Lecture 11
Visual words and computer vision applications

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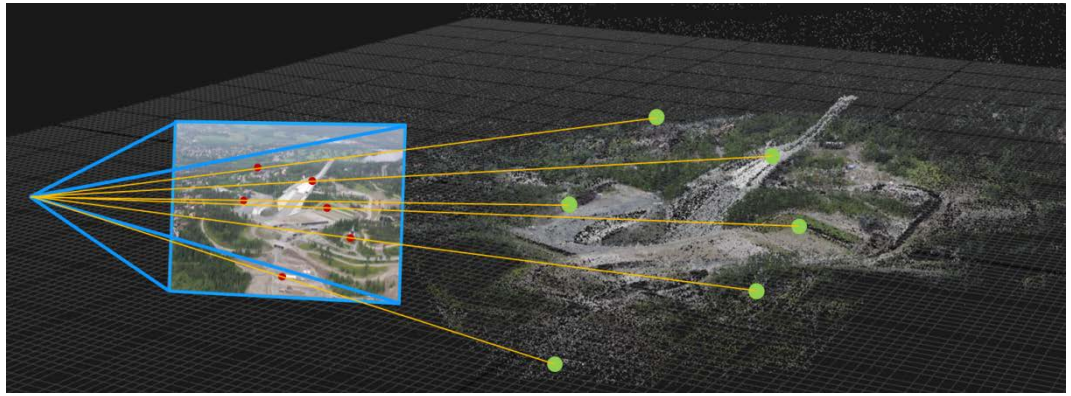
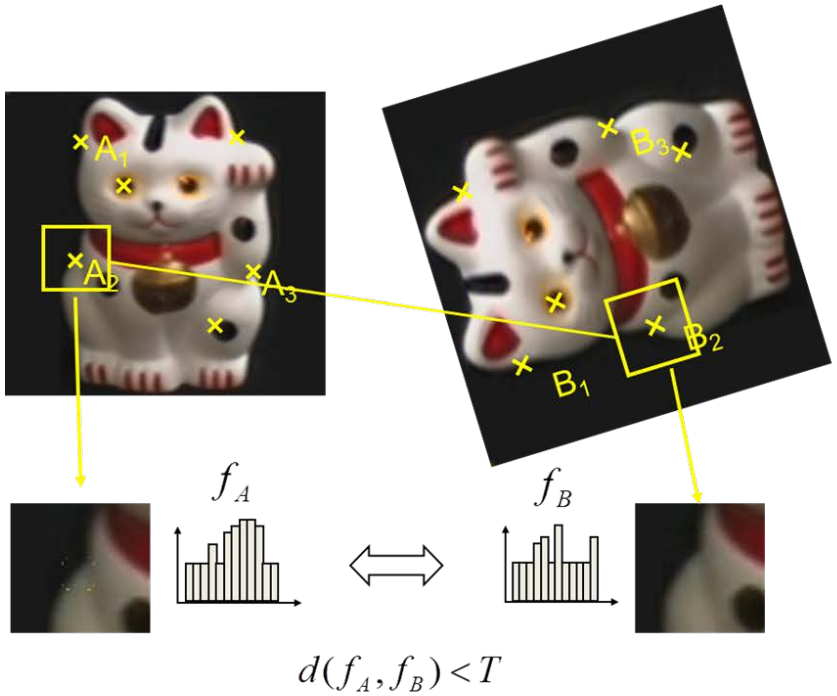
Vocabulary of visual words

- We have seen now throughout the course that we can use feature descriptors to
  - Estimate transformations to coregister images
  - Estimate camera motion
  - Estimate scene structure
  - Detect objects



Vocabulary of visual words

- This was based on finding correspondences between feature points by matching feature descriptors



1. Detect a set of distinct feature points
2. Define a patch around each point
3. Extract and normalize the patch
4. Compute a local descriptor
5. Match local descriptors

Vocabulary of visual words

- But what if we have a large amount of objects or images that we want to query?

- The number of features we have to compare will grow fast,
  and the time it takes to match against the database can become prohibitive

Vocabulary of visual words

- One way to resolve this is to map high-dimensional descriptors to a vocabulary of discriminating visual words

- A database of images or objects may then be indexed on these visual words, similar to other information retrieval tasks such as web search

- Please read the following chapters in Szeliski now (mandatory):
  - 14.3: Instance recognition
  - 14.4.1: Bag of words

Vocabulary of visual words

- Vocabularies of visual words have several interesting applications:
  - Classification
    - https://gilscvblog.com/2013/08/23/bag-of-words-models-for-visual-categorization/
  - Visual place recognition
    - https://sites.google.com/site/lsvpr2014/
  - Appearance-only SLAM (no geometry)
    - FAB-MAP 2.0
    - https://www.youtube.com/watch?v=GRTx5ovOSHo
  - Loop-closure for visual SLAM
    - ORB-SLAM: https://www.youtube.com/watch?v=8DISRmsO2YQ

Computer Vision applications

- Congratulations, you have just finished all lectures in this introductory course in computer vision!

- Our goals for this course is to enable you to:
  - Understand and follow the principles in current research within computer vision
  - Create and implement your own computer vision applications

- The rest of the course will now let you focus on the latter through the projects

- But first, lets take a look at some computer vision applications…

Computer Vision applications

- Study at least one of these applications (mandatory),
  and try to understand how computer vision methods have been used in these cases

  – Scene Reconstruction and Visualization From Community Photo Collections
  https://www.microsoft.com/en-us/research/wp-content/uploads/2010/08/Snavely-PIEEE10.pdf

  – ORB-SLAM: a Versatile and Accurate Monocular SLAM System
  http://webdiis.unizar.es/~raulmur/MurMontielTardosTRO15.pdf

  – A Machine Learning Approach to Visual Perception of Forest Trails for Mobile Robots
  http://rpg.ifi.uzh.ch/docs/RAL16_Giusti.pdf

  – RI Seminar: Tim Barfoot : Long-Term Visual Route Following for Mobile Robots
  https://www.youtube.com/watch?v=W_zVn9y9wLs

- Feel free to contact us at the labs if you have questions. Have fun!