

Proposal for Master's Dissertation Project

Title: An Android Application for Fruit Detection in Orchards

Advisor, Co-Supervisor and Contacts

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Summary / Scope

The advent of deep learning has taken by storm the computer vision community, pushing forward the state-of-art performance in different challenging tasks. The research topics of object detection, object segmentation and object recognition have experienced remarkable advances in performance, paving the way for the development of automated systems. Indeed, these advances allowed the development of a multitude of applications with added value for the society. Nevertheless, the vast majority of these applications is focused on human analysis (e.g. people counting, human detection, human surveillance), being expected that these advances will soon be extended to other domains.

Smart farming is the application of information and data technologies for optimizing complex farming systems, and farming is one of the domains where computer vision techniques can play an important role in the next years. Automatic detection of fruits in orchards is a challenge where computer vision can contribute to smart farming. The detection of fruits when they are still in the tree may provide the basis for different intelligent analysis that need to be carried out through a manual process (e.g., fruit counting, fruit maturation stage, fruit size). This topic has been addressed recently in some research works using images from moving robots, but to the best of our knowledge it has never been done using images captured from hand-held devices. While the accuracy of the method is a crucial factor for the overall success of the application running in a hand-held device, the processing time is also of extreme importance for developing an usable application.

Considering this, the main contribute of this proposal is the development of a method for detecting fruits in orchards from images acquired from hand-held devices, and the major research challenge is the development of strategies for maintaining a high accuracy in devices with a low computational capability, such as the the hand-held devices.

During this master's project, the student will have the chance to engage in discussions with other people involved in the area of computer vision, as well as the opportunity to improve his or her knowledge in several computer science fields, namely computer vision and mobile app development.

Objectives

As hinted in the previous discussion, this master's project has two main objectives:

1. Development of a method for detecting fruits in orchards from images acquired from hand-held devices;
2. Development of an android application for collecting images from orchards and detecting the presence of fruits in these images;

Tasks

In order to achieve its objectives, the following tasks are proposed as an initial work plan for this master's project:

Task 1 Revision of the specialized literature and related works. Study and practice how to develop methods using the state-of-the-art computer vision frameworks (2 month);

Task 2 Acquisition and annotation of a dataset comprising images of fruits from orchards using different types of hand-held devices (2 month);

Task 3 Development of a computer vision based method for detecting fruits in the dataset acquired (3 months);

Task 4 Implement an android application for collecting data from camera and integrate the fruit detection method in this application (2 months);

Task 5 Test and fine-tune the prototype (1 month);

Task 6 Writing of the master's dissertation, technical documentation and a journal or conference paper (3 months, eventually distributed and interleaved with the time periods of other tasks).

Timetable

An approximate scheduling for the execution of the previously identified tasks is included below. The execution of a given task in a given month is marked with a cross (x).

Task \ Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1	x	x									
2		x	x								
3			x	x	x						
4					x	x					
5							x				
6								x	x	x	

Expected Outcomes and Dissertation

The most visible outcome of this master's project is an android application capable of acquiring and process in real-time images from orchards for locating the regions of the image containing fruits.

References

- [1] S. Bargoti and J Underwood. "Deep fruit detection in orchards."IEEE International Conference on Robotics and Automation, 2017. pp. 3626-3633.
- [2] X. Liu, et al. "Robust fruit counting: Combining deep learning, tracking, and structure from motion."IEEE International Conference on Intelligent Robots and Systems, 2018. pp. 1045-1052.
- [3] M. Rahnemoonfar and C. Sheppard. "Deep Count: Fruit Counting Based on Deep Simulated Learning."Sensors, 2017.