Procurement of
Algorithm Development for Automatic Red
Pepper Identification and Measurements in
Matlab

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1 Background

The CROPS project\textsuperscript{1} are developing new methods to automatically harvest
tomatoes using a harvesting robot. The original project evaluated methods
based on a single RGB camera. In this course you will develop and evaluate
methods based on close-range optical photogrammetry for the same task. The
project owner is Associate Professor Thomas Hellström at the Department of
Computing Science.

2 Task

Your task is to develop and evaluate algorithms for red pepper detection based
on close-range digital imagery and 3D point clouds derived therefrom. The
location of the peduncle for each detected pepper should also be estimated.
Furthermore, you should develop a tool in Matlab that enables Matlab novices
to use the algorithms. The tool should be extendible with other algorithms
with a reasonable programming effort. One important property of each classifi-
cation algorithm is that it should produce a quality indicator together with each
detection. For fully visible peppers, the recall rate is expected to be at least
80\% and the accuracy 90\%. The peduncle localization is expected to have an
average absolute error of less than 2 cm if the peduncle is fully visible. Results
for partially visible fruits and peduncles should be reported separately. Image
should be taken such that no single fruit occupies more than 3\% of the total
image area. Each image may contain between 1 and 5 fruits.

\textsuperscript{1}www.crops-robots.eu
3 Data
A test area will be set up where the data to be used in the experiments will be acquired.

4 Target group and limitations
- There are two target groups for this project. The tool should be possible to operate by any novice Matlab user. The tool should be possible to extend with new algorithms by a reasonable good Matlab programmer.
- The code should be executable on Matlab R2012b on Windows and Linux.

5 Expected results and delivery
The expected result includes:
- The application code, well documented.
- Evaluations of selected algorithms for classification and measurements. The work should be based on images with at least 50 detected peppers. Performance should be reported by 10-fold cross-validation.
- Descriptions of the algorithms. This includes algorithms that were deemed interesting but were not evaluated due to lack of time.
- A suggestion on which algorithms to use, including motivation.
- Instructions for how to use the application.
- Instructions on how to extend the application with new algorithms.

The delivery should be approved on June 5th, 2014.

6 Operation
As clients, we expect full transparency of the work and want a method of operation that includes continuous feedback. It is especially important that we can participate and guide the work in whatever direction we believe to be most valuable to us.

7 Resources and costs
We have allocated approx 2000 hours for this task. We intend to buy this as a fixed price order with a delivery guarantee, i.e. that you undertake to deliver with the requested result.