Augmented Reality & Video Service Emerging Technologies

SIFT SURF FAST BRIEF ORB BRISK

Prof. Jong-Moon Chung

SIFT SURF FAST BRIEF ORB BRISK

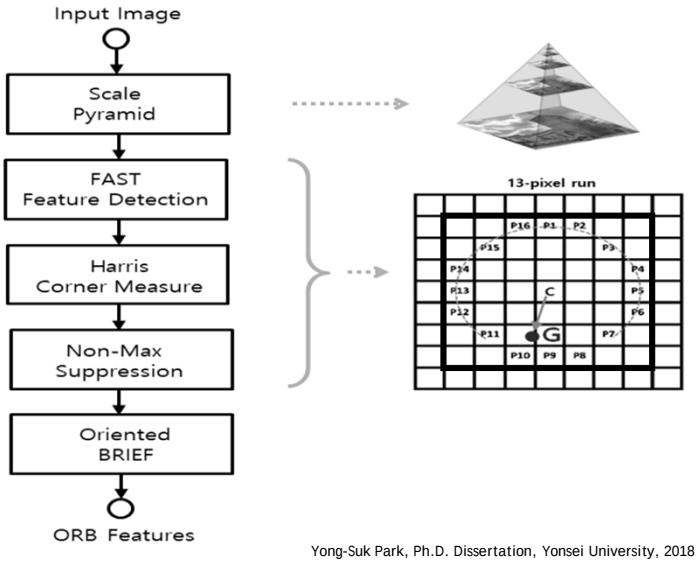
ORB

ORB

❖ ORB: Oriented FAST and Rotated BRIEF

- ORB combines features of FAST and BRIEF for feature extraction & description
- Fast computation speed
- Efficient memory usage
- High matching accuracy
- ORB can be used instead of SIFT and SURF for feature extraction

ORB Feature Extraction Process



Yong-Suk Park, Ph.D. Dissertation, Yonsei University, 2018

ORB

❖ Multi-Scale Image Pyramid

- Multi-scale feature based scale pyramid is used
- FAST & rBRIEF (Rotated version of BRIEF) are applied to each scale of the image pyramid

❖ FAST Feature Detection

- FAST corner detector is used to detect keypoints

ORB

❖ Harris Corner Measure

- Applied on the keypoints to select the top *N* points with the strongest FAST responses
- Center of gravity (centroid) *G* of an image patch is computed with moments to improve rotation invariance

ORB

❖ Oriented BRIEF

- Orientation is computed based on the direction of the vector from the keypoint to *G*
- BRIEF features use the orientation information to be rotation-invariant
- rBRIEF (Rotated version of BRIEF) is used as the binary descriptor

ORB

❖ Search & Matching process

- Correspondence search uses MP-LSH (Multi-Probe Locally Sensitive Hashing)
- When a match fail occurs, neighboring buckets are searched for matches
- MP-LSH uses fewer hash tables to save memory consumption
- MP-LSH generates more consistent hash bucket sizes compared to BRIEF

SIFT SURF FAST BRIEF ORB BRISK

References

References

- **J.-M. Chung, Y.-S. Park, J.-H. Park, and H. Cho, "Adaptive Cloud Offloading of Augmented Reality Applications on Smart Devices for Minimum Energy Consumption,"** *KSII Trans. Internet Inf. Syst.*, **vol. 9, no. 8, pp. 3090-3102, Aug. 2015.**
- **T. Lindeberg, "A Survey of Recent Advances in Visual Feature Detection,"** *Neurocomputing*, **vol. 149, pp. 736-751, 2015.**
- **Y. Li, S. Wang, Q. Tian, and X. Ding "Scale-Space Theory: A Basic Tool for Analysing Structures at Different Scales,"** *Journal of Applied Statistics*, **vol. 21, no. 2, pp. 224-270, 1994.**
- **D. Lowe, "Distinctive Image Features from Scale-Invariant Keypoints,"** *Int. Journal of Computer Vision*, **vol. 60, no. 2, pp. 91-110, Nov. 2004.**
- **H. Bay, A. Ess, T. Tuytelaars, and L. Van Gool, "Speeded-Up Robust Features (SURF),"** *Computer Vision and Image Understanding*, **vol. 110, no. 3, pp. 346-359, June 2008.**
- **E. Rosten and T. Drummond, "Machine Learning for High-speed Corner Detection," in** *Proc. of the 9th European Conf. on Computer Vision (ECCV '06)*, **Graz, Austria, May 2006, pp. 430-443.**
- **M. Calonder, V. Lepetit, C. Strecha, and P. Fua, "BRIEF: Binary Robust Independent Elementary Features," in** *Proc. European Conf. on Computer Vision (ECCV 2010)*, **Heraklion, Greece, Sep. 2010, pp. 778-792.**
- **E. Rublee, V. Rabaud, K. Konolige, and G. Bradski, "ORB: An Efficient Alternative to SIFT or SURF," in** *Proc. 2011 IEEE Int. Conf. on Computer Vision (ICCV)*, **Barcelona, Spain, Nov. 2011, pp. 2564-2571.**
- **S. Leutenegger, M. Chli, and R. Siegwart, "BRISK: Binary Robust Invariant Scalable Keypoints," in** *Proc. 2011 IEEE Int. Conf. on Computer Vision (ICCV)*, **Barcelona, Spain, Nov. 2011, pp. 2548-2555.**
- **E. Mair, G. Hager, D. Burschka, M. Suppa, and G. Hirzinger, "Adaptive and Generic Corner Detection Based on the Accelerated Segment Test," in** *Proc. European Conference on Computer Vision (ECCV 2010)*, **Heraklion, Greece, Sep. 2010, pp. 183-196.**
- **Yong-Suk Park, "Computation Resource Allocation Through Smart Device Ad-hoc Cloud Establishment in Mobile Environments." Ph.D. Dissertation, Yonsei University, 2018.**