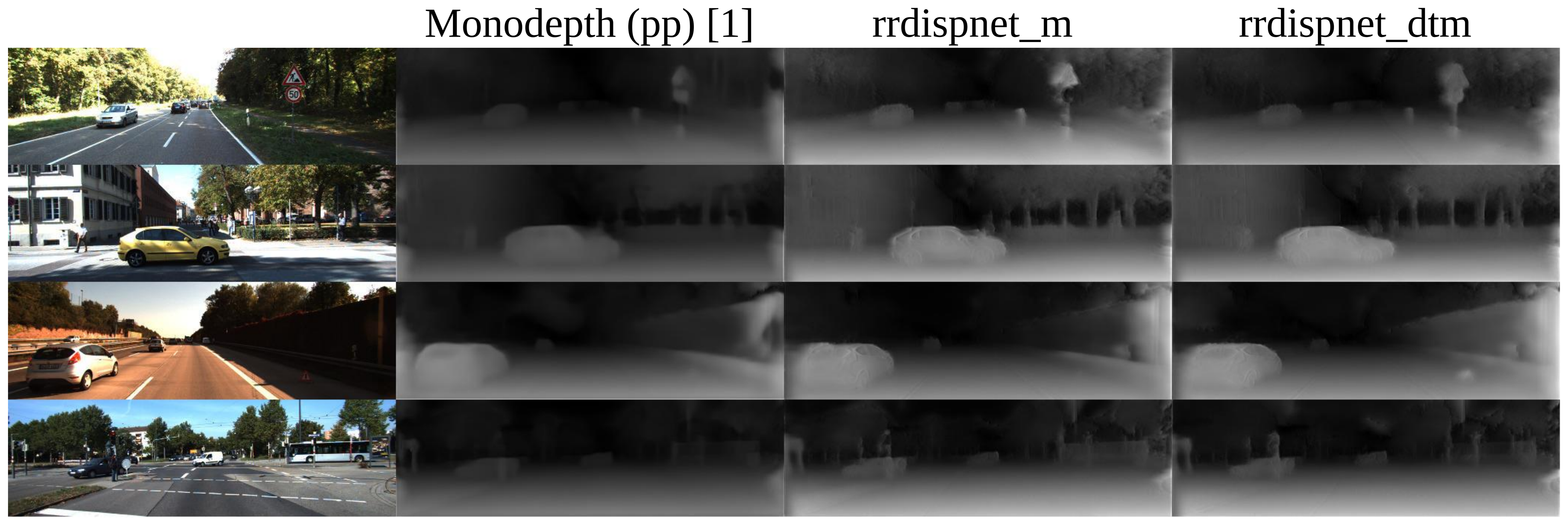
Ambiguity learning allows for full depth estimation in a single pass.

RESIDUAL AND DOMAIN TRANSFORMATION BLOCKS

For better feature extraction with less filter channels, and content alignment between left and right domain features

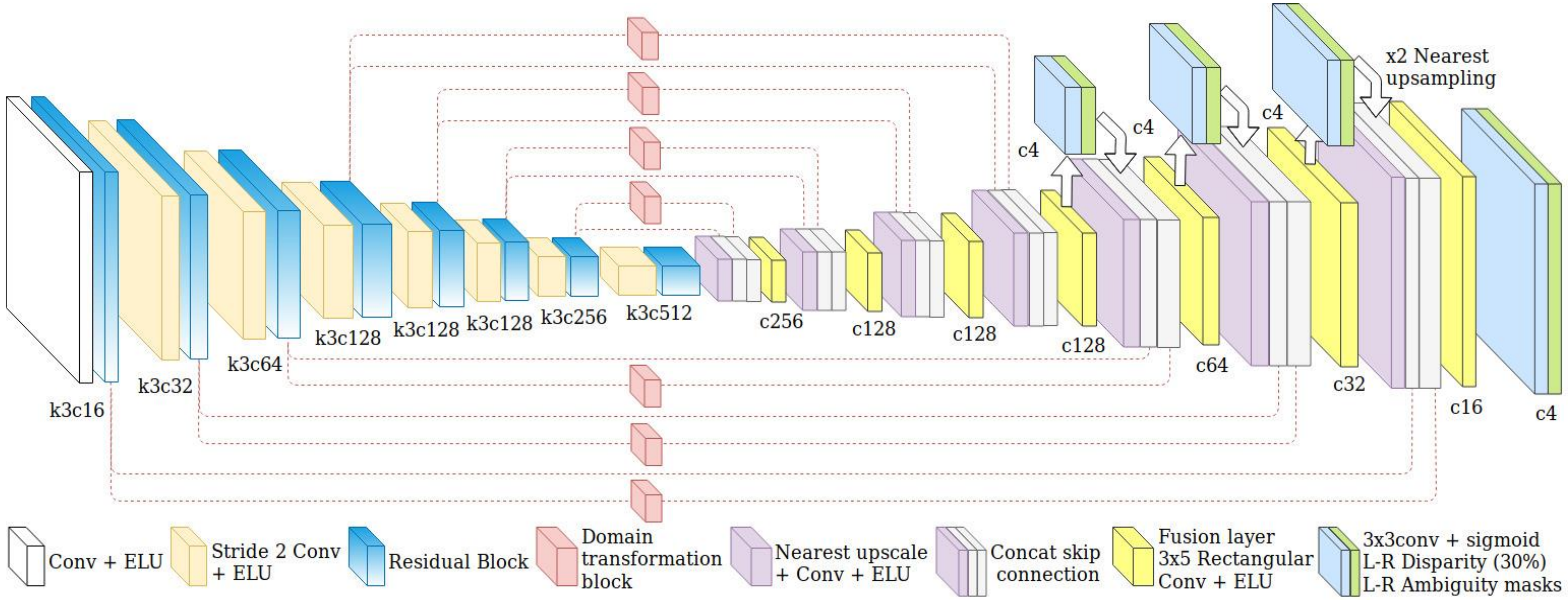


EXPERIMENTAL RESULTS ON THE KITTI DATASET



Model	D	R	F	abs rel	sq rel	rmse	log rmse	a1	a2	a3
Monodepth				0.149	2.565	6.645	0.245	0.849	0.936	0.969
Monodepth pp			x	0.114	1.138	5.452	0.204	0.859	0.946	0.977
rdispnet_m			x	**0.111**	**1.031**	5.416	0.199	0.860	0.948	0.978
rrdispnet_m		x	x	0.113	1.114	5.364	**0.195**	**0.866**	**0.951**	**0.981**
rrdispnet_dtm	x	x	x	0.112	1.038	**5.304**	0.198	0.863	0.950	0.979
rrdispnet_m pp		x	x	0.105	0.949	5.174	0.190	0.866	0.952	0.981

PROPOSED NETWORK ARCHITECTURE



[1] Clement Godard, Oisin Mac Aodha, and Gabriel J. Brostow, "Unsupervised monocular depth estimation with left-right consistency," in CVPR, July 2017.