Precise Pollen Grain Detection in Bright Field Microscopy Using Deep Learning Techniques (2019)

TÃ-tulo:Precise Pollen Grain Detection in Bright Field Microscopy Using Deep Learning Techniques
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The determination of daily concentrations of atmospheric pollen is important in the medical and biological fields. Obtaining pollen concentrations is a complex and time-consuming task for specialized personnel. The automatic location of pollen grains is a handicap due to the high complexity of the images to be processed, with polymorphic and clumped pollen grains, dust, or debris. The purpose of this study is to analyze the feasibility of implementing a reliable pollen grain detection system based on a convolutional neural network architecture, which will be used later as a critical part of an automated pollen concentration estimation system. We used a training set of 251 videos to train our system. As the videos record the process of focusing the samples, this system makes use of the 3D information presented by several focal planes. Besides, a separate set of 135 videos (containing 1234 pollen grains of 11 pollen types) was used to evaluate detection performance. The results are promising in detection (98.54% of recall and 99.75% of precision) and location accuracy (0.89 IoU as the average value). These results suggest that this technique can provide a reliable basis for the development of an automated pollen counting system.

Keywords: Convolutional neural networks; Deep learning; Bright-field microscopy; Visible light camera sensor; Automated palynology