Google Project Tango @ Warsaw University of Technology

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We are currently looking for **senior researchers and/or PhD students** interested in the 1-year funded project run in collaboration with Google in the topics of computer vision, machine learning and efficient search.

Project Description

Google Tango technology gives a mobile device the ability to navigate the physical world in a similar way to humans. Tango brings a new kind of spatial perception to the Android device platform by adding advanced computer vision, image processing, and special vision sensors. One of the key aspects of Tango is the recognition of previously visited places using image-based geolocalization technology.

In case of Tango, this is done by first capturing the information about the surrounding environment and then matching incoming images with the pre-computed 3D maps. The environment is represented with models consististing of sparse 3D point clouds which are estimated using structure-from-motion (SfM) algorithms. Since SfM reconstructs each 3D scene point from multiple image observations, each such 3D landmark is associated with a set of local image descriptors.

Given a novel image together with features extracted from it, the camera pose w.r.t. the 3D model (map) can be computed from 2D-3D matches between image features and landmark positions using absolute pose solvers. To obtain these 2D-3D matches efficient and accurate correspondence search techniques, such as nearest-neighbor (NN) search, are inevitable. Challenges for nearest neighbor retrieval are the limited discriminative power of the descriptors, a large number of items in the database (i.e., the map size), noise introduced into descriptors due to a lack of keypoint detector repeatability, or low descriptor invariance to viewpoint and appearance changes.

Project Goals

- Efficient and accurate nearest-neighbor search for binary descriptors (modified FREAK on DoG interest points).
- Investigation of both raw (binary) descriptors as well as dimensionality reduced variants. This part includes evaluation of the applicability of existing approaches to the problem statement in Tango, as well as novel approaches.
- Compressed storage of the binary descriptors to allow sending small size localization maps from server to device. This builds on top of the results from the nearest neighbor search results and incorporates the obtained findings. This part includes learning improved nearest neighbor search structures which are more memory and cpu efficient.

Requirements

- Proficiency in **C/C++** (Matlab is a plus).
- Deep understanding and practical knowledge of **hashing and linear algebra**.
- Practical knowledge of **machine learning** techniques such as LDA, boosting and search trees.
- Experience with computer vision, especially with binary local feature descriptors like FREAK, is a **plus**.
- Experience with efficient search within binary vectors is a **plus**.

In case you are interested, please contact Tomasz Trzciński: t.trzcinski@ii.pw.edu.pl

Google Tango Zakład Grafiki Komputerowej