School of Computer Science

Undergraduate Research Opportunities Scheme (UROS) 2017

Staff Project Proposal Form

Completed project proposal forms to be emailed to <u>Sarah Williams</u> by
<u>**midday Wednesday 31st May 2017**</u>

Supervisor Name: Wenting Duan Supervisor Email: wduan@lincoln.ac.uk Tel: 01522886955
Name of second supervisor (if you aren't available for the whole of July)
Project Title: (this will be released to the students). Automatic Photometric Analysis of Primula Seeds
Supporting information about the project (this will be released to the students). The main aim/deliverable The identification of plants is an important step in many conservation projects, ecological studies and agricultural and horticultural processes. Any automation of this task would greatly improve the efficiency of such work and have significant environmental and social benefits. *Primula* is a large plant genus containing about 500 species, and more if related genera are included within its circumscription. Their seeds vary in size, angularity, colour, texture, presence of 'wings' etc, and botanists can examine them to identify to which taxon they belong. However, the process of examining an image of a seed and, for example, taking measurements, is time consuming and requires significant manual effort. This project is about developing a standard and automated image analysis approach to allow *Primula* taxonomists to process seed images, enhancing their capacity to study the genus. More specifically, the student will be provided with various images of different *Primula* seeds like the one shown in Fig 1. The student will research and develop a robust and automated algorithm to 1. Segment each seed from the background; 2. Measure the length and width of the seed; 3. Categorise the colour of the seed (e.g. light to dark) 4. Measure the angularity of the seed; 5. Detect the presence of the wing.

Figure 1, Sample image of Primula Seeds.

Any previous or related work carried out in this area that might be helpful for the students to know about

Lurstwut, B and Pornpanomchai, C. Plant Seed Image Recognition System (PSIRS), IACSIT International Journal of Engineering and Technology, Vol.3, No. 6, December 2011.

V. Sandeep Varma, Kanaka Durga K and Keshavulu K. Seed image analysis: its applications in seed science research. International Research Journal of Agricultural Science Vol. 1(2) pp. 30-36 June 2013.

Pierre Barré, Ben C. Stöver, Kai F. Müller, &Volker Steinhage (in press). LeafNet: A computer vision system for automatic plant species identification. Ecological Informatics.

Jin, T., Hou, X., Li, P., Zhou, F., 2015. A Novel Method of Automatic Plant Species Identification Using Sparse Representation of Leaf Tooth Features.

Project milestones

The timescale and the milestone of this project is as following:

01/07/2017– 07/07/2017	Literature review
08/07/2017 – 19/07/2017	Algorithm development
20/07/2017 – 25/07/2017	Evaluation of the algorithm
26/07/2017 – 31/07/2017	Writing up and poster production

The end products of this project will be a piece of functional code that achieves the goals outlined above, a poster and a work demonstration for UROS. The student is also encouraged to publish the work in a conference or journal in the area of computer vision and image processing.

The candidate for this project should be competent in programming, especially C++, Python or Matlab. Enthusiasm for the topic is essential and students with good mathematical skills are preferred.

Any other information

Please indicate which of the following apply:
I have previously supervised a UROS student in the last two years   YES/~~NO~~ I have been working at the University for less than two years   ~~YES~~/NO
In addition to the benefits derived by the student, this project will have the following wider benefits for the School: This is a feasibility study that I would like to carry out in order to collaborate further with Prof David Rankin from Edinburgh University and Pam Eveleigh, a Canadian Primula taxonomist, on a seed recognition project. An automatic approach will enable these researchers to quickly identify the seeds and gather and label more seeds image data. With more data, we will be able to apply deep learning to enhance and transform the identification process. The approaches that will be developed have many wider practical applications in conservation, ecology, agriculture and horticulture. In particular the project aligns with the SOCS' track record in developing innovations in Agri-Tech.
Ethical consideration
Please confirm that any ethical considerations for the project have been addressed (Research Ethics Committee requirement)   YES/~~NO~~
Name: Wenting Duan   Date: 31/05/2017