DeepMaizeCounter: Smarter Stand Counts for Seedling Maize from Mosaic Imagery with YOLOv4

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November 23, 2022

Abstract

Knowing how many plants have germinated in a farmer's or researcher's field is central to crop management and research. Plants are commonly counted by walking the field and counting the plants in each row. This technique is labor-intensive, slow, and error-prone. Automating stand counts using RGB imagery from Unmanned Aerial Vehicles (UAV) is an obvious solution. We propose DeepMaizeCounter, a robust computational system that provides accurate stand counts for research and production fields from imagery captured by freely flown, inexpensive drones and processed with an inexpensive computer. DeepMaizeCounter exploits mosaics computed from RGB videos, using a YOLOv4 model that is trained to recognize seedling maize plants in the V2–V10 growth stages (approximately 10–40cm in height), singly or in groups of two and three plants, and determines its accuracy on these classes of seedlings. We evaluated DeepMaizeCounter against in-field and on-frame manual stand counts for a number of different maize lines in both nursery and production fields. DeepMaizeCounter can reliably distinguish corn from weeds and other grasses, counting only the maize. The network is light and able to run 175 test frames in 6 seconds, or 29 frames per second. This opens the prospect that DeepMaizeCounter can eventually be deployed on cheap platforms for real-time counting.

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October 15, 2021

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