Segmentation based features for wide-baseline multi-view reconstruction

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Problem Definition

A common problem in wide-baseline stereo is the sparse and non-uniform distribution of correspondences when using conventional detectors such as SIFT, SURF, FAST and MSER for sparse and dense scene reconstruction.

Contribution

A novel segmentation based feature detector SFD that produces:
(a) Increased number of 'good' features for wide-baseline reconstruction;
(b) Increased scene coverage and improved accuracy;
(c) Order of magnitude increase in wide-baseline matches and reconstructed points. Matches are consistent across views.

Method and application

Original Images — Segmentation — Proposed Features — Matches

Dense reconstruction — Clustering — Sparse reconstruction

(a) — (b)
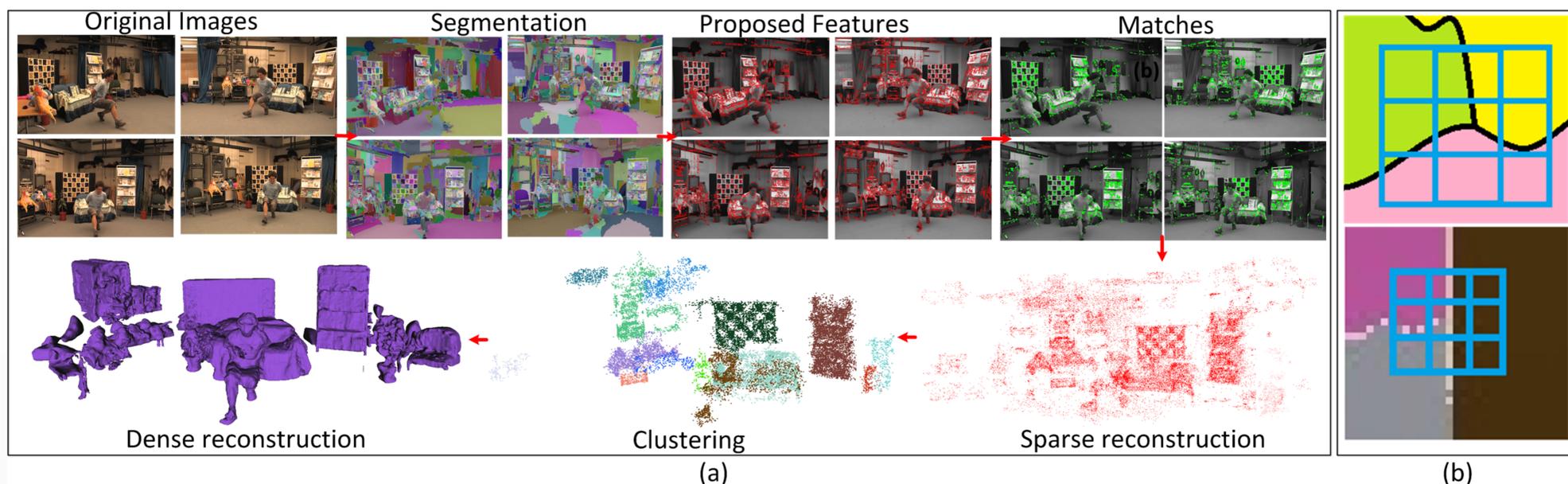
SFD for wide-baseline reconstruction: (a) Framework (b) Definition of SFD feature and example for Odzemok.

Evaluation and results

SIFT — SFD
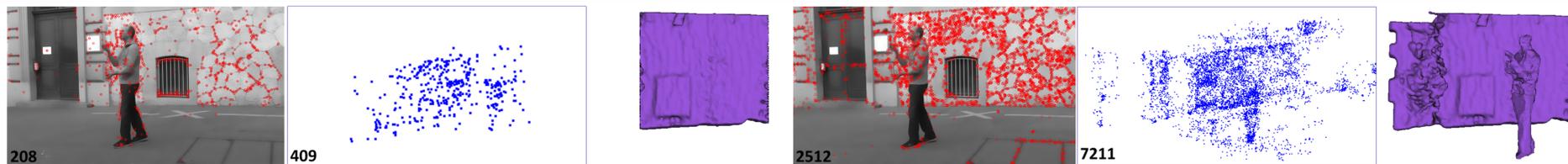
Comparison of features, sparse and dense reconstruction points for Juggler dataset(6 handheld cameras).

Original Image — Watershed — Mean-Shift — SLIC

Dataset	SFD-MS	SFD-SLIC	SFD-WA	SIFT
Merton	8118	**10965**	9619	316
Valbonne	3369	**5121**	4084	261
Odzemok	9087	**14515**	12385	1884
Rossendale	1017	**3983**	2213	238
Cathedral	9733	**12895**	10840	960
Juggler	6501	**8102**	7211	409

Different segmentation algorithms for SFD detection.
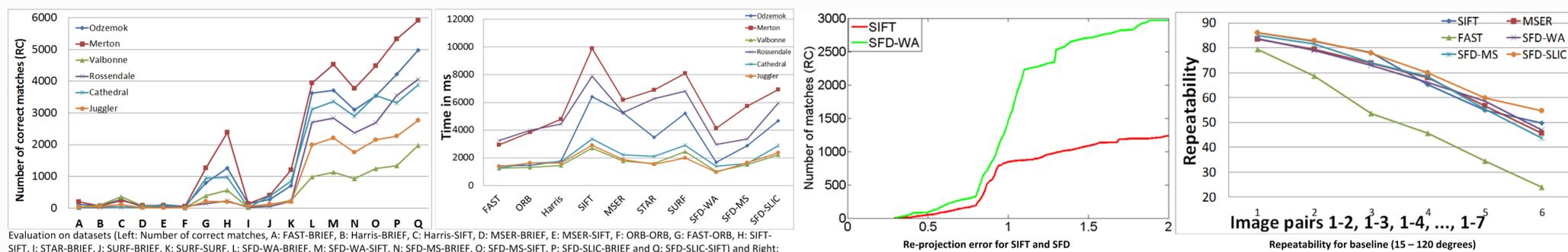
Evaluation on datasets (Left: Number of correct matches, A: FAST-BRIEF, B: Harris-BRIEF, C: Harris-SIFT, D: MSER-BRIEF, E: MSER-SIFT, F: ORB-ORB, G: FAST-ORB, H: SIFT-SIFT, I: STAR-BRIEF, J: SURF-BRIEF, K: SURF-SURF, L: SFD-WA-BRIEF, M: SFD-WA-SIFT, N: SFD-MS-BRIEF, O: SFD-MS-SIFT, P: SFD-SLIC-BRIEF and Q: SFD-SLIC-SIFT) and Right: Time for detecting features on a wide-baseline stereo pair for each sequence in *ms*.

Evaluation: Top: Matches and speed for all datasets; Bottom: Accuracy and Repeatability for Odzemok.

Conclusion

SFD evaluation on wide-baseline image pairs of indoor and outdoor scenes gives more features, matches and reconstructed points with improved accuracy compared to the existing approaches.