

Regularized Neural Networks Fusion and Genetic Algorithm Based On-Field Nitrogen Status Estimation of Wheat Plants

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Abstract	<p>The estimation of nutrient content of plants is considerably important in agricultural practices, especially in enabling the application of precision farming. A plethora of methods has been used to estimate nitrogen amount in plants, including the utilization of computer vision. However, most of the image-based nitrogen estimation methods are conducted in controlled environments. These methods are not so practical, time consuming, and require many equipment. Therefore, there is a crucial need to develop a method to estimate nitrogen content of plants based on leaves images captured on field. It is a very challenging task since the intensity of sunlight is always changing and this leads to an inconsistent image capturing problem. In this paper, we develop a low-cost, simple, and accurate approach image-based nitrogen amount estimation. Plant images are captured directly under sunlight by using a conventional digital camera and are subject to a variation in lighting conditions. We propose a color constancy method using neural networks fusion and a genetic algorithm to normalize various plant images due to different sunlight intensities. A Macbeth color checker is utilized as the reference to normalize the color of the images. We also develop a combination of neural networks using a committee machine to estimate the nitrogen content in wheat leaves. Twelve statistical RGB color features are used as the input parameters for the nutrient estimation. The obtained result shows considerable better performance than the conventional gray-world and scale-by-max approaches, as well as linear model and single neural network methods. Finally, we show that our nutrient estimation approach is superior to the commonly used soil-plant analysis development meter based prediction.</p>
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