

**Cyswllt Ymchwil : "Dynamic modelling of plant growth with computer vision"
36.5 awr yr wythnos (Cyfnod penodol hyd at 16 mis)**

**Adran Cyfrifiadureg
Athrofa Mathemateg, Ffiseg a Chyfrifiadureg
Graddfa 7: £32,277 – £37,384 y flwyddyn**

Dymuna'r Adran Cyfrifiadureg benodi Cynorthwydd/Cyswllt Ymchwil i weithio ar brosiect a gyllidir gan Gyngor Ymchwil Peirianeg a'r Gwyddorau Ffisegol, sef "Dynamic Modelling of Plant Growth with Computer Vision". Mae'r prosiect wedi'i leoli yn yr Adran Cyfrifiadureg ac mae ganddo gysylltiadau cryf â Chanolfan Genedlaethol Ffenomeg Planhigion, sydd hefyd yn Aberystwyth. Bydd yr ymgeisydd llwyddiannus yn gweithio yn Aberystwyth ac yn atebol i Dr Hannah Dee. Swydd yw hon am gyfnod penodol o hyd at 16 mis ac mae hi ar gael ar unwaith, fel y gall deiliad y swydd ddechrau ar 1 Medi 2014 neu cyn gynted â phosibl ar ôl hynny. Gall darpar ymgeiswyr drafod y swydd yn anffurfiol â Dr Hannah Dee (e-bost: hmd1@aber.ac.uk).

**Cyf: IMPACS.14.13
Dyddiad Cau: 13 Hydref 2014**

Am fwy o wybodaeth ac am ffurflen gais ewch i <http://www.aber.ac.uk/cy/hr/jobs/vacancies-external/>

Dylid llofnodi'r ffurflen gais ar ôl ei llenwi ac yna ei dychwelyd i'r **Tim Recriwtio Adnoddau Dynol** drwy e-bost neu post. Tîm Gweithredol: swyddi@aber.ac.uk / Ffôn: 01970 628555

NODYN: Nodwch gyfeirnod y swydd ar flaen yr amlen ac ar y ffurflen gais os gwelwch yn dda.

Sefydliad Dwyieithog sy'n gweithredu Cynllun Iaith Gymraeg ac yn ymroddedig i Gyfle Cyfartal.

FEL ARFER FE BENODIR I SWYDDI O FEWN 4-8 WYTHNOS WEDI'R DYDDIAD CAU. GALL YMGEISWYR NA FYDDANT WEDI DERBYN LLYTHYR ODDI WRTH Y BRIFYSGOL ERBYN Y DYDDIAD HWNNW RAGDYBIO NAD YW EU CEISIADAU YN CAEL EU HYSTYRIED YMHELLACH AC NA FYDDANT YN DERBYN GOHEBIAETH BELLACH.

**Research Associate: "Dynamic modelling of plant growth with computer vision"
36.5 hours a week (Fixed term of up to 16 months)**

**Department of Computer Science
Institute of Mathematics, Physics and Computer Science
Grade 7: £32,277 – £37,384 per annum**

The Department of Computer Science wishes to appoint a Research Associate to work on the EPSRC funded project "Dynamic Modelling of Plant Growth with Computer Vision". The project is based within Computer Science and has strong links to the National Plant Phenomics Centre, also in Aberystwyth. The successful applicant will be located in Aberystwyth and will report to Dr Hannah Dee. The post is for a fixed term of up to 16 months and is available immediately, for the post-holder to start on 1 September 2014 or as soon as possible thereafter. Prospective applicants may discuss the post informally with Dr Hannah Dee (e-mail: hmd1@aber.ac.uk).

**Ref: IMPACS.14.13
Closing Date: 13 October 2014**

For information and application forms please go to www.aber.ac.uk/en/hr/jobs/vacancies-external/

Completed Application Forms should be signed and returned to the **Human Resources Recruitment Team** by e-mail, or post. Email address: vacancies@aber.ac.uk / Tel: 01970 628555

NOTE: Please put the post reference on the front of your envelope and on your application form.

We are a Bilingual Institution which operates a Welsh Language scheme and is committed to Equal Opportunities.

APPOINTMENTS ARE NORMALLY MADE WITHIN 4-8 WEEKS OF THE CLOSING DATE. IF WE HAVE NOT BEEN IN TOUCH WITHIN THIS TIMESCALE YOU MAY ASSUME THAT YOUR APPLICATION IS NOT BEING FURTHER CONSIDERED AND NO OTHER COMMUNICATION WILL BE SENT.

Further Particulars (Yn Saesneg yn Unig)

ROLE AND MAIN DUTIES

The research associate will be responsible for achieving the aims and objectives of the project and for writing high-quality peer reviewed publications. The RA will be the main researcher on the project, designing and building computer vision systems for the segmentation and modelling of the plant *Arabidopsis Thaliana* from time-lapse photography. The RA will also be involved in direct public engagement and so should possess excellent communication skills.

The main responsibilities of the post holder will be:

- **To undertake original research** of a high standard in the specified subject area.
- **To disseminate the results** of research through publication in appropriate peer reviewed journals at a level of excellence consistent with a world-class institution, and through academic conferences.
- **To design and develop a set of techniques/methods** to process images of plants, exploiting time-series information and reasoning about occlusion to develop 2.5-3d models enabling a detailed understanding of the morphology of the plant.
- **To collaborate with other partners.** To work closely and in partnership with other members of the group and the National Plant Phenomics Centre.
- **To make presentations about the work.** This includes writing design documents about the work, contributing to reports that describe the work and presenting research findings at both national and international conferences.
- **To contribute to the work of the Department.** For instance, to present work to colleagues, be involved with research meetings at the University, collaborate with PhD students on related projects, and make presentations and demonstrations of work in progress.

PUBLIC ENGAGEMENT

The project also aims to develop resources and a workshop for engaging with school children on this research, for example using time-lapse cameras to study plants in class. The RA is expected to be involved in creating and delivering some of these resources/workshops.

PERSON SPECIFICATION

Essential criteria

Education, training and qualifications

1. PhD in a relevant subject (e.g. Computer Science);
2. Research experience in computer vision, image processing, computer graphics or a closely related area.

Skills and abilities

1. Excellent software engineering skills including programming in at least one of C, C++, Python or Java;
2. Able to write high-quality research publications;
3. Excellent interpersonal and communication skills;
4. Ability to work independently and take initiative;
5. Capacity to meet deadlines;
6. The ability to understand the bilingual nature of the University and an awareness of the procedures in place to support working bilingually (Welsh Language Standard A - Level 0/0).

Desirable criteria

1. Excellent publication track record;
2. Experience with computer vision techniques for analysing video and shape;
3. Experience with a computer vision library such as OpenCV;
4. Interest in plant science;
5. Experience of public engagement, particularly with schools;
6. The ability to communicate both written and verbally through the medium of Welsh to Standard B (Level 2/0)*.

** Explanation of Welsh Language Standard/Safon B (Level 2/0)*

- The ability to **understand** simple instructions or simple telephone messages.
- The ability to **understand** people conversing on familiar subjects.
- The ability to **hold a conversation** on familiar subjects, e.g. the weather, work, family.
- The ability to **transfer** simple instructions or convey simple messages from telephone calls.

PROJECT DESCRIPTION

The project aims to develop computer vision techniques for the modelling, measurement and tracking of plants during growth, working not at the level of the whole plant, but instead detecting, tracking and measuring individual leaves. This is a hard computer vision problem, with application to computational biology, phenomics, and precision agriculture. Phenomics is the study of the way in which genes and environment interact to produce an organism (*a phenome*); this involves monitoring precisely the way an organism grows in or reacts to specific environmental situations. Within plant phenomics, monitoring has traditionally been through destructive measures (dissection) or hand measurement; in recent years image

processing and computer vision have begun to rise to the challenge of providing key inputs to the phenotyping pipeline.

VISION

The aim of this project is to develop methods and algorithms for segmenting, labelling and measuring the plant *Arabidopsis Thaliana* (hereafter Arabidopsis) as it grows, incorporating occlusion reasoning to enable modelling of both visible and hidden leaves. The result will be a computer vision system capable of providing a reliable estimate of biomass, leaf area, and other biologically salient measurements from timelapse photography. Arabidopsis has a relatively short growth cycle, which enables the capture of a dataset representing the key establishment phase within the first few months of the project; Arabidopsis is also a model organism, indeed the first plant to have its genome sequenced, meaning that there is a demand within biology for detailed information about how it grows and the ways in which different populations vary phenomically.

RESEARCH AIMS AND OBJECTIVES

The project aims to use spatial and temporal image features to build up a model of a plant as it grows; this model will encode each leaf's size and shape, and whether that leaf is occluded by or occludes any other leaves. We aim to treat plants as complex, self-occluding objects whilst modelling from a single viewpoint: constructing not a full 3D model, but a 2.5D sketch. From this it will then be possible to derive accurate estimates of biomass, leaf area, and other biologically significant measurements. There are three main computational aims for this project:

1. To develop algorithms to segment plants at the level of the leaf, rather than the organism
2. To develop plant-specific occlusion reasoning algorithms enabling the modelling of hidden structures
3. To create a gold standard public dataset for the modelling of growth and morphological change

There are also some broad methodological aims linked to plant science, which are secondary to the computational aims stated above but still important for the proposal, particularly in terms of impact. These involve the exploitation of the NPPC as a state-of-the-art commercial system (benchmark), and the development of systems and algorithms that extend the NPPC's capabilities for temporal modelling of plant growth from images.

Note that we hope to have the primary dataset (including hand-marked-up *ground truth*) in place by the start of the RA contract, enabling the post-holder to begin the computer vision work immediately without needing to engage with dataset creation or hand-segmentation.

For more information, please go to the link below for the Academic Role Profile for Research Grade 7:

<http://www.aber.ac.uk/en/media/departmental/humanresources/hera/R2.pdf>

This job description is subject to review and amendment in the light of the changing needs of the University, to provide appropriate development opportunities and/or the addition of any other reasonable duties.