Glume pubescence classification of wheat using computer vision techniques

Artemenko N.V., Genaev M.A., Kruchinina Y.V.

Federal Research Center Institute of Cytology and Genetics, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia
E-mail: n.artemenko@g.nsu.ru

Pubescence is an important phenotypic feature of plants. Plants with pubescence have increased resistance to drought, frost, insect pests and other adverse environmental conditions [1], which can be an important morphological marker in particular for wheat. The problem requires to involve an expert, moreover methods without using a microscope are quite subjective.

In this paper, we will propose alternative methods for determining the feature of pubescence using convolutional neural networks. Deep learning has already been used, for example, to classify plants based on hairiness. The article [2] considered the classification of soybean plots into different types of pubescence. At the same time, it should be emphasized that the problem of predicting the presence or absence of the feature itself has not been previously studied.

Final results: efficient-net_b1, accuracy: 0,85; precision 0,81; auc: 0.85;

The work supported by RSF project № 23-14-00150.

The main publications of authors on the subject of the abstract:

[1] Johnson H.B. Plant pubescence: an ecological perspective // The Botanical Review, 1975, Vol. 41, pp.233-258.

[2] Robert W. Bruce. Istvan Rajcan. John Sulik. Classification of Soybean Pubescence from multispectral aerial Imagery // Plant Phenomics, 2021.

Take-home message:

Pubescence is an important phenotypic feature of plants. Plants with pubescence have increased resistance to adverse environmental conditions. How good could neural networks distinguish wheat by that feature? Better than expert? We've found out!

DOI 10.18699/PlantGen2023-07