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## Detection of Soybean Root Area Using 2D Imagery Data by Python Algorithm

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### [Introduction]

Image processing involves evaluating and monitoring different attributes of images, with thresholding being the initial step. Image analysis has been used in yield estimation, disease detection and shoot phenotyping of the plants. In this study, we estimated the root area of soybean [*Glycine max* (L.) Merr.] plants using a simple python algorithm.

### [Materials and Methods]

100 different soybean root images were scanned and subjected to analysis using the algorithm developed. Three different methods were used for the thresholding of the image; global threshold, adaptive threshold, and Otsu threshold. The results obtained were compared with those from WinRHIZO software taken as the standard.

### [Results and Discussion]

Among the three thresholding methods, global thresholding along with the adjustment of the threshold value (depending upon the root image) showed better results. Adaptive and Otsu thresholding showed better results than global thresholding, where no adjustment was done, but the results were less accurate than the adjusted threshold. The root mean squared error, residual standard error, mean absolute error, and average error percentages also suggest that threshold values adjusted according to the image yielded better results than other methods. Overall, it was observed that the root area can be estimated using python algorithm and adjustment of the threshold value of the image plays a significant role in the area estimation. Because roots have both pale and thick parts on the same surface, proper adjustment of the threshold value must be performed to obtain precise results.

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