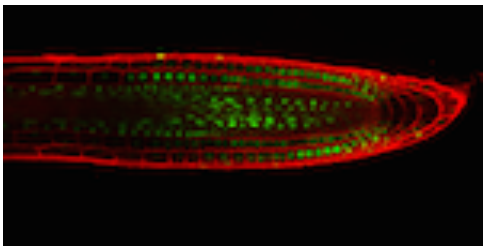
School of Computer Science – Coursework Issue Sheet

Session	2019/20	**Semester**	Spring
Module Name	Introduction to Image Processing	**Code**	COMP2005
Module Convenor(s) **(CW Convenor in Bold)**	**Tony Pridmore**		

Coursework Name	COMP2005 Coursework	**Weight**	40%
Deliverable (a brief description of what is to be handed-in; e.g. 'software', 'report', 'presentation', etc.)	Matlab code and written report		
Format (summary of the technical format of deliverable, e.g. "C source code as zip file", "pdf file, 2000 word max", "ppt file, 10 slides max", etc.)	Matlab code: .m file Report: PDF, 2000 words max.		

Issue Date	Monday 3rd February 2020
Submission Date	**3.00pm Thursday 12th March 2020**
Submission Mechanism	Moodle
Extenuating Circumstances	Students are responsible for ensuring that they inform the University of any circumstances that they consider are affecting their ability to study and/or undertake assessments as early as possible. Please see your Student Handbook on Moodle for further information on the University's extenuating circumstances procedure. Late submissions will be subject to the University's policy regarding late submissions of assessed work, unless an extenuating circumstances claim has been approved.
Feedback Date	Thursday 2nd April 2020
Feedback Mechanism	Moodle

Instructions	**Counting Cell Nuclei** Microscope images are essential tools in the natural sciences. Biology in particular makes heavy use of confocal laser scanning microscopy. Confocal microscopy is used to analyse samples that have been treated to make components of interest fluoresce when illuminated with laser light. They then effectively intersect a laser plane with the sample and use a colour camera to

	image the resulting fluorescence. The example below shows the tip of a plant root in which cell walls appear red and cell nuclei are green. Image processing and analysis methods are often used to extract quantitative data from confocal microscope images. The size, shape and brightness (following the various chemical, etc. processes that have been applied) are often of interest to biological scientists. Identification of cell nuclei from this type of image requires a processing pipeline that usually includes at least some of the following steps: - **Colour space conversion**: choose a colour space. Any can be used, but most people choose to work in a lower-dimensional space whenever possible - **Noise reduction**: depending on image quality, some form of noise suppression may be required - **Thresholding/Segmentation**: image regions corresponding to nuclei must be identified, and thresholding is a common approach. The method used varies, and may be global or local. Methods that automatically determine the threshold value have obvious advantages over those that require user interaction - **Binary image processing**: Identifying a perfect threshold value is almost impossible, and most methods will result in some mis-classified pixels. A further binary image processing stage is often needed to clean up the image, hopefully leaving it containing only regions that correspond to nucleii. Nothing, however, is perfect.  1. You will be provided with a set of confocal laser microscope images of plant roots, obtained as described above. Design and implement a Matlab program that inputs one of these images and outputs a binary image marking regions corresponding to nuclei. You do not need to employ all the steps listed above, but you will probably find it worthwhile to at least consider them all. **Note: The aim here is to produce one, single Matlab program. This should be able to process each of the three images without changes being made to any parameters involved.** **You should also seek a solution that is as automatic as possible, i.e. try to minimise the number of user-supplied parameters.** 2. Write a report (max 2000 words) which: - *describes* the steps included in your method and specific image processing techniques employed - *explains* why you chose those methods - *presents* the results obtained on the images supplied - *critically evaluates* your method on the basis of those results; what are its strengths and weaknesses? This section of the report should make explicit reference to features of the results you obtained.
Assessment Criteria	Matlab code: 30% Description of key features of the implementation: 20% Explanation of the results obtained: 20% Discussion of the strengths and weaknesses of the chosen approach and methods: 30%
