

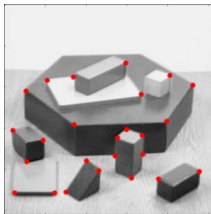
Feature Detection Algorithms

Jun Okamoto Jr.

Feature Detection Algorithms

- Moravec corner detector — H. Moravec; 1980
- Harris corner detector — C. Harris, M. Stephens; 1988

Harris corner detector



<https://medium.com/@wath/harris-corner-detector-an-overview-of-the-original-paper-c20c502ab0f>

Feature Detection Algorithms

- SIFT (Scale Invariant Feature Transform) — D. Lowe; 2004
- FAST (Features from Accelerated Segment Test) — E. Hosten, T. Drummond; 2006
- SURF (Speed-up Robust Features) — H. Bay, A. Ess, T. Tuytelaars, L. Van Gool; 2009
- BRIEF (Binary Robust Independent Elementary Features) — M. Calonder, M. V. Lepetit, C. Strecha, P. Fua; 2010
- ORB (Oriented FAST and Rotated BRIEF) — E. Rublee; 2011
- AKAZE (Accelerated-KAZE) — P. F. Alcantarilla, J. Nuevo, Adrien Bartoli; 2011

Feature Detection Algorithms Applications

- Camera calibration
- Object Recognition
- Robot navigation
- Panoramas (multiple view mosaic)
- 3-D reconstruction

Examples

- SIFT Descriptors



https://opencv-python-tutobols.readthedocs.io/en/latest/py_tutorials/py_features2d/py_sift_intro_py_sift_intro.html

Examples

- Object recognition



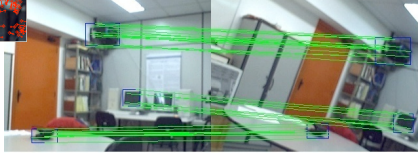
Guizilini (2008)

Examples

- SIFT and image matching with rotation



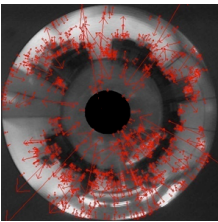
SIFT descriptors



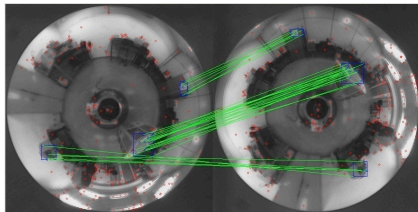
Matching

Examples

- SIFT and matching with omnidirectional vision



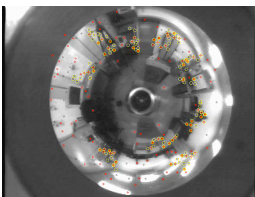
Descritores SIFT



Matching

Example

- SLAM with SIFT



Examples

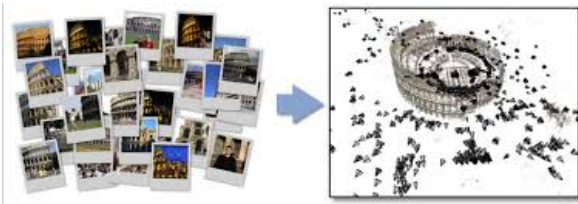
- Panorama (multiple view mosaic)



https://www.imagesearch.com/wp-content/uploads/2018/12/image_stitching_opencv_header.jpg

Examples

- 3-D reconstruction

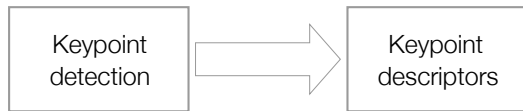


https://web.stanford.edu/class/cs231a/psproj_projects_2015/CS231a-FinalReport-agnoccam.pdf

Reference paper

- Lowe, D.G. Distinctive Image Features from Scale-Invariant Keypoints. International Journal of Computer Vision 60, 91–110 (2004). <https://doi.org/10.1023/B:VISI.0000029664.99615.94>

SIFT algorithm structure



- construction of a representation in the scale space
 - take DoG
 - localize DoG extrema
 - filter responses excess
- assign orientation to keypoints
 - construction of keypoint descriptors

The assignment

- Study the paper from Lowe (2004)
- Explain in detail how the algorithm works
- Research in the Internet an application of the algorithm
- Describe the use of the SIFT algorithm in the application
- Analyse in detail the results
- Submit a report in 1 week (upload the researched paper and the report in the Moodle)