

Wang, Jiaxin, Renninger, Heidi, & Ma, Qin. (2023). StoManager1: Automated, High-throughput Tool to Measure Leaf Stomata Using Convolutional Neural Networks (v.0504.23). Zenodo. <https://doi.org/10.5281/zenodo.7686022>

StoManager1: Automated, High-throughput Tool to Measure Leaf Stomata Using Convolutional Neural Networks

Select or type in image input & output path

Step1

Step2

Select models and set images resolution info and give the threshold for detection

Press start process

Step3

Step4

Do Statistical analysis

View the table and image output

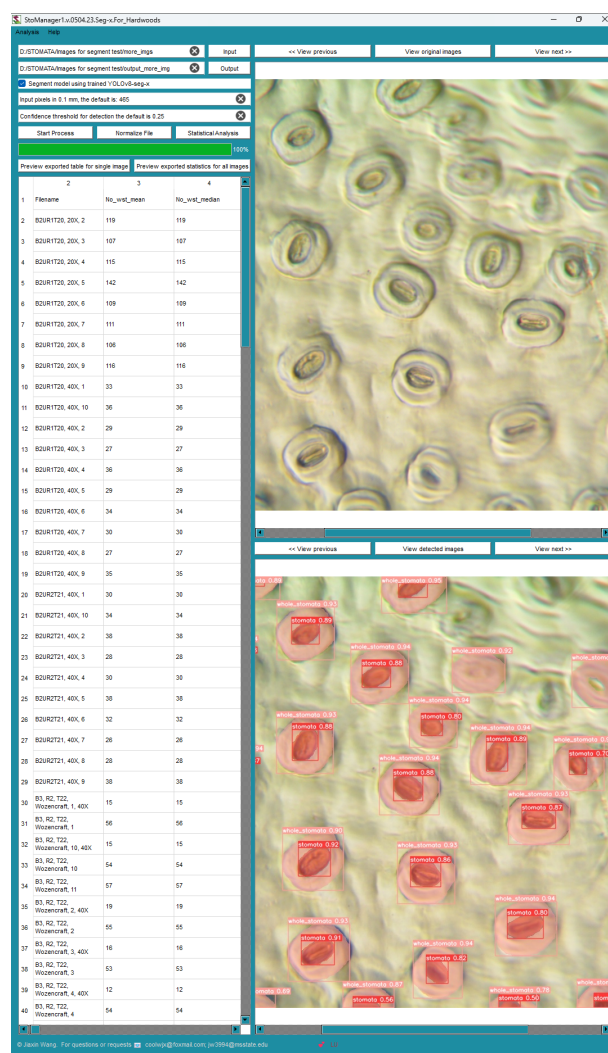
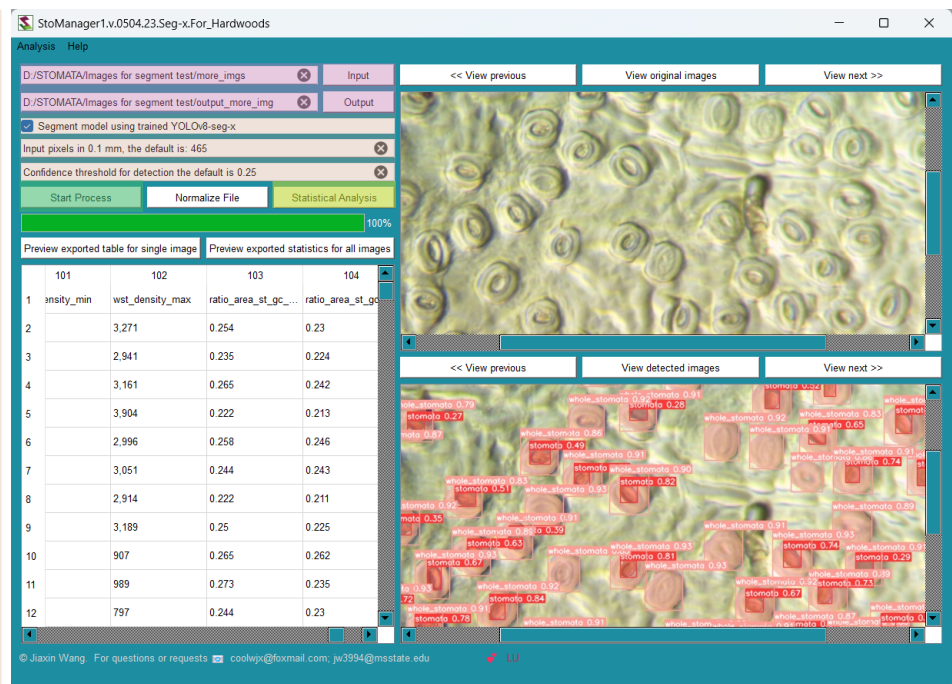
Step5

Feed image that has stomata in it.

Use independent paths for input and output

GPU version works 30-40 times faster than CPU version, but you must have a GPU with cuda11.7 installed correctly.

More training will be conducted to enhance the capability for more species.



Schematic diagrams of model training processes (a), detection workflow (b), and segmentation model pipeline for stomatal metrics measuring (c, d, e, f, g).

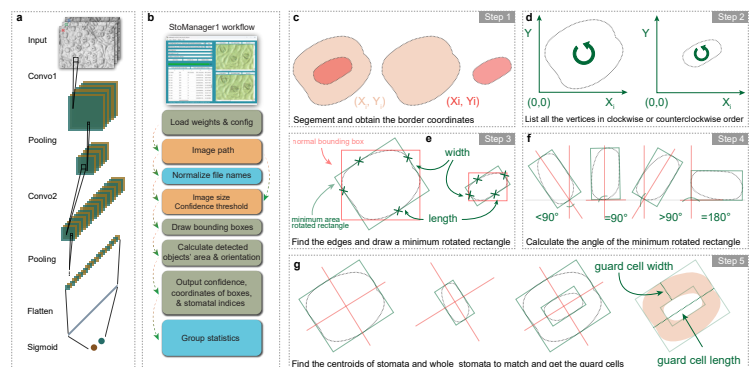


Table 2. Metrics of "stomata", "whole_stomata", and guard cell measured by StoManager1.

Output variables	Definition	Unit
ori_img_shape	original image shape, e.g., (1024, 768)	NA
class_wst	class of whole stomata, e.g., "1"	NA
number_wst	total number of whole stomata	NA
index_wst	index of whole stomata	NA
box_w_wst	bounding box width of whole stomata	pixels
box_h_wst	bounding box height of whole stomata	pixels
area_wst	area of whole stomata	μm ²
width_wst	width of whole stomata	μm
length_wst	length of whole stomata	μm
var_area_wst	variance of whole stomata area	μm ²
var_width_wst	variance of whole stomata width	μm ²
var_length_wst	variance of whole stomata length	μm ²
centroid_wst	centroid of whole stomata	NA
class_st	class of whole stomata, e.g., "0"	NA
number_st	total number of stomata	NA
index_st	index of stomata	NA
box_w_st	bounding box width of stomata	pixels
box_h_st	bounding box height of stomata	pixels
area_st	area of stomata	μm ²
width_st	width of stomata	μm
length_st	length of stomata	μm
var_area_st	variance of stomata area	NA
var_width_st	variance of stomata width	μm ²
var_length_st	variance of stomata length	μm ²
centroid_st	centroid of stomata	NA
guardCell_length	guard cell length	μm
guardCell_width	guard cell width	μm
guardCell_area	guard cell area	NA
guardCell_angle	orientation of guard cell	degree (°)
var_angle	variance of stomatal orientation	degree (°)
var_width_guardCell	variance of guard cell width	NA
var_length_guardCell	variance of guard cell length	NA
var_area_guardCell	variance of guard cell area	NA
wst_density	whole stomata density in each image	stomata/mm ²
ratio_area_st_to_gc	ratio of stomata area to guard cell area	μm ² /μm ²
ratio_area_st_to_img	ratio of the sum of all whole stomata area to image area	μm ² /μm ²
SEve	stomatal evenness index	NA
SDiv	stomatal divergence index	NA
SAgg	stomatal aggregation index	NA

What's new in this version?

1. Substantially improved group analysis speed.
2. Updated line-edit default text. Fine-tuned weights for Hardwoods.
3. Enhanced detection capacity for blurred images.
4. Implement segment models for directly measuring stomatal metrics.
5. Enhanced version with more stomatal metrics measured with theoretical algorithms!!
6. Increased Stomata indices such as stomatal evenness index, stomatal divergence index, and stomatal aggregation index.