

Functional Plant Biology

Contents

Volume 42 Issue 5 2015

Special Issue: Plant Image Analysis

Foreword: From image processing to computer vision: plant imaging grows up
Hannah Dee and Andrew French iii–v

Image-based estimation of oat panicle development using local texture patterns Roger Boyle, Fiona Corke and Catherine Howarth 433–443	High-throughput phenotyping facilities provide opportunities for plant development observation and monitoring on new scales, but also present new problems in automatic image analysis. This paper presents a solution to one such problem by automating the detection of flowering in oats. This demonstrates the applicability of state-of-the-art computer vision algorithms to phenotyping, which may well be of value in similar atlas-based measurement.
Surface reconstruction of wheat leaf morphology from three-dimensional scanned data Daryl M. Kempthorne, Ian W. Turner, John A. Belward, Scott W. McCue, Mark Barry, Joseph Young, Gary J. Dorr, Jim Hanan and Jerzy A. Zabkiewicz 444–451	Realistic virtual models of leaf surfaces are important for several applications in plant sciences, such as simulating agrichemical spray droplet motion on the leaf surface. Although there are effective approaches for reconstructing leaf surface from 3D scanned data, complications arise when dealing with wheat (<i>Triticum aestivum</i>) leaves, which tend to twist and bend. We present an algorithm that overcomes this topological difficulty, allowing significantly more leaf varieties to be modelled in this way.
Automatic estimation of wheat grain morphometry from computed tomography data Harry Strange, Reyer Zwiggelaar, Craig Sturrock, Sacha J. Mooney and John H. Doonan 452–459	Accurate and non-invasive measures of wheat grain morphometry can have impact on improvements in milling yield. An automated approach is presented to extract such measures from wheat CT data. The results show significant differences in measures between two disparate strains of wheat.
On the evaluation of methods for the recovery of plant root systems from X-ray computed tomography images Stefan Mairhofer, Craig Sturrock, Darren M. Wells, Malcolm J. Bennett, Sacha J. Mooney and Tony P. Pridmore 460–470	The evaluation of root system recovery methods for X-ray microcomputed tomography images is a challenging task. In this work, we aim to raise awareness of the evaluation problem and to propose experimental approaches that allow the performance of root extraction methods to be assessed. This should help users to better understand the strengths and limitations of each method and should allow a better comparison.

Cover illustration: Three dimensional rendered plant root systems in soil using X-ray computed tomography (see Mairhofer *et al.* pp. 460–470). Image supplied by Stefan Mairhofer.

Blobs and curves: object-based colocalisation
for plant cells

***Carl J. Nelson, Patrick Duckney,
Timothy J. Hawkins, Michael J. Deeks,
P. Philippe Laissue, Patrick J. Hussey
and Boguslaw Obara***

471–485

Quantifying the colocalisation of labels is a major application of fluorescent microscopy in plant biology. Pixel-based quantification of colocalisation, such as Pearson's correlation coefficient, gives limited information for further analysis. We show how applying bioimage informatics tools to a commonplace experiment allows further quantifiable results to be extracted. We use our object-based colocalisation technique to extract distance information, show temporal changes and demonstrate the advantages and pitfalls of using bioimage informatics for plant science.

Automated estimation of leaf area development
in sweet pepper plants from image analysis

***Graham W. Horgan, Yu Song, Chris A. Glasbey,
Gerie W. A. M. van der Heijden, Gerrit Polder,
J. Anja Dieleman, Marco C. A. M. Bink
and Fred A. van Eeuwijk***

486–492

The total area of the leaves on a plant is important in horticulture, but manually measuring it is tedious and destructive. Getting a computer to recognise and count leaves is difficult, so we have used statistical methods to relate leaf area to the variations in colour in an image. This has potential to be a big help for scientists developing and testing new crop cultivars.