CoMaL Dataset

November 13, 2015

In order to evaluate the performance of point detectors at the object boundary regions and under a varying background, we have designed the challenging CoMaL dataset. The dataset has objects, homogeneous and textured, moving against a set of differently textured books as shown in Fig. 1 and Fig. 2.

With the knowledge of the static background image, the delineation of the foreground object boundary is made possible through background subtraction as shown in Fig. 3. This enables an analysis of the performance of the features at the boundary and non-boundary regions of the object.

Ground-truthing is done by assuming that the point position relative to the detected foreground blob remains the same.

1 Results

Qualitative and Quantitative Results: Matches obtained with CoMaL+SSD and Hessian+SIFT (which performs second-best in our evaluation) are shown visually for a homogeneous object in Fig. 4 and for a textured object in Fig. 5.

We can observe that CoMaL points are correctly re-detected at the cornered locations on the boundary of the object more often than other methods.

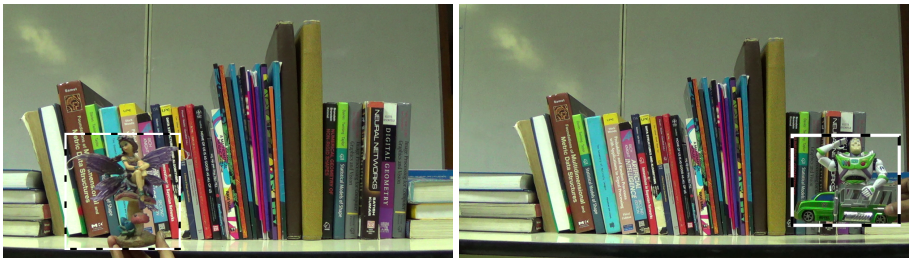

Figure 1: Example Non homogenous objects in the CoMaL dataset: Doll and Hero

Figure 2: Example Homogenous objects in the CoMaL dataset: Box and House.

(a) (b)

Figure 3: (a) An image frame with the House object. (b) The background subtracted image with only the foreground object.

Figure 4: Matches on the Homogenous object - Box are shown. CoMaL + SSD matches are shown in the first two rows followed by Hessian + SIFT in the next rows. CoMaL finds most of the corners at the boundary of the Box object in spite of a significant change in the background, while Hessian+SIFT points are missed at several locations and are shifted (match shown in red).

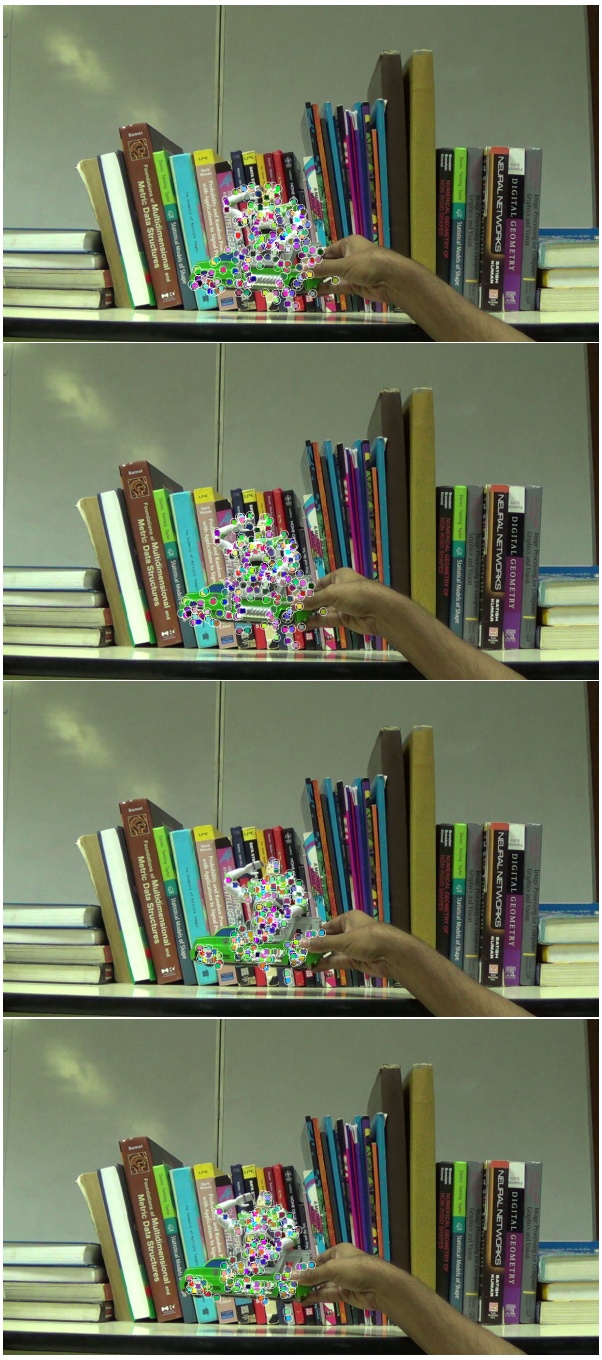

Figure 5: Matches on the Textured object - Hero are shown. CoMaL + SSD matches are shown in the first two rows followed by Hessian + SIFT in the next rows. While CoMaL points are better distributed across the object, with several matches in the boundary regions and a good number of matches in the interior portions, Hessian has good numbers only in the interior portions.

Type	Seq	CoMaL+SSD	SSD				NSD				SIFT			
			Harris	Hessian	MSER	FAST	Harris	Hessian	MSER	FAST	Harris	Hessian	MSER	FAST
Textured	Pens	**27.6**/0.9	12.6/0.8	8.5/0.9	0.2/0.2	3.2/0.8	14.8/0.9	17.0/0.9	0.3/0.3	15.1/0.9	12.1/0.8	20.8/0.9	0.5/0.4	12.3/0.9
	Doll	**39.0**/0.9	14.8/0.8	11.7/0.8	0.6/0.3	9.0/0.8	21.4/0.9	29.4/0.9	0.4/0.5	31.1/0.9	16.2/0.8	22.3/0.9	0.7/0.6	24.7/0.9
	Toy	**31.2**/0.8	9.0/0.7	13.6/0.8	0.7/0.4	12.3/0.8	13.1/0.8	11.9/0.8	0.3/0.3	11.7/0.8	10.4/0.7	12.8/0.8	0.4/0.4	13.6/0.8
	Hero	**47.4**/0.9	16.4/0.9	17.8/0.9	1.2/0.5	16.7 /0.9	18.2/0.8	29.6/0.9	1.1/0.6	30.0/0.9	15.9/0.8	24.0/0.9	1.3/0.7	25.1/0.9
	Race-car	**52.5**/0.9	17.0/0.8	18.6/0.8	0.7/0.5	12.4/0.9	20.7/0.9	30.6/0.9	0.4/0.4	27.9/0.9	16.5/0.8	31.0/0.9	0.6/0.5	28.3/0.9
Homogeneous	Box	**37.5**/0.9	14.5/0.9	21.8/0.9	0.5/0.2	19.3/0.9	19.4/0.9	19.2/0.9	0.3/0.4	18.8/0.8	16.3/0.9	25.3/0.9	0.5/0.4	24.5/0.9
	Tape-Box	**39.1**/0.9	15.9/0.9	16.0/0.9	0.8/0.5	16.5/0.9	18.9/0.9	25.2/0.9	0.5/0.3	26.2/0.9	16.3/0.9	21.3/0.9	0.6/0.4	26.3/0.9
	House	**32.9**/0.9	13.2/0.9	21.0/0.9	0.6/0.4	22.4/0.9	17.7/0.8	25.0/0.9	0.5/0.5	27.5/0.9	13.9/0.8	25.7/0.9	0.7/0.6	28.8/0.9
	Average	**38.4**	14.2	16.1	0.7	14.0	18.0	23.5	0.5	23.6	14.7	22.9	0.7	23.0

Table 1: Number of Correct Matches M_{cor} on the boundary regions for sequences in the CoMaL dataset averaged over all the frames in the sequence. The second number is the Matching accuracy M_{acc} for the method. The best is in bold and the second best is underlined.

Type	Seq	CoMaL+SSD	SSD				NSD				SIFT			
			Harris	Hessian	MSER	FAST	Harris	Hessian	MSER	FAST	Harris	Hessian	MSER	FAST
Textured	Pens	<u>64.1</u>/0.9	29.9/0.9	52.1/0.9	6.6/0.4	46.7/0.9	32.2/0.9	64.2/0.9	6.4/0.4	46.6/0.9	29.8/0.9	**70.8**/0.9	9.2/0.5	58.2/0.9
	Doll	**119.5**/0.9	32.6/0.8	88.2/0.8	13.8/0.5	50.5/0.9	39.8/0.9	96.5/0.9	11.2/0.5	66.3/0.9	36.2/0.9	<u>117.0</u>/0.9	15.5/0.8	69.2/0.9
	Toy	<u>84.3</u>/0.9	22.8/0.8	60.8/0.8	7.8/0.5	45.4/0.8	28.8/0.9	78.5/0.9	7.4/0.4	58.3/0.9	21.9/0.9	**95.2**/0.9	9.1/0.6	77.9/0.9
	Hero	<u>152.0</u>/0.9	51.7/0.9	123.2/0.9	19.3/0.6	111.5/0.9	53.0/0.9	139.5/0.9	20.6/0.6	118.3/0.9	45.7/0.9	**157.5**/0.9	21.6/0.7	148.6/0.9
	Race-car	<u>118.9</u>/0.9	42.2/0.9	116.3/0.9	15.6/0.6	**119.2**/0.9	44.2/0.9	114.5/0.9	3.7/0.2	100.2/0.9	42.0/0.8	105.0/0.9	11.7/0.4	114.9/0.8
Homogeneous	Box	**33.5**/1.0	15.6/0.8	25.0/1.0	1.5/0.3	19.2/1.0	18.3/0.9	27.3/1.0	0.9/0.2	18.2/1.0	16.9/0.9	<u>32.0</u>/1.0	1.3/0.5	23.5/1.0
	Tape-Box	**40.7**/1.0	20.2/0.8	18.0/1.0	3.7/0.6	14.0/1.0	21.6/0.9	24.5/1.0	3.6/0.5	18.0/1.0	21.6/0.8	<u>27.0</u>/1.0	4.0/0.5	22.5/1.0
	House	**67.6**/0.8	36.6/0.8	49.2/0.8	20.3/0.5	33.4/0.8	43.1/0.8	63.2/0.8	12.6/0.5	48.5/0.8	35.6/0.8	<u>64.5</u>/0.8	17.3/0.7	53.7/0.8
	Average	**85.1**	31.5	66.6	11.1	55.0	35.1	76.0	8.3	59.3	31.2	<u>83.6</u>	11.2	71.1

Table 2: Number of Correct Matches M_{cor} on the non-boundary regions for sequences in the CoMaL dataset averaged over all the frames in the sequence. The second number is the Matching accuracy M_{acc} for the method. The best is in bold and the second best is underlined.