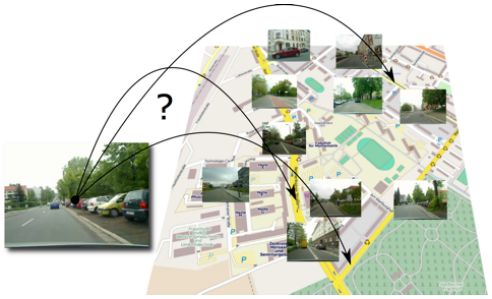
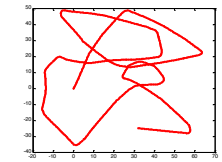
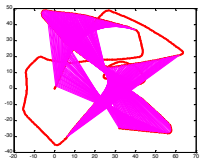
Visual Place Recognition (a.k.a. Loop Closure Detection) Part II

Visual loop closure detection (a.k.a. visual place recognition)



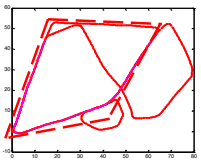


odometry ***U***



loop closures ***Z***

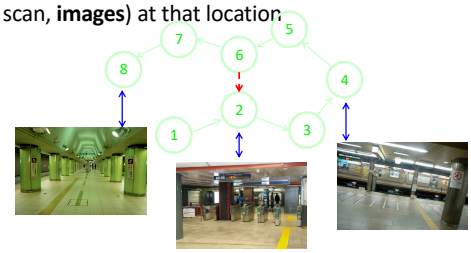
ground truth



X

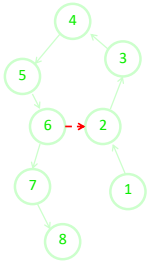
Pose-Graph SLAM

- Topological map of key locations, each of which is described by sensory measurements (e.g., laser scan, **images**) at that location

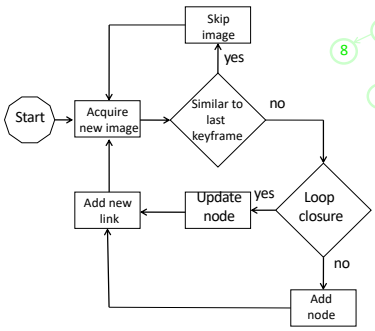


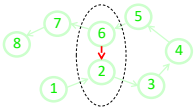
Pose-Graph SLAM

- Mapping: visual sampling of environment
  - Key location or key frame detection
  - Loop closure detection (LCD) by matching images
- Localization = LCD
- Metric information from "pose-graph SLAM"
  - Calculate robot poses from odometry and loop closures



Keyframes in pose-graph SLAM

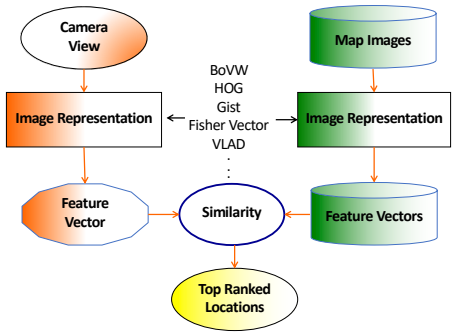




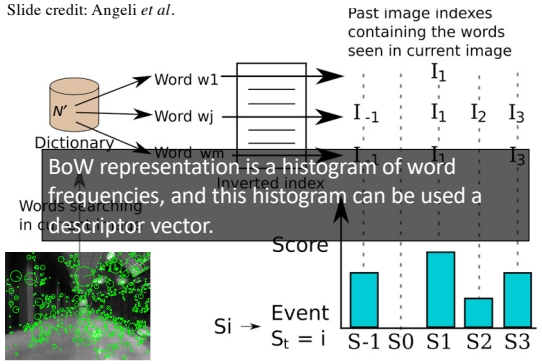
Challenges in visual place recognition

Mapillary HK

General VPR Framework



Slide credit: Angeli *et al.*



BoW representation is a histogram of word frequencies, and this histogram can be used a descriptor vector.

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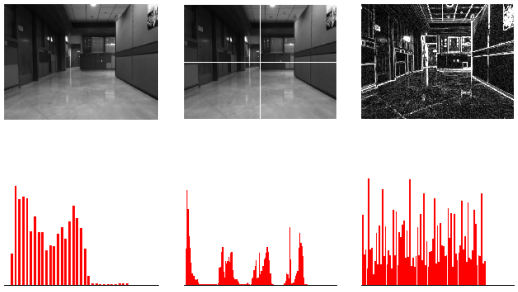
Other Whole Image Descriptors



Histogram | Local histogram | Gradient based

Gabor-Gist

Visual loop closure detection with a compact image descriptor [PDF] ieee.org

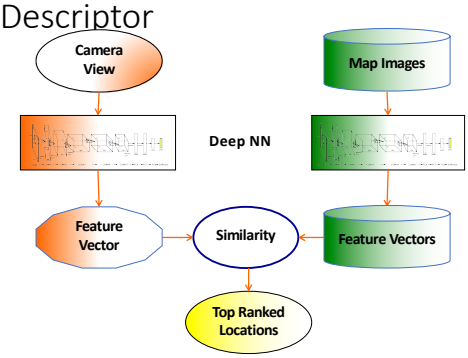
Y Liu, H Zhang - 2012 IEEE/RSJ International Conference on …, 2012 - ieeexplore.ieee.org

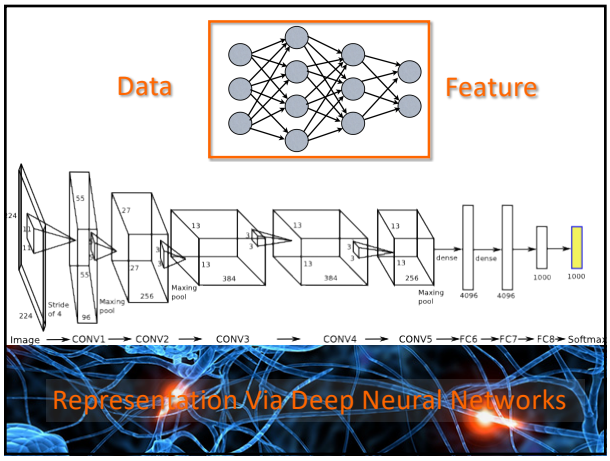
In this paper, we present a method for visual loop closure detection using a compact image descriptor, Gabor-Gist. In contrast to the Bag-of-Words (BoW) approach, which is dominant in recent studies of the loop closure detection problem that derives an image descriptor from locally extracted keypoint descriptors, our method relies on a single efficient image descriptor of low dimension to describe and measure similarities among images. We employ PCA to transform a high dimensional Gabor-Gist descriptor to a lower dimensional form to …

☆ Cited by 80 Related articles All 4 versions

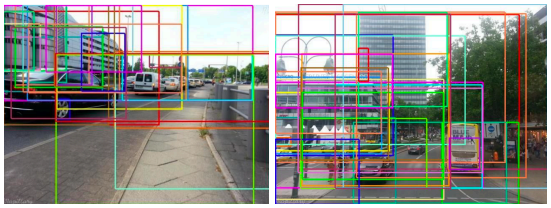
Yang Liu and Hong Zhang, **Visual Loop Closure Detection with a Compact Image Descriptor**, 2012 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Algarve, Portugal, October 2012

VPR: Whole Image ConvNet Descriptor

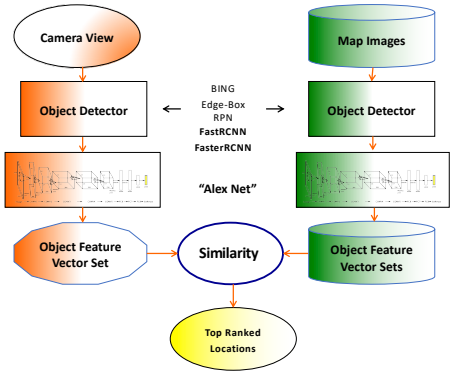




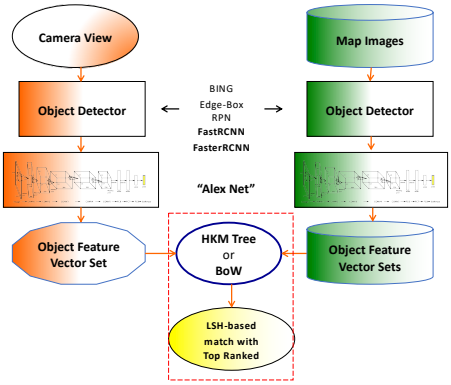
Viewpoint Invariance via ConvNet Landmark Representation

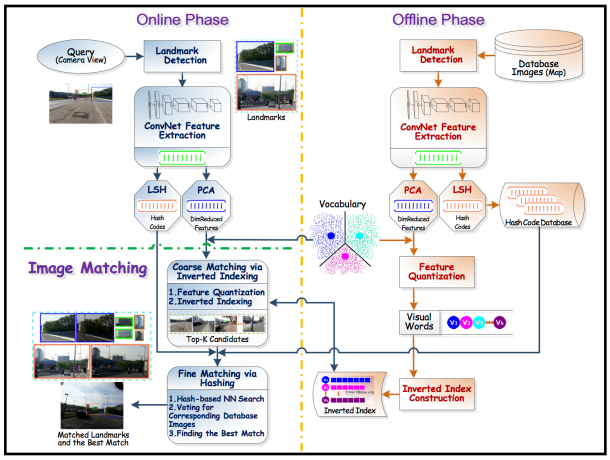


Landmarks-Based VPR

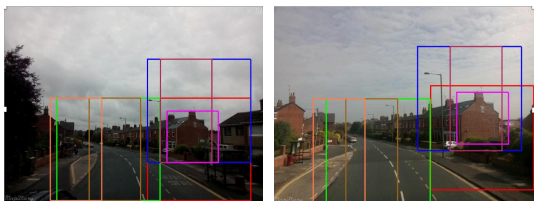


Efficient Landmarks-Based VPR





VPR by Matching ConvNet Landmarks

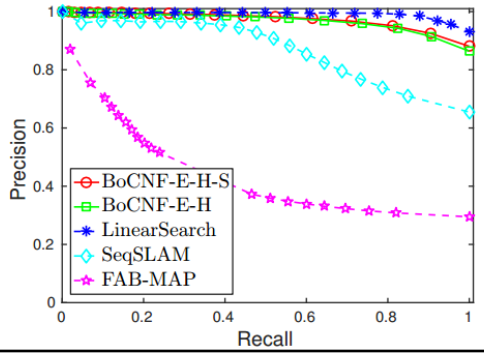


BoCNF:
Efficient Image Matching with Bag of ConvNet Features for Scalable and Robust Visual Place Recognition

Yi Hou
National University of Defense Technology, China
yihouhowie@gmail.com

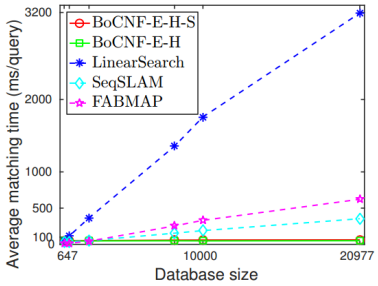
Hong Zhang
University of Alberta, Canada
hzhang@ualberta.ca

BoCNF: LCD accuracy

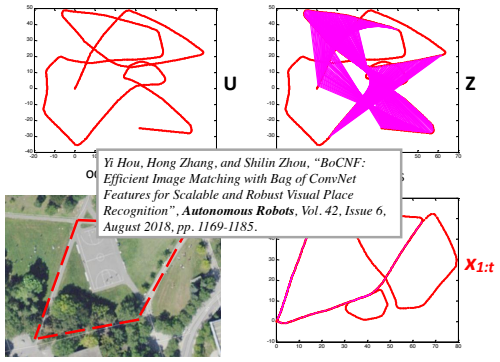


20

BoCNF: matching efficiency



Hou Y, Zhang H, Zhou S. "BoCNF: Efficient image matching with bag of ConvNet features for scalable and robust visual place recognition", *Autonomous Robots*, 42(6), August 2018.



*Yi Hou, Hong Zhang, and Shilin Zhou, "BoCNF: Efficient Image Matching with Bag of ConvNet Features for Scalable and Robust Visual Place Recognition", **Autonomous Robots**, Vol. 42, Issue 6, August 2018, pp. 1169-1185.*

ground truth