

Thesis and Internship Opportunities

for students in

Computer/Electrical Engineering, Microsystems Engineering, Computer Science or similar fields

Development of Algorithms for Depth Image Processing and Fusion with Color Images

The Institut für Mikro- und Informationstechnik of the Hahn-Schickard-Gesellschaft develops miniaturized sensors and actuators. In the field of inertial sensors and systems. The research activities in Villingen-Schwenningen started in 1997. Since then several silicon-based micromachined sensors have been built that can either measure acceleration (accelerometers) or rotation velocity (gyroscopes). Silicon based micromachining makes it possible to produce low-cost and small size sensors for a variety of applications, e.g. navigation and stabilization systems for automotive industry or hardware for low-cost virtual-reality systems.

Recently some low-cost products entered the consumer market providing both RGB (conventional color) and depth (D) imaging. The information from both sources can be combined in order to get the better estimation about the environment compared to the information available from a single source. Such a combination of RGB and D cameras can be used for robotic applications, where the robot has to deduce his own position within the unknown environment and simultaneously construct the map of the environment (Simultaneous Localization and Mapping- SLAM). Moreover, such cameras are helpful for some more conventional applications such as robust human tracking with complex background under occlusions.

Usually, the object tracking is performed using some modification of existing tracking techniques such Kalman Filtering or Particle Filtering, adopted for specific data representation of images and corresponding features extracted in the preprocessing steps and analysis. However, the combination of tracking algorithms using both RGB and D images is non-trivial compared to rather standard fusion algorithms such as those used for localization and orientation, due to specific information representation in the data. Moreover, the algorithm can be very computationally demanding and has to run in real time, resulting in trade-off between performance and accuracy as well as extra demand on the efficiency of implemented methods.

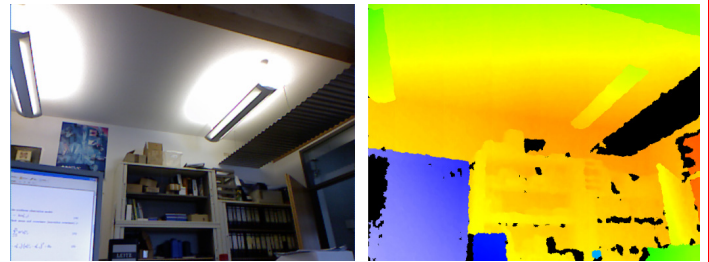


Fig. 1 Example of a conventional RGB image (left) and corresponding depth image (right).

Currently available work includes:

- Theoretical analysis of the existing algorithms for depth image processing.
- Implementation of the most promising algorithms by adopting standard techniques available OpenCV techniques or extending OpenCV if necessary.
- Analysis of the possibility to fuse information from RGB and depth images using Bayesian estimation framework.
- Implementation of the modification OpenCV's Condensation algorithm for depth image.
- Preliminary analysis of feasibility of SLAM algorithms using RGB-D images.

Requirements:

- Strong mathematical background.
- Interest in advanced algorithm development.
- Good knowledge in image processing algorithms and basic computer vision techniques.
- Advanced programming skills in C/C++ (Win OS).
- Familiarity with good software engineering practice.

The students can make advantage of HSG-IMIT experience in developing sensor fusion algorithms. Additionally, the content of the thesis or internship can be adapted to the specific interests of the applicant. We would be very pleased to welcome You as a new student co-worker of HSG-IMIT. Further information and details can be obtained from the contact listed below.

Facts about HSG-IMIT:

- Located since 1990 in the new facilities in Villingen-Schwenningen
- Currently more than 90 employees in research and development
- Typically 10-20 student co-workers per semester
- Approximately 700 m² of laboratory space with state-of-the-art equipment
- Approximately 600 m² of cleanroom classes 10-1000, solely dedicated for the production of microstructures

Benefits for our students:

- Involvement in an up-to-date and application-oriented field of research
- State-of-the-art software and equipment
- A highly motivated and interdisciplinary work environment
- A competitive compensation to which a rent subsidy can be granted
- Support in finding an appropriate room during the stay at HSG-IMIT

Your contact:



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