



Second sight

Emma Leonard, AgriKnowHow

Computer vision technology is central to the development of future precision crop and weed management systems.

Taking images of crops grown in stubble covered soil and bare soil, Mahmood Golzarian is developing a computer vision system able to spot the difference.

Using purpose developed algorithms and computer vision technology, PhD student Mahmood Golzarian is developing a computer vision system that aims to differentiate crops from weeds and from stubble residue. While commercialisation of a paddock ready system is many years away, Mr Golzarian's work is providing the foundations for precision crop and weed management systems of the future. This work is funded by a scholarship from the Ferdowsi University of Mashhad (Iran) and is co-supported by the University of South Australia.

Working under the supervision of Dr John Fielke and Dr Jack Desbiolles at the University of SA, Mr Golzarian is taking hundreds of colour, digital images, which he then analyses using purpose developed image recognition algorithms to assess differences in leaf shape, colour texture and light reflectance.

If such a system is to be used in the field it has to first be able to differentiate plants and weeds from non-uniform soil and residue cover. Mr Golzarian has analysed over 500 images taken in field conditions with crop residue cover ranging from 20% to 100%.

"The reflectance of stubble, which to the human eye looks a dull gold, can be very similar to a green plant, this causes interference in the systems ability to differentiate between the two," says Mahmood Golzarian.

"By taking images of crops grown in stubble covered soil and bare soil, I am working to develop systems able to spot the difference."

For each image, the contrast between plants and the background of stubble and soil is artificially increased. The modified images are assessed using novel algorithms and Mr Golzarian has shown successfully that the removal of low saturated colours improves the reliability and accuracy of plant recognition against these challenging backgrounds.

Mr Golzarian is further developing the system, taking images of growing wheat plants and three selected grass weeds between germination and the four leaf stage.

So far, the system developed has been able to distinguish ryegrass from wheat seedlings because these are sufficiently different in shape and colour. Progress has also been made with distinguishing brome grass from wheat but wild oats are proving more difficult as they are very similar to wheat as seedlings. The difficulty in developing a plant recognition

system is identifying key parameters that are unique and easily measured for each plant type.

The overall challenge in this area is to match as closely as possible the performance of a 'human expert' in detecting and identifying plants using known visual indicators, while combining the extra capabilities available to computer vision such as reflectance information in the non-visible light spectrum (eg. NIR). Various indices are then used to increase the contrast and thus the differentiation between plant objects of interest.

Ultimately, the successful technology could be adapted for a range of tasks including improved patch spraying of in crop weeds, crop and weed establishment counts, and measurement of seedling growth rates including water and nutrient stresses. Research applications could include monitoring the dynamics of crop and weed seedling emergence, measuring growth at the seed row level and ultimately better quantifying the impact of competition between crops and weeds.

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