Supplementary Appendix for LIFT: Learned Invariant Feature Transform

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1 Supplementary Appendix

In this appendix, we provide the implementation details necessary to make our experimental results reproducible. Second, we provide references to the algorithms used as baselines.

1.1 Implementation details

Table 1 details the parameters of the different components in our LIFT network.

	Conv. filter	# of nodes	Pooling	Activation	Stride
Kp-1	25×25	1		GHH, $N = 4$, $M = 4$	—
Кр-2 Кр-3	softargmax Mapping Spatial Transformer 'Crop'				
Ori-1	5×5	10	Max pooling	ReLU	
Ori-2	5×5	20	Max pooling	ReLU	
Ori-3	3×3	50	Max pooling	ReLU	
Ori-4	1×1	100	_	GHH, $N = 4, M = 4$	_
Ori-5	1×1	2		GHH, $N = 4, M = 4$	—
Ori-6	arctan Mapping				
Ori-7	Spatial Transformer 'Rot'				
Desc-1	7×7	32	l_2 pooling, 2×2	Tanh	2
Desc-2	6×6	64	l_2 pooling, 3×3	Tanh	3
Desc-3	5×5	128	l_2 pooling, 4×4	Tanh	4

 Table 1. The LIFT network architecture.

During the descriptor training, we use Stochastic Gradient Descent with momentum. With the trained descriptor, we train the Orientation Estimator with the ADAM [1] solver. Finally, the Detector is trained in conjunction with the two components using ADAM as well.

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1.2 Implementations of the Compared Methods

For fair comparison, we used the authors implementations where applicable, as well as the publicly available ones. All methods were used with default parameters, unless stated otherwise.

- SIFT [2]: OpenCV library. http://opencv.org/downloads.html
- SIFT-HesAff [3]: VLFeat library. http://www.vlfeat.org/download.html
- SURF [4]: OpenCV library. http://opencv.org/downloads.html
- KAZE [5]: Implementation by the authors.
 https://github.com/pablofdezalc/kaze
- ORB [6]: OpenCV library.
 http://opencv.org/downloads.html
 To obtain enough keypoints we used nFeatures=1000 and nLevels=3.
- Daisy [7]: Provided by the authors.
 https://github.com/etola/libdaisy
 Patches were extracted to be four times the scale, which was the value authors used in [8].
- sGLOH [9]: Implementation by the authors. http://www.math.unipa.it/fbellavia/htm/research.html
- MROGH [10]: Implementation by the authors. https://github.com/bfan/MROGH-feature-descriptor
- Edge Foci [8] and BiCE [7]: Implementation by the authors. http://research.microsoft.com/en-us/downloads/ ae6ab93a-4e17-46b9-a1e4-907aeb64d1e5/
- BRISK [11]: Implementation by the authors.
 http://www.asl.ethz.ch/people/lestefan/personal/BRISK
 To obtain enough keypoints we used threshold of 20.
- FREAK [12]: Implementation by the authors. https://github.com/kikohs/freak
- VGG [13]: Implementation by the authors.
 http://www.robots.ox.ac.uk/~vgg/software/learn_desc/
 http://www.vlfeat.org/download.html
 Patches were extracted with the VLFeat library, with a relativeExtent of 7.5, which is the same as what SIFT uses. We use the pre-learned model learned with the *liberty* dataset from [13].
- MatchNet [14]: Implementation by the authors.
 https://github.com/hanxf/matchnet
 We use the models learned with the *liberty* dataset.
- DeepDesc [15]: Implementation by the authors.
 https://github.com/etrulls/deepdesc-release
 We used the models trained on split #4.
- PN-Net [16]: Implementation by the authors.
 https://github.com/vbalnt/pnnet
 We used the networks trained on the *liberty* dataset.

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