ETHzürich TOSHIBA





SGM-Nets: Semi-global matching with neural networks ¹Toshiba Corporation ²ETH Zurich ³Microsoft

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4. Signed parameterization

P1/P2 have different penalties depending on either positive or negative disparity change. Eq.(1) becomes to

$$E(\hat{D}) = \min_{D} \sum_{\mathbf{x}} \left(c(\mathbf{x}, d^{\mathbf{x}}) + \sum_{\mathbf{y} \in N_{\mathbf{x}}} P_{1}^{+} T \left[\delta d = 0 \right] \right)$$

 \rightarrow SGM-Net is also applicable to the parameterization

5. SGM-Net architecture

• Standard and Signed SGM-Nets output 8 and 16 values, respectively.



6. Results Synthetic dataset

SceneFlow: https://lmb.informatik.uni-freiburg.de/

- ZNCC / MC-CNN as a matcher
- Various settings of SGM.

Percentage of erroneous pixels on non-occluded areas with an error threshold of 3 pixels $\rightarrow \rightarrow \rightarrow$

Real dataset KITTI: http://www.cvlibs.net/datasets/kitti/

- MC-CNN as a matcher (67 [sec.] for the matching)
- Got 1st rank at the CVPR deadline[#]



[1] H.Hirschmuller, "Stereo Processing by Semiglobal Matching and Mutual Information", PAMI 2008. [2] J.Zbontar et al., "Stereo Matching by Training a Convolutional Neural Network to Compare Image Patches", JMLR2016.





- 3x3 16 filters and 128 dim FCs
- Computation takes 0.02 seconds on GPU

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Method	Test [%] (scene_backwards)	
Hand tuned	Fixed	24.0 / 23.2
	Dynamic	24.0 / 22.0
	Initial	32.9 / 32.8
Standard	Neighbor cost	23.4 / 22.3
Stanuaru SGM-Net	Path cost	21.7 / 20.1
SOM-INCL	All	21.2 / 19.5
	All (w/o pos.)	22.3 / 20.1
	Initial	33.2 / 32.9
Signed	Neighbor cost	24.3 / 22.5
SGM-Net	Path cost	20.4 / 18.3
	All	20.4 / 18.3



(d) SGM-Net(Neighbor cost) (e) SGM-Net with all costs

Hand tuned SG Signed SGM-Net

KITTI 2012

Rank	Method	Error	Time [sec.]				
1	Signed SGM-Net	2.29%	67*				
2	Standard SGM-Net	2.33%	67*				
3	PBCP	2.36%	68*				
4	Displets v2	2.37%	265				
5	MC-CNN-acrt	2.43%	67*				
#18/10/2016 except anonymous submission							