18th Mediterranean Conference on Control and Automation, MED'10

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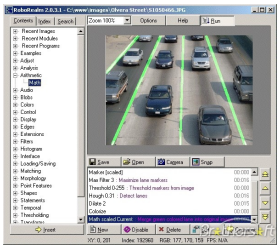
Marrakech, Morocco, at the Hotel Mansour Eddahbi - Palais des Congres

TUTORIAL:

"A Practical Approach to Machine Vision for Robot Control"

ABSTRACT

Machine vision finds applications in many domains from medicine, archaeology, oceanography to robotics. However, due to the relative low cost of image capturing devices and the plethora of information contained in the visual domain, machine vision is most suitable for developing control software for robots. Machine vision can enable navigation, mapping, object recognition and other behaviors performed by an autonomous robot. Developing image processing algorithms and then coding them using complex software libraries like OpenCV can be a daunting task for many researchers, especially if results are desired quickly; even though software like Matlab provides the ability to rapidly prototype image processing systems, their real-time performance is poor and the flexibility to integrate these in to robot control is not high.



This tutorial aims to provide participants with an overview of machine vision and its many applications. Participants will also have the opportunity to get an overview of algorithms from image processing, which can be used to develop control systems for robots. Following this, they will be introduced to RoboRealm, a powerful vision software application that allows for rapid development of machine vision systems with little to no programming required. They will also implement practical exercises by means of RoboRealm, for developing their own algorithms and integrating them to robot control systems. Programming more complex systems using a language of the users' choice, while harnessing the flexibility of RoboRealm, will also be covered in the tutorial.

THEORETICAL TOPICS

⇒ **Introduction to Computer Vision (13:30 – 14:00)**

The attendees will learn basics of computer vision and see some of its applications in various fields. This will be a basic introduction to the topic. The state-of-the-art in computer vision and its applications in robotics will also be introduced to the participants in order to give them an overview of the capabilities of such a system.

⇒ **Important Methods and Approaches (14:00 – 15:00)**

Participants will be introduced to methods from graphics, image processing and computer vision. These methods are mostly used for filtering and analysis of images and videos. The color-mapping, color space, visualization methods, edge detection algorithms, convolution filters, feature extractions and transformations introduced in this part will provide participants with the basic understanding necessary to design machine vision systems suitable to their robotic application.

PRACTICAL EXERCISES

⇒ **Interacting with RoboRealm (15:00 – 16:00)**

Simple applications will be introduced to familiarize participants with RoboRealm. They will have the opportunity to use basic filters (geometrical and color) for more in-depth understanding of the theoretical material.

⇒ **Coffee Break (16:00 – 16:15)**

⇒ **Developing Machine Vision Applications (16:15 – 17:15)**

Starting with point and click applications participants will be guided to designing recognition systems, which could be used for shape detection and also obstacle avoidance in robots. Tracking applications to follow objects in a video stream based on color, movement and/or shape will be covered. An introduction to more advanced pattern recognition methods for detecting complex shapes will be discussed.

⇒ **Designing Advanced Applications (17:15 – 18:00)**

In this section, participants will learn how to build complex vision-based tracking applications, such as hand and facial tracking, by interfacing RoboRealm to other programming languages. Gesture recognition using synergy of RoboRealm and C# will be discussed. Information extraction from video streams and post-processing in RoboRealm will be the focus of this section.

Contact: Daniel Cernea (cernea@cs.uni-kl.de) and Anuj Sehgal (anuj@iurs.org).

Registration: **80 Euros** including CD of presentations & software and coffee break.

Note: All software necessary to complete the practical exercises will be provided on the handout CD to attendees. Due to the programming based nature of practical exercises, the attendees are requested to bring laptops. Familiarity with programming in C, C++ or C# is required to complete the exercises.