UNIVERSITY OF SOUTHERN QUEENSLAND

Centre for Agricultural Engineering

Image analysis methods for automating furrow irrigation

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Australian Government
Department of Agriculture and Water Resources

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

Introduction

New image analysis software uses cameras to replace labour intensive irrigation monitoring tasks previously completed by growers. Image analysis has been utilised by industry and researchers to autonomously detect variability in crop growth, pest population density and weed presence, which farmers can use to form variable rate treatments to increase application efficiency of water and chemical inputs.

Through CRDC, SRA, Dairy Australia and Rural R&D for Profit funding, USQ has developed two new image analysis applications to further increase productivity gains of precision irrigation on Australian cotton farms.

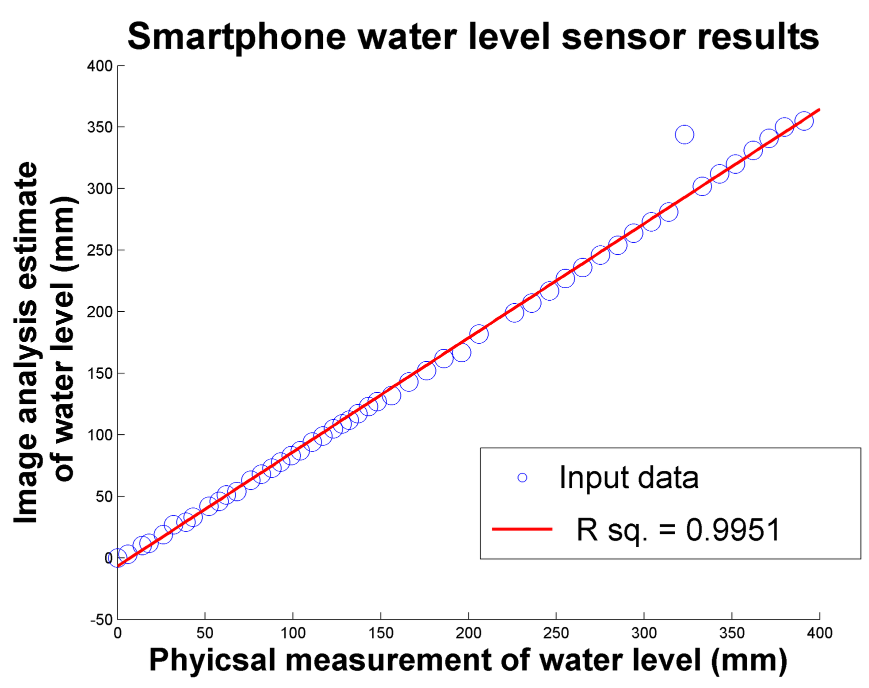
Checking irrigation channel water levels with deployed smartphones

Growers commonly check water levels in irrigation channels multiple times per day to ensure channel integrity and maximise irrigation efficiency with appropriate channel flowrates. Most growers drive to check channels regularly, but some have installed sensors to measure and report the water level.

USQ has been developing a low-cost smartphone camera system to replace the expensive sensors used in irrigation channels. An app was developed for the smartphone to:

- periodically take a photo of the water level in the channel;
- process each image to determine water level; and
- transmit water level through a cellular connection to for display on the grower's phone or tablet.

The image analysis software maps the water level against a calibrated reference sign (shown above). An accuracy of ± 5 mm was achieved in preliminary testing, suggesting the system could match the accuracy of existing pressure sensors.

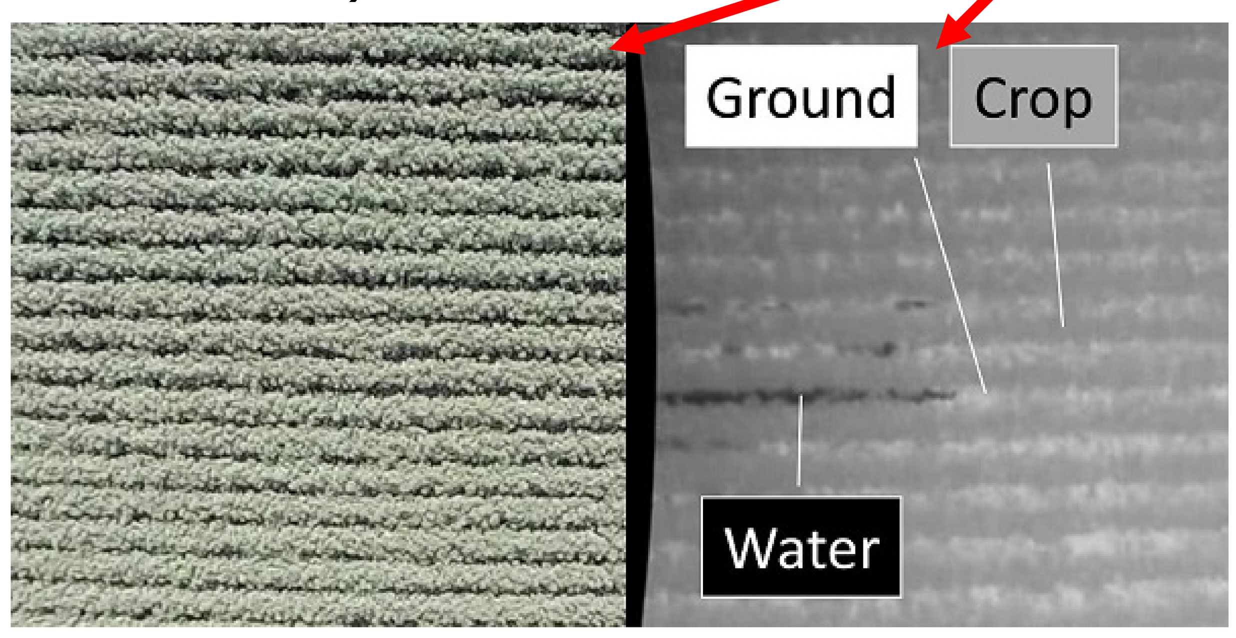


Monitoring surface irrigation advance rate with small drones

Sensors are commonly installed in irrigated furrows in cotton fields to autonomously record furrow irrigation water advance, which allows growers to optimise water application efficiency in response to varying soil infiltration characteristics. However, advance sensors are manually deployed in limited areas, and thus, are not suitable for larger scale instantaneous monitoring or for quick one-off furrow irrigation assessments.

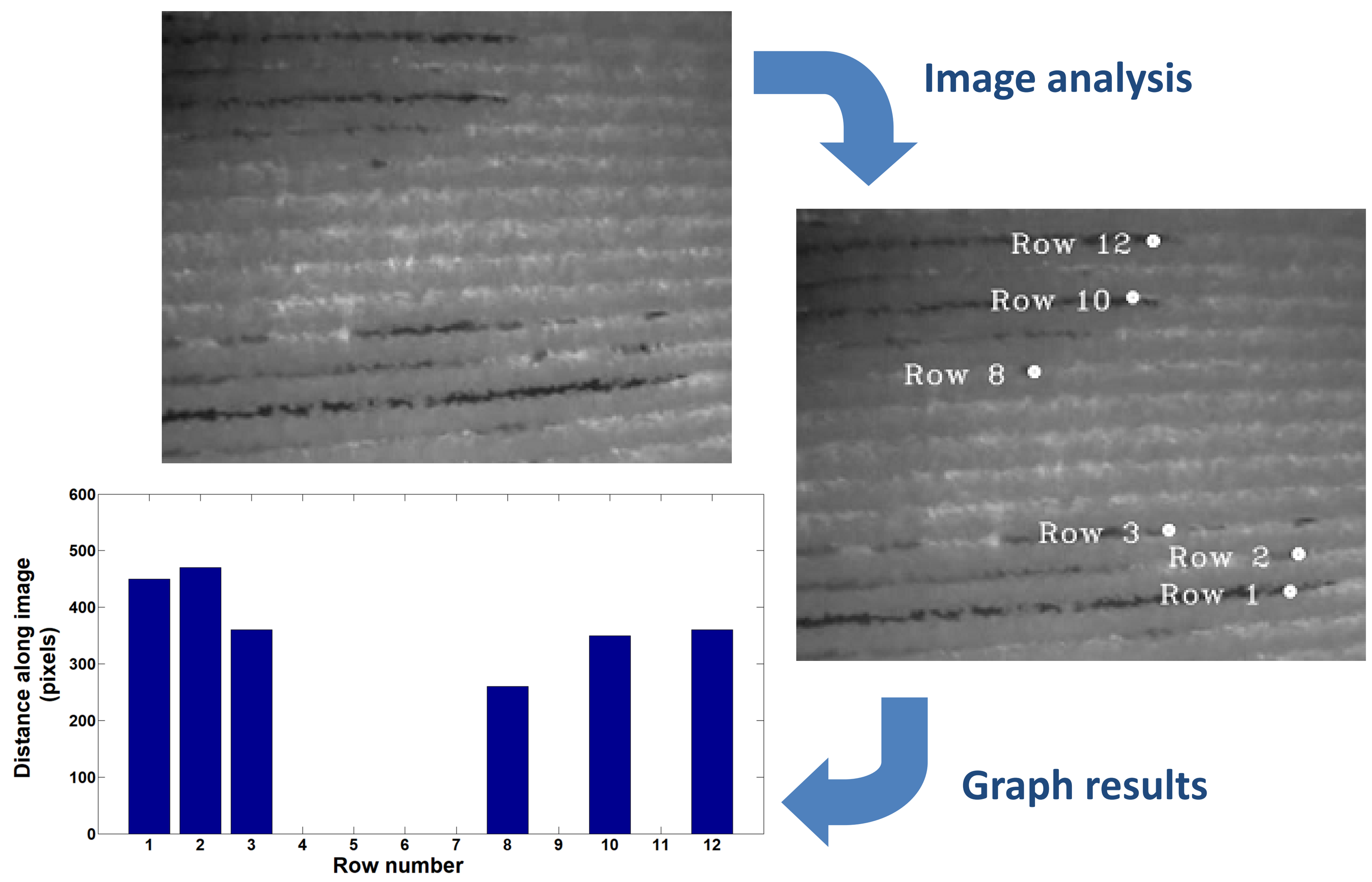
Small drones with thermal sensors and image analysis software have been identified as a potential alternative technology to in-field sensors for the collection of furrow irrigation advance rates. The drone system can be rapidly deployed to scout large fields with a single sensor.

The thermal sensor does not require light to reach the base of the crop, and thus can detect water in later crop growth stages when canopy closure obscures the view of the ground to standard colour cameras (as shown below).



Phantom 4 with mounted thermal camera. Photo acknowledgement: Warwick Waters, CottonInfo

The novel image analysis software processes the captured crop imagery after a scouting flight, and autonomously reports the irrigation advance position in each furrow to within 0.2 metres of actual. This drone and software system was shown in field trials to report irrigation advance to similar accuracy levels as existing field sensors.



Dr Derek Long, derek.long@usq.edu.au
A/Prof. Joseph Foley, foley@usq.edu.au