

UNIVERSITY OF TARTU
Institute of Computer Science
Computer Science Curriculum

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Image Feature Usability Testing in Various Environments

Bachelor's Thesis (9 ECTS)

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Abstract

In this thesis, a method for evaluating the performance of different feature descriptors for structure from motion (SfM) algorithms is presented. This method is used to compare the performance and time consumption of different configurations of Scale-invariant feature transform (SIFT) and Accelerated KAZE (AKAZE) feature descriptors in various off-road environments. This is achieved by performing SfM based visual reconstruction on data gathered by an unmanned ground vehicle (UGV) and comparing the quality of the results. Performance of the algorithms is compared by evaluating the positional and rotational correspondences between two co-localized cameras. The visual reconstruction performs well in all chosen conditions, which include the forest, open field, sand and different illumination conditions. The different feature extractors and their parameters have an impact on the time consumption, reconstruction success rate and the accuracy of reconstruction. The method to compare the feature descriptors and results from this comparison is presented in the thesis, along with the results obtained by using it.

Keywords: Visual navigation, image features, Structure from Motion, off-road, unmanned ground vehicle, SIFT, AKAZE

Pildi tunnuste kasutatavuse võrdlemine erinevates keskkondades

Eestikeelne lühikokkuvõte

Selles bakalaureusetöös tuuakse välja meetod erinevate pilditunnuste võrdlemiseks visuaalse rekonstruktsiooni algoritmides. Seda meetodit kasutatakse, et analüüsida *Scale-invariant feature transform* (SIFT) ja *Accelerated KAZE* (AKAZE) algoritmidega eraldatud pilditunnuste kasutamisel saavutatavat täpsust ja ajakulu erinevates keskkondades. Andmed on kogutud erinevates vähestruktuursetes keskkondades mehitamata maismaasõiduki kaamerate poolt. Neid andmeid kasutatakse visuaalse rekonstruktsiooni teostamiseks, mille tulemusena leitakse kaamerate läbitud teekonnad. Täpsuse ja kiiruse määramatust hinnatakse kahe sama rekonstruktsiooni käigus leitud kaamera trajektoori võrdlemise abil. Visuaalne rekonstruktsioon töötab kõigis valitud keskkondades: metsas, avatud väljal, liival ja vähese valgustuse korral. Erinevate pilditunnuste leidmise algoritmide ja nende erinevate seadetega jooksutatamine mõjutab visuaalse rekonstruktsiooni ajakulu, töökindlust ja täpsust. Lõputöös on esitatud väljatöötatud meetod erinevate pilditunnuste võrdlemiseks ning võrdluse tulemused.

Võtmesõnad: Visuaalne navigatsioon, pildi tunnused, *Structure from Motion*, maastikul sõitmine, mehitamata sõidukid, SIFT, AKAZE

CERCS: P160 Statistics, operation research, programming, actuarial, mathematics; P170 Computer science, numerical analysis, systems, control; P175 Informatics, systems theory.

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