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ON THE USE OF INS TO IMPROVE STRUCTURE FROM MOTION

A. Masiero [a, *], A. Guarnieri [a], A. Vettore [a], F. Pirotti [a]

[a] Interdepartmental Research Center of Geomatics (CIRGEO), University of Padova,
Viale dell'Università 16, Legnaro (PD) 35020, Italy -
masiero@dei.unipd.it
(alberto.guarnieri, antonio.vettore, francesco.pirotti)@unipd.it

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ABSTRACT:

Thanks to their flexibility and their ability to quickly collect a large amount of geospatial data, mobile mapping technologies are continuously increasing their importance among the currently available remote sensing systems.

Nevertheless, most of the already existing mobile mapping systems suffer of certain issues, among them: quite expensive cost, limited portability in certain environments, the quality of the acquired data can be checked only a posteriori. Despite these issues are not so relevant for a number of applications, they can limit the diffusion of mobile mapping technologies among not specialized personnel.

In order to tackle the issues mentioned above, in this work we consider the development of a low cost mobile mapping system, based on the sole use of a smartphone-like device. The proposed system aims at properly exploiting the sensors embedded in the device. To be more specific, the device is assumed to be provided with a standard camera and with a MEMS based Inertial Navigation System.

Shots taken by the embedded camera will be used to compute a 3D reconstruction of the scene by means of a photogrammetry approach. The limited computational power and battery life of the considered mobile device impose challenging requirements from these points of view. In order to reduce the computational load, a very efficient algorithm based on the Incremental Singular Value Decomposition (ISVD) is considered to solve the Structure from Motion (SfM) problem (Tomasi, 1992, Brand, 2002, Kennedy, 2013), and hence to compute the reconstruction of the scene.

Taking advantage of a previously developed navigation technique (Masiero, 2013), measurements provided by the Inertial Navigation System will allow to estimate the device position and orientation at the shooting instants. In this paper we exploit such information to improve the results of the reconstruction procedure. Specifically, the ISVD solution of the SfM problem relies on the use of features correctly matched in different images. It is well known that the use of SIFT features (or Affine SIFT (Morel, 2011)) allow to obtain features invariant to certain transformations (e.g. rotations), however the information about device position and orientation can be exploited in order to estimate the changes between two different views of the same feature, and hence obtaining a more robust matching.

The results of the obtained system for the estimation of 3D reconstruction of real scenes will be compared with those obtained by means of other techniques (e.g. laser scanner measurements).

1.1 References

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* Corresponding author.