Image Analysis with IAP

Example Workflow for the Analysis of the Provided Maize Dataset

Analysis of the example data set

Load data set

Remark: the provided example data set contains compressed JPG images, the uncompressed PNG data set is available upon request.

At first download and start the IAP. You can find the link to the example data set on the starting screen as shown below (take in mind, this is the link to the compressed data set, it is saved on our webserver, the following steps show how it is used).
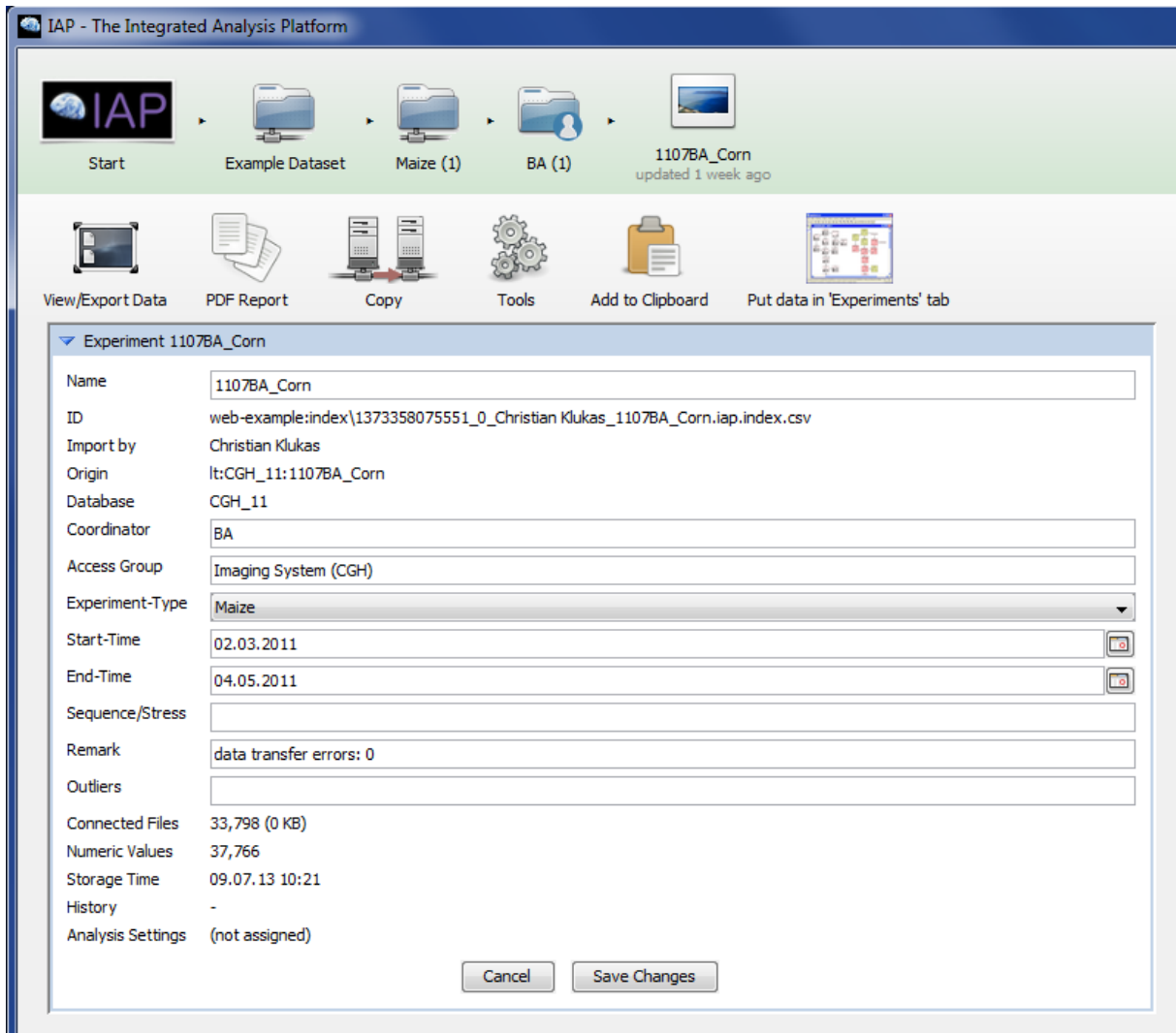

To navigate to the data click "Example Data Set" > "Maize (1)" > "Ba (1)" > "1107BA_Corn"
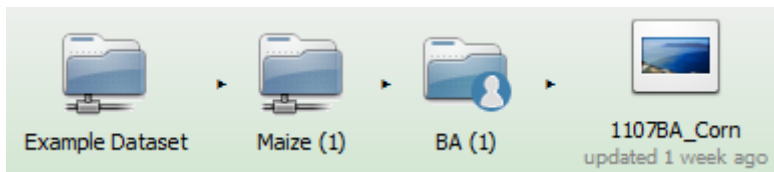

Data set overview

Now you are on the data set overview page. Here you can find some information about the data set also you can view the images by clicking on the Icon "View/Export Data".

However for performing the analysis you have to download the data set by clicking on the "Copy" button, here choose the button "To Local File System" and select your target folder. When the coping starts you should see a progress bar as shown below.
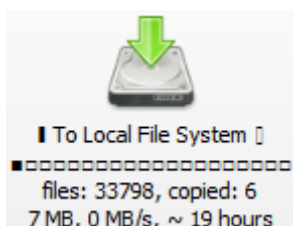

After coping, go to the IAP start screen by clicking on the "Start" icon. Now it is time to load the downloaded data set by clicking on "Load or Create Dataset" > "Load IAP Dataset(s) from File System", choose your target folder, where you saved the data set before. Then navigate further to the data set overview screen. This should look like this:
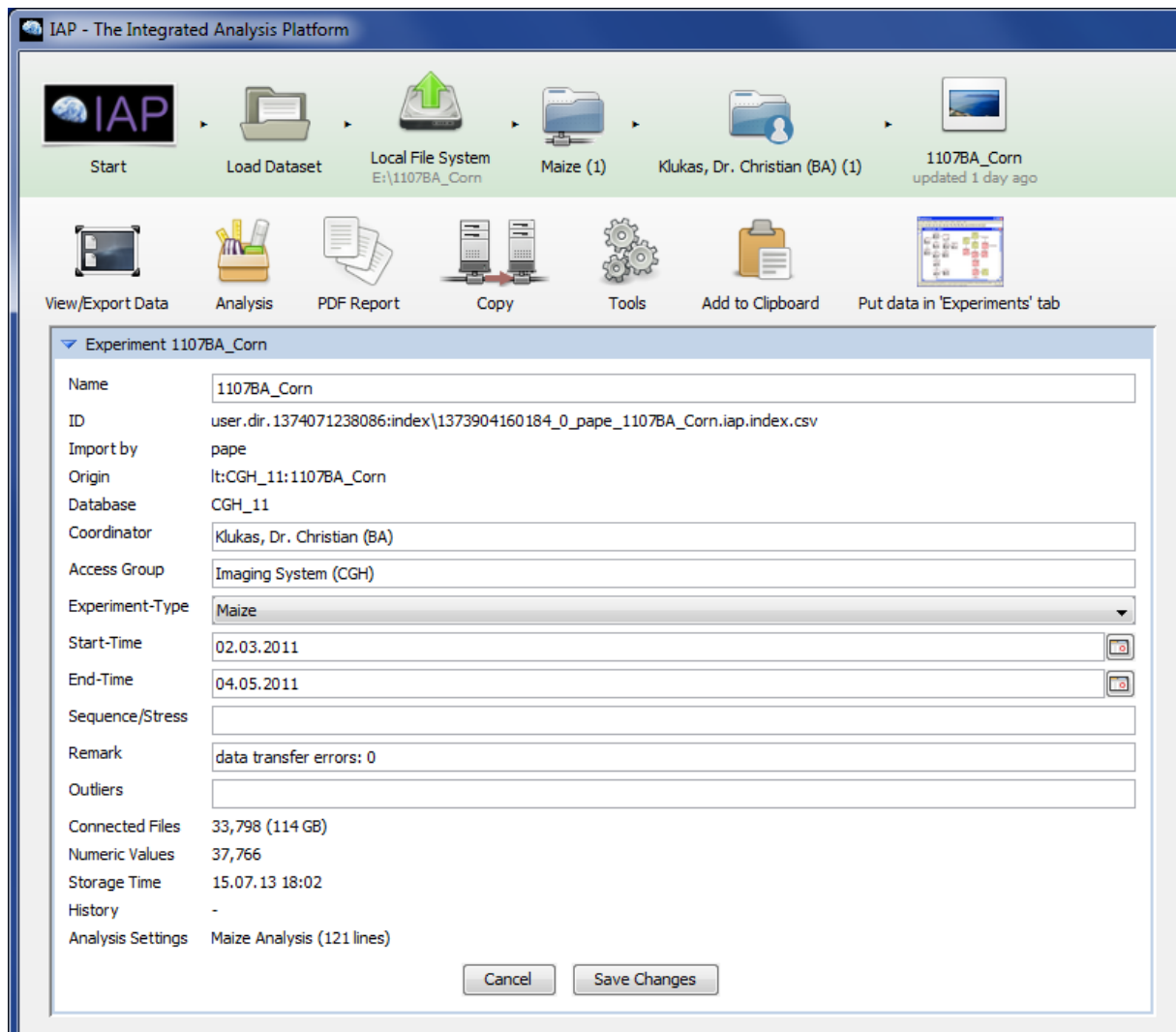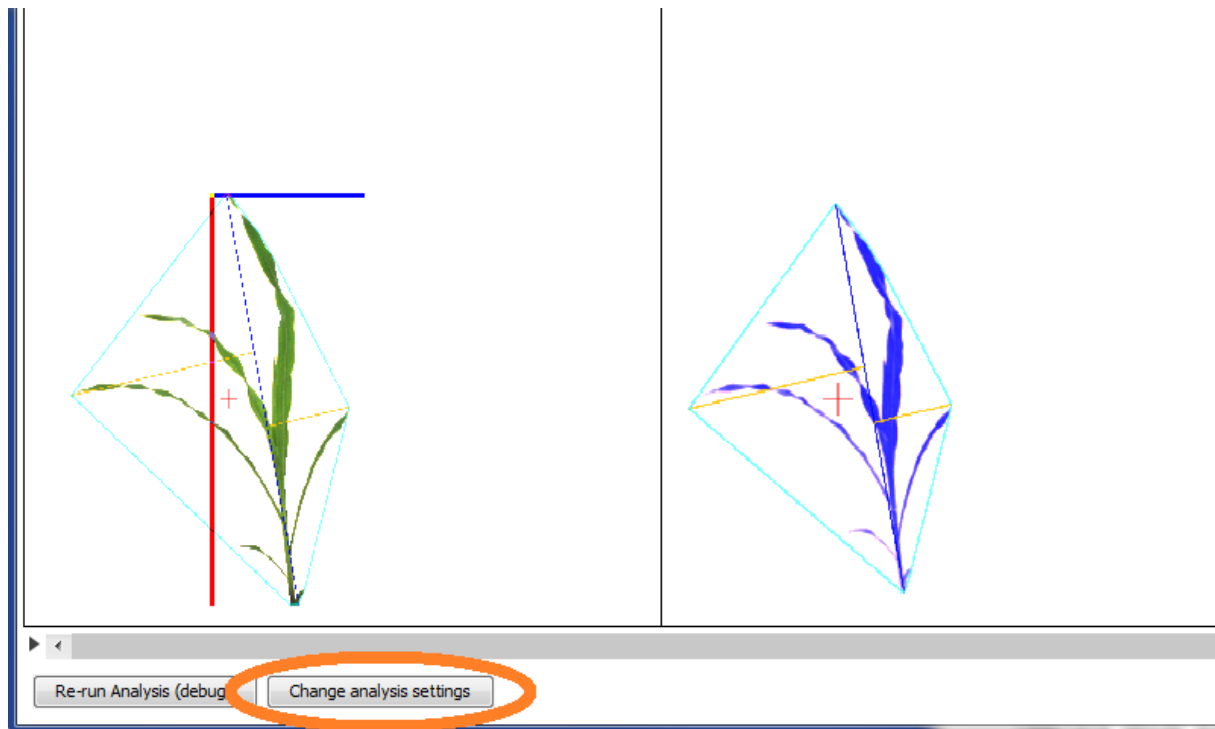
Perform Analysis

Now you can see a button "Analysis", click this and then click "Select Analysis Template" to choose the template which fits best to your data set, in our case the "Maize Analysis". Then you can go back and start the analysis with the default settings, but it is recommend to perform some test analysis to convince that the system works properly and maybe to change some settings. Therefore click on "View/Export Data" and select some images by navigating in the tree view as shown below.
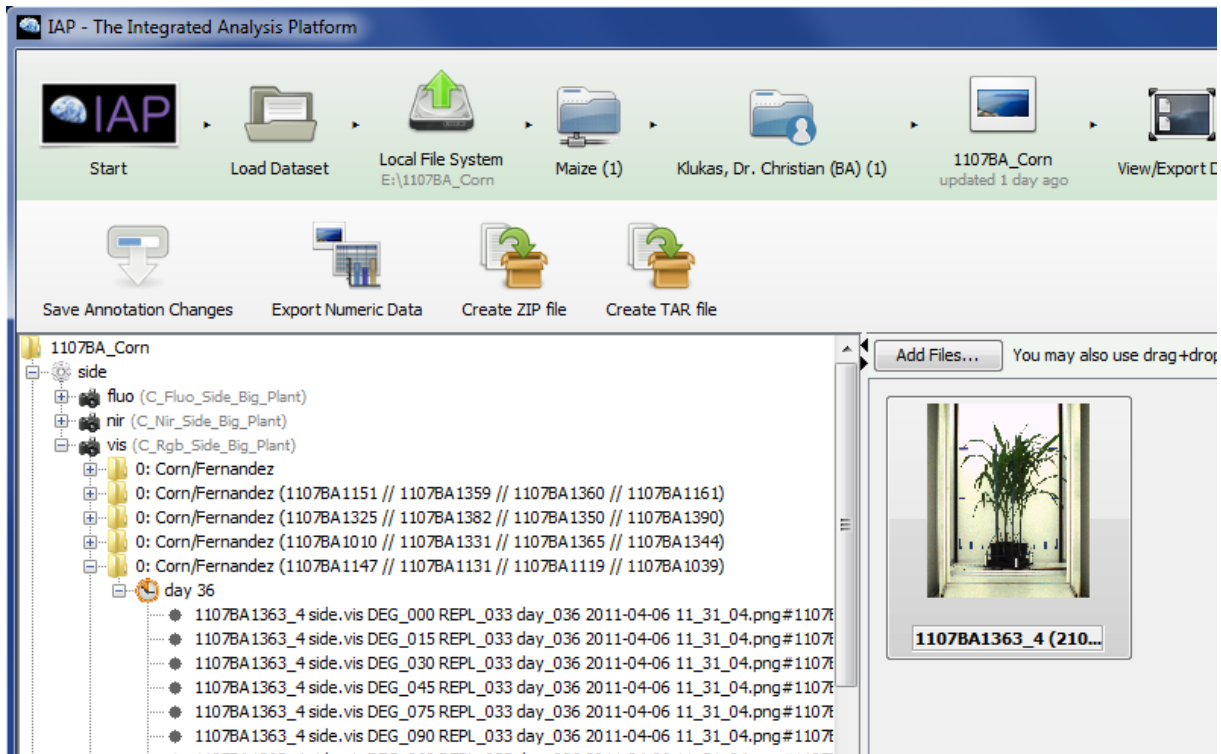
Now you can perform a test analysis by clicking right on the image as you can see below.
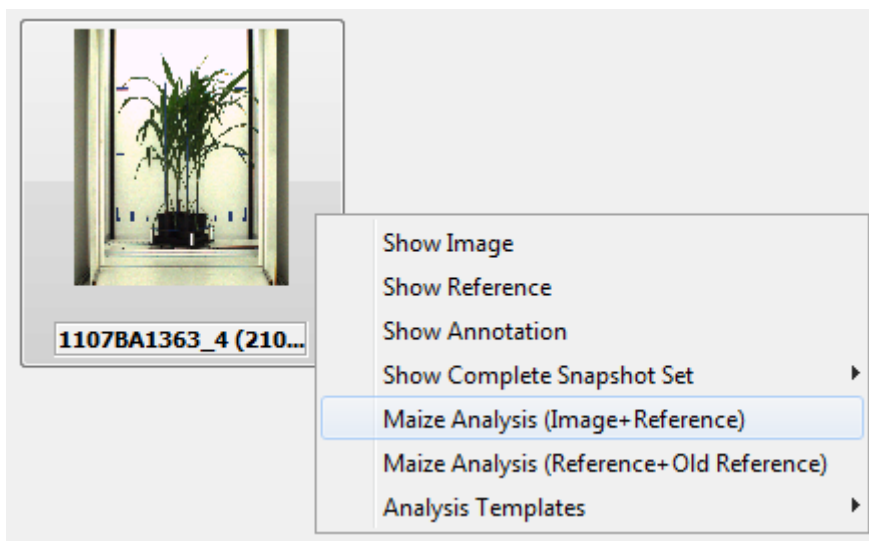

If the analysis is finished a new window appears. You can scroll through the result of each analysis block step by step. The analysis settings can be changed by clicking on "change analysis settings" as marked in the picture below.

After that you can perform an analysis, go back to the data set overview page and select "Analysis" -> "Perform Maize Analysis". After clicking a progress bar should appear. When the analysis is finished the result is automatically displayed.

Numeric Data Export

The numeric results can be exported by navigating "View/Export Data" > "Export Numeric Data" and then choose your preferred data-format.
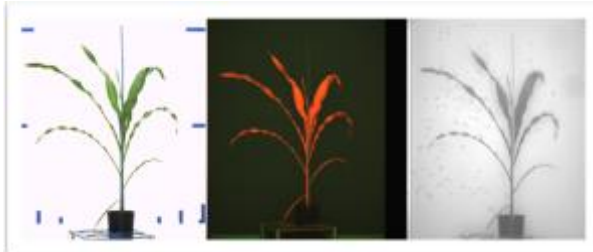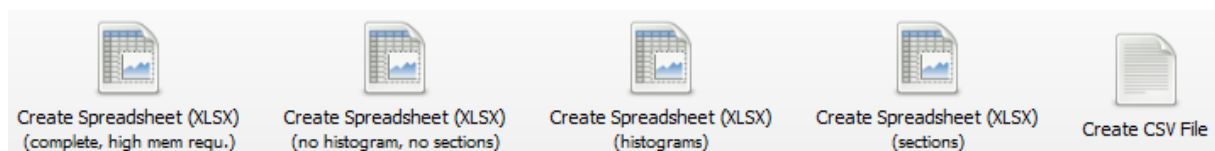
Analysis Steps of the Maize Analysis Pipeline

For getting a better understanding of the pipeline construction, we divided the analysis into 5 Steps. The images on the right show the output for each step. The pipeline is defined in the file MaizePipeline.java.

Data-Aquisition

At first the image data will be loaded.

Class Name	Description	Section Result
BlLoadImages	images of all imaging domains loaded	
BlCreateDummyReferenceIfNeeded	masks of all imaging domains loaded	

Data-Preprocessing

To get reliable results it is necessary to reduce influences caused by the imaging system. Therefore we perform an image normalisation and to aquire some calibration values.

Class Name	Description	Section Result
BlRotate	align rotation	
BlAlign	align orientation	
BlColourBalanceVerticalVis	apply vertical Colour Balancing on visible image	
BlColourBalanceVerticalFluo	apply vertical Colour Balancing on fluorescence image	

Class Name	Description	Section Result
BlColourBalanceVerticalNir	apply vertical Colour Balancing on near-infrared image	
BlColorBalanceCircularVisNir	apply circular Colour Balancing	
BlDetectBlueMarkers	detect and delete blue markers	
BlCutFromSide	clear images	

Segmentation

The segmentation step is used to separate the foreground (plant) and background (imaging chamber, carrier system).

Class Name	Description	Section Result
BlRemoveBackground	clear background by reference image	
BlIntensityCalculationFluo	create intensity images	
BlKMeansVis	use K-means color segmentation to detect fore- and background	
BlAutoAdaptiveThresholdNir	apply adaptive thresholding on near-infrared image	

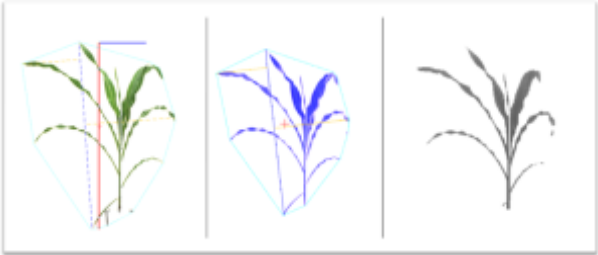| Class Name	Description	Section Result
BlClosing	apply closing operation	
BlMedianFilterFluo	apply median filter	
BlAdaptiveRemoveSmallObjectsVisFluo	remove artefacts	
BlAdaptiveUseFluoMaskToClearOther	remove artefacts by image compare	

Feature-Extraction

In this step the plant traits will be extracted.

Class Name	Description	Section Result
BlSkeletonizeVisFluo	calculate the skeleton by thinning	You can find a complete overview about the calculated traits in the documentation, in the appendix ([User Documentation](#)).
BlSkeletonizeNir	↑ see above	
BlCalcWidthAndHeight	get maximal height and width	
BlCalcMainAxis	calculate the main axis rotation	
BlCalcColorHistograms	calculates overall properties (#pixels, intensities, NDVI)	
BlCalcConvexHull	calculates convex hull based shape parameters	
BlCalcAreas	calculates plant area based on segmentation result	
BlCalcVolumes	calculates plant volumes (biomass)	

Postprocessing

At last, all the data will be collected and saved in a result data set. Also some results will be highlighted in the result images.

Class Name	Description	Section Result
BlRunPostProcessors	draw analysis results of feature extraction blocks	
BlDrawSkeleton	draw skeleton in result images	
BlMoveMasksToImageSet	copy images in result image set	
BlHighlightNullResults	mark errors and outliers in result image set	