Classification Tools

Powerful software based on supervised classification technology to efficiently classify objects of interest

Classifying Objects in Images

The Aphelion™ Imaging Software Suite includes four powerful tools for developing advanced classification applications for automatically identifying the type or class of objects found in a set of images. The four tools are Classifier Builder (the classification application front-end) and three classifier plug-ins: Fuzzy Logic, Random Forest and Neural Network, with the last two being an optional Aphelion extension product.

Classifier Builder

Classifier Builder, a tool included with the Aphelion Dev product, serves as a front-end for a classification application. It is used to define training data and to configure a classifier tool through a supervised learning process performed on a training dataset. With Classifier Builder, the user can easily and seamlessly perform a manual classification that assigns objects of interest to user-defined classes. This is especially useful for creating a training dataset. The Classifier Builder modifies ObjectSets in the sense it is adding a new attribute to each object that will contain the object's class.

Classifier Builder includes capabilities to:

- Load ObjectSets in a classification project
- Define object classes
- Select object measurements to compute
- Select attributes to use during the training process
- Discard highly correlated attributes, keeping only one
- Compute classifier parameters automatically
- Perform a manual classification

The Classifier Builder is provided with the Fuzzy Logic extension to enable the user to quickly perform object classification based on fuzzy logic. As options, the Neural Network and Random Forest extensions can be used for more advanced classification tasks.

Fuzzy Logic Extension

The Fuzzy Logic extension lets the user define a supervised classification that assigns an object to a class based on the numeric values of the object's attributes. The user interacts with Classifier Builder to define the lower and upper bounds for all user-selected attributes,

for each class. In addition to attribute bound values, the user can alter the fuzziness shape type (e.g., pass-band, cut-band, low-pass, high-pass), the fuzziness width, and the attribute weight. The output of Fuzzy Logic is a classifier that assigns each object to the class for which it computes the highest score. The settings of the Fuzzy Logic classifier can be saved and then loaded into Aphelion Dev to be automatically applied to any Aphelion ObjectSet.

Neural Network Extension

The Neural Network extension is an optional Aphelion extension. It enhances Dev with a powerful capability to automatically classify complex objects of interest based on a supervised classification of objects into categories or classes. The Neural Network extension frees the user from the necessity of specifying complex rules for object classification, such as are required by probability and information-based classifiers.

The Aphelion Neural Network extension was developed in partnership with the University of Caen (Normandy, France)[1]. It has been successfully used to perform Optical Character Recognition as the last phase of a License Plate Reader application that has been implemented on a portable device equipped with a low-resolution camera.

Random Forest Extension

The Random Forest Extension for Classifier Builder is also an Aphelion extension. It enhances Aphelion Dev and Classifier Builder with a powerful capability to automatically classify complex objects of interest based on a supervised classification of objects into categories or classes. The extension frees the user from the necessity of specifying complex rules for object classification, such as the ones that are required by probability and information-based classifiers.

Training Database Generation

The first step in creating a classification application is to build a training database using Classifier Builder. This includes specifying the list of object classes. The list of defined classes is saved as an XML file in a Classifier Builder Project. Next, a representative ObjectSet is chosen and its objects are manually assigned to object classes

Classifier Settings

The second step of the classification process is to select the classifier to use and specify the classifier settings (i.e., define user parameters including settings used during the classification process).
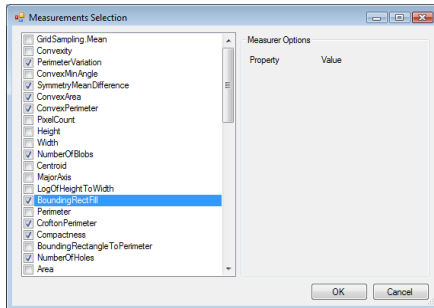

This step includes the user choosing object attribute measurements from the list provided in Aphelion Dev. These include shape attributes (e.g., area, perimeter, Feret diameters), texture attributes (e.g., Haralick parameters), and statistical attributes (e.g., pixel mean, minimum, maximum). The list of selected measurements is saved in the Classifier Builder Project.

The class attribute and all computed attributes are added to each loaded ObjectSet to form new ObjectSets, which can be saved and later imported into Aphelion Dev for further analysis.
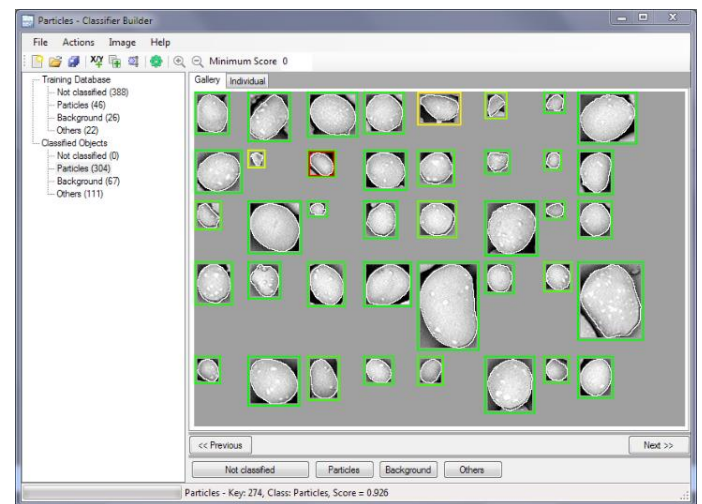
Classification Results

The classification results can be reviewed by browsing all of the object pictures and their assigned classes. In the screen capture below the text "Picture XXX - Key = Y" connects the picture with index "XXX" to its corresponding object "Y" in the ObjectSet.

After it is configured, a classifier can be executed in the Aphelion Dev environment in order to automatically apply the classifier to new ObjectSets.

Picture 001 - Key = 9
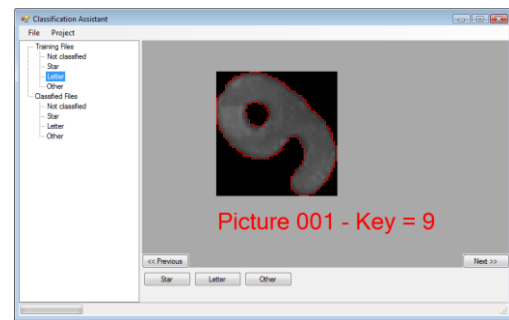
Application fields

The Aphelion Neural Network extension has been successfully used in the fields of biology, cytology (e.g., cell analysis), particle recognition and characterization, agriculture, quality control, optical character recognition (e.g., license plate analysis), remote sensing, and more. Its versatility makes it well-suited for any image domain requiring advanced classification tools.

[1] O. Lezoray, H. Cardot, A Neural Network Architecture for Data Classification, International Journal of Neural Systems, Vol. 11, n°1, pp. 33-42, 2001.

Main benefits of the Aphelion Classification tools

- Easy to use graphical interface designed specifically for classification applications
- Powerful tools for advanced image understanding using Aphelion Dev ObjectSets
- Optimized classification based on the MONNA architecture
- Capable of high-level classification for a broad range of applications
- Effective for applications where number of classes requires a large set of attributes
- Compatible with Windows 10 and 11
- Compatible with main image file including Big-Tiff and Tiff Tiled image file formats