

## CellFileAnalyzer–Automatic Plant Cell File Length Estimator

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### Abstract

CellFileAnalyzer is an automatic tool for cell file detection and cell length estimation, developed without using explicit image segmentation. Most analysis of plant structure is performed through manually measurement. In these conditions, researchers spend large amounts of time performing measurements which may not be reliable due to varying bias. This need to analyze a large amount of images from many replicate roots motivates the development of automatic tools for root structure analysis.

CellFileAnalyzer enables the detection of cell files, the main structure in plant roots, and extracts the length of the cells in those files. Contrary to most automatic plant root analysis applications it does not use image segmentation to detect cells and analyze their properties. Through the use of image symmetry analysis, cell files can be detected without requiring segmentation. Furthermore, after the detection of a cell file, the cell length estimation problem becomes a one dimensional problem with a much easier solution than that of cell segmentation. In both cases we use the phase based image symmetry.

CellFileAnalyzer reduces analysis time in more than 90%, improving the biologist work and more data to be analyzed. While the software implements a fully automatic approach, it is well known that fully automated solutions are unlikely to have zero errors. Manual editing is provided to the user for error correction, enabling the verification of results given by the approach. Users did not correct more than 20% of all automatically detected structure, taking no more than 10% of manual analysis time to do so.

### Keywords

Plant cell structure analysis, image symmetry, user interaction

