Machine vision App for automated cotton insect counting: initial development and first results

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Silverleaf whitefly, cotton aphids and spider mites cause cotton yield loss through plant feeding and lint contamination from waste secretions. Agronomists determine if control action is required from weekly monitoring of changes in pest counts. This manual sampling is labour-intensive as hundreds of leaves are sampled at 20-30 leaves per 25 hectares of cotton and examined by eye for the presence and density of each pest. Machine vision has potential to automate the pest counting on each leaf using infield cameras and image analysis software. There is potential to transfer the machine vision algorithms to a mobile device App for agronomist to enable real-time photo capture and analysis for pest counting. This App would standardise pest counting between different observers, improve chemical control decisions, provide a convenient method for logging and viewing data for each field, and inform Area Wide Management from silverleaf whitefly nymph counts.

Data collection and software development have been conducted to develop the image analysis algorithms for detecting silverleaf whitefly nymphs. A dataset of training images was captured from glasshouses cultures of whitefly and commercial cotton farms in southern Queensland with three smartphone models. Image analysis algorithms were developed to extract numbers of silverleaf whitefly nymphs (3rd/4th instar) on each leaf. Two image analysis methods were implemented: a segmentation-based approach, and a machine learning approach. The segmentation-based approach and machine learning approach detected silverleaf whitely nymphs with up to 67% and 79% accuracy, respectively. The image analysis algorithms will be refined through parameter optimisation and incorporated into an App that will be evaluated by agronomists in the 2019/20 season. The image analysis algorithms will be extended to cotton aphids and mites as all three insects can occur simultaneously.