

IMDEX ioGAS™

New Features

SOFTWARE 7.2

IMDEXHUB-IQ ENABLED

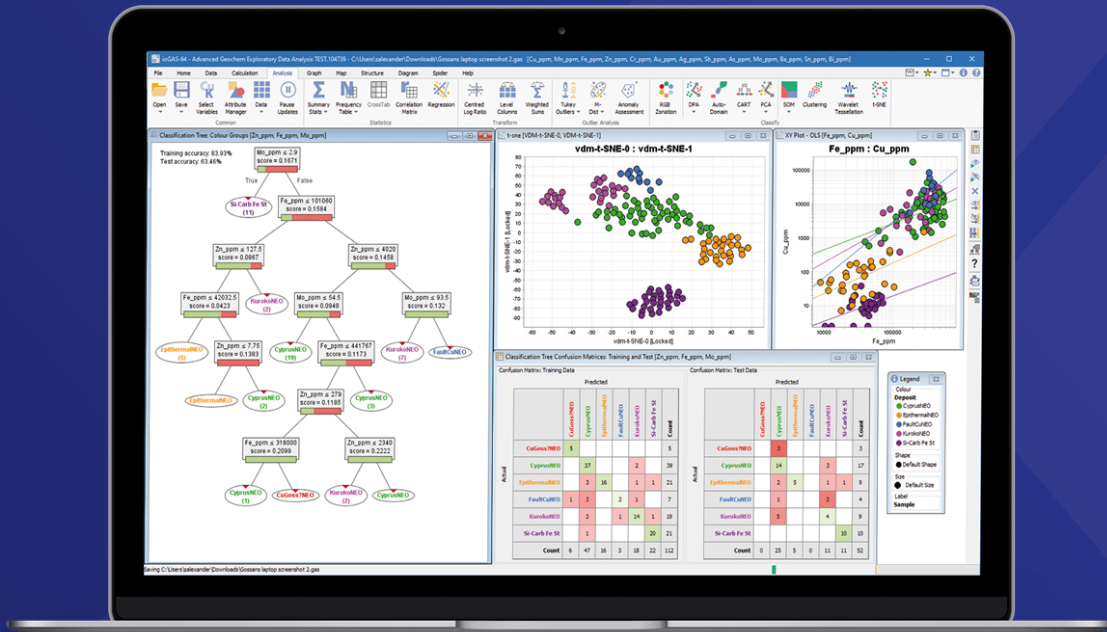


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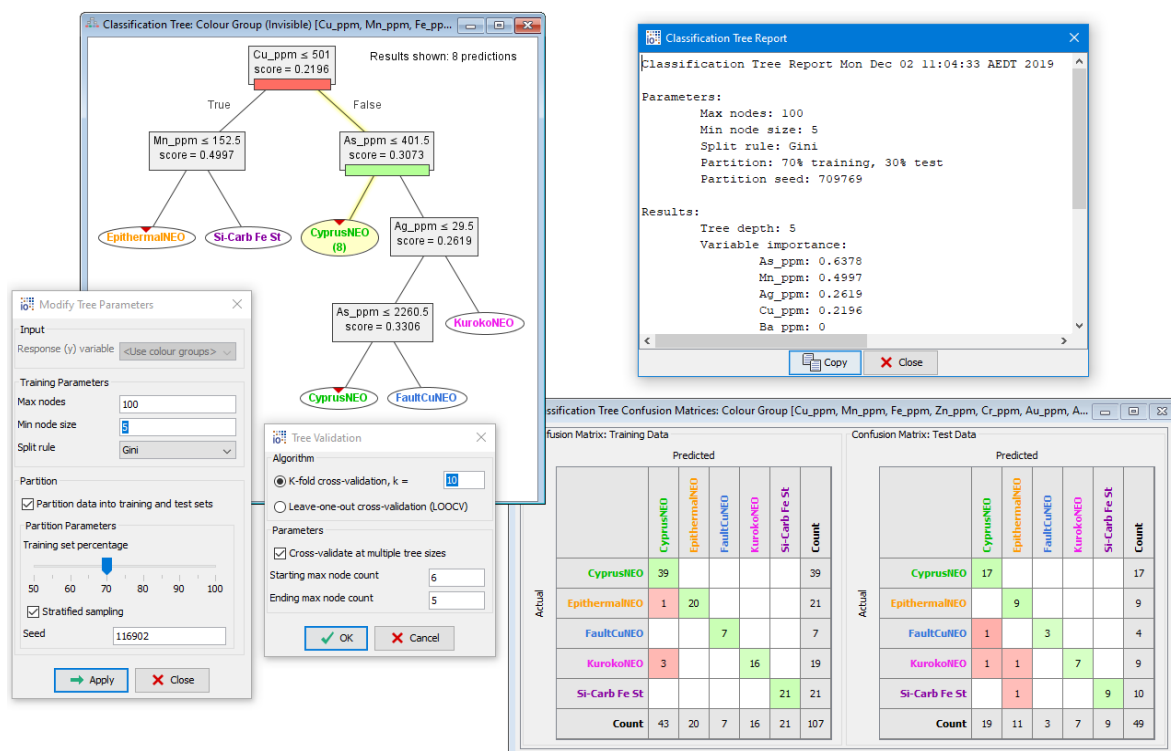
What's New in ioGAS™ 7.2

CART (classification and regression trees)

CART is a non-parametric supervised machine learning algorithm used for the generation of decision trees. Decision trees are predictive models used to devise an optimum set of parameters to allocate a sample into one of a set of target groups (classification tree) or to predict the value of a target variable (regression tree). In order to define these parameters, a training dataset is used where the target group memberships are known ahead of time (*a priori*).

A decision tree is a highly visual tool, making it easy to determine the importance of the input variables in the binary decision process in order to achieve the desired output target. Using sample group visibility controls within ioGAS™, optimised decision trees can be used to predict results for unknown samples, either from within the learning dataset or from another dataset.

Industry examples include rock, mineralisation, alteration or deposit type classification, prediction of ore grade or bio-geochemical plant species, etc or any other application requiring ongoing classification of new data.



The screenshot displays several windows from the ioGAS software interface:

- Classification Tree: Colour Group (invisible) [Cu_ppm, Mn_ppm, Fe_ppm...]**: Shows a decision tree structure. The root node is $Cu_ppm \leq 501$ (score = 0.2196). The 'True' branch leads to $Mn_ppm \leq 152.5$ (score = 0.4997), which splits into EpithermalNEO and Si-Carb Fe St. The 'False' branch leads to $As_ppm \leq 401.5$ (score = 0.3073), which splits into CyprusNEO (8) and $Ag_ppm \leq 29.5$ (score = 0.2619). The latter splits into KurokoNEO and $As_ppm \leq 2260.5$ (score = 0.3306), which further splits into CyprusNEO and FaultCuNEO.
- Modify Tree Parameters**: A dialog box for adjusting training parameters. It includes fields for Max nodes (100), Min node size (5), Split rule (Gini), Partition (70% training, 30% test), and Stratified sampling (checked).
- Tree Validation**: A dialog box for validation settings. It shows K-fold cross-validation with k=10 selected, and checkboxes for cross-validation at multiple tree sizes and stratified sampling.
- Classification Tree Report**: A text report window showing parameters (Max nodes: 100, Min node size: 5, Split rule: Gini, Partition: 70% training, 30% test) and results (Tree depth: 5, Variable importance: As_ppm: 0.6378, Mn_ppm: 0.4997, Ag_ppm: 0.2619, Cu_ppm: 0.2196, Ba_ppm: 0).
- Confusion Matrices**: Two tables comparing predicted vs actual results for training and test data. The predicted classes are CyprusNEO, EpithermalNEO, FaultCuNEO, KurokoNEO, and Si-Carb Fe St.

Actual \ Predicted	CyprusNEO	EpithermalNEO	FaultCuNEO	KurokoNEO	Si-Carb Fe St	Count
CyprusNEO	39					39
EpithermalNEO	1	20				21
FaultCuNEO			7			7
KurokoNEO	3			16		19
Si-Carb Fe St					21	21
Count	43	20	7	16	21	107

Actual \ Predicted	CyprusNEO	EpithermalNEO	FaultCuNEO	KurokoNEO	Si-Carb Fe St	Count
CyprusNEO	17					17
EpithermalNEO		9				9
FaultCuNEO	1		3			4
KurokoNEO	1	1		7		9
Si-Carb Fe St		1			9	10
Count	19	11	3	7	9	49

The new CART tool in ioGAS™ includes:

- training/test group partitioning
- stratified sampling
- tree optimisation and cross-validation tools
- variable importance reports
- generate predictions using visible, invisible or all data groups
- highlight predicted tree pathways
- write results to new data columns
- save tree as XML file

Classification trees contain the following additional options:

- use colour attribute groups as input targets
- choice of three split rule algorithms: Gini Impurity, entropy or classification error
- display confusion matrix for sample mis-classification analysis
- build random forest

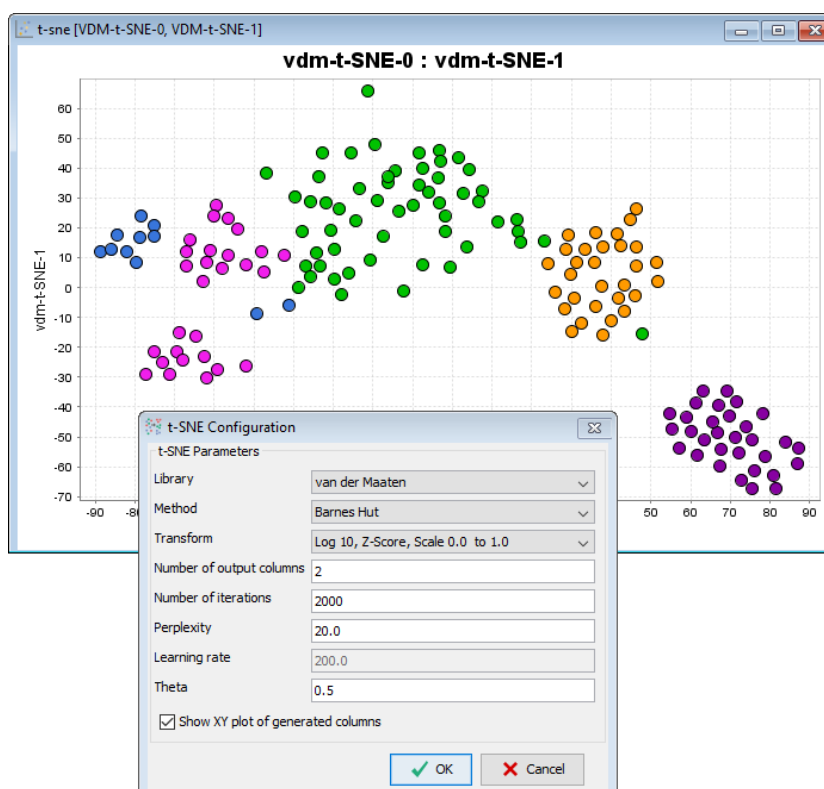
CART complements the other existing supervised learning tools in ioGAS™: DPA and Auto-Domaining.



t-distributed Stochastic Neighbour Embedding (t-SNE) is an additional dimension reduction exploratory technique similar to PCA used for the analysis and visualisation of high-dimensional data in low-dimension or 2D space. As an unsupervised method, no 'a priori' groups are required although transformation of the input variables remains important. In contrast to the linear PCA however, the non-linearity of the t-SNE method may reveal additional insights into the structure of the data. The output of a t-SNE is a simple scatter plot.

ioGAS™ supports two **t-SNE** algorithms:

- van der Maaten (including Barnes Hut)
- SMILE



The example above is a t-SNE analysis of 15 chemical variables from a group of gossan samples showing the groups easily separated by the t-SNE projection onto a 2-dimensional scatter plot rather than the original input variables.

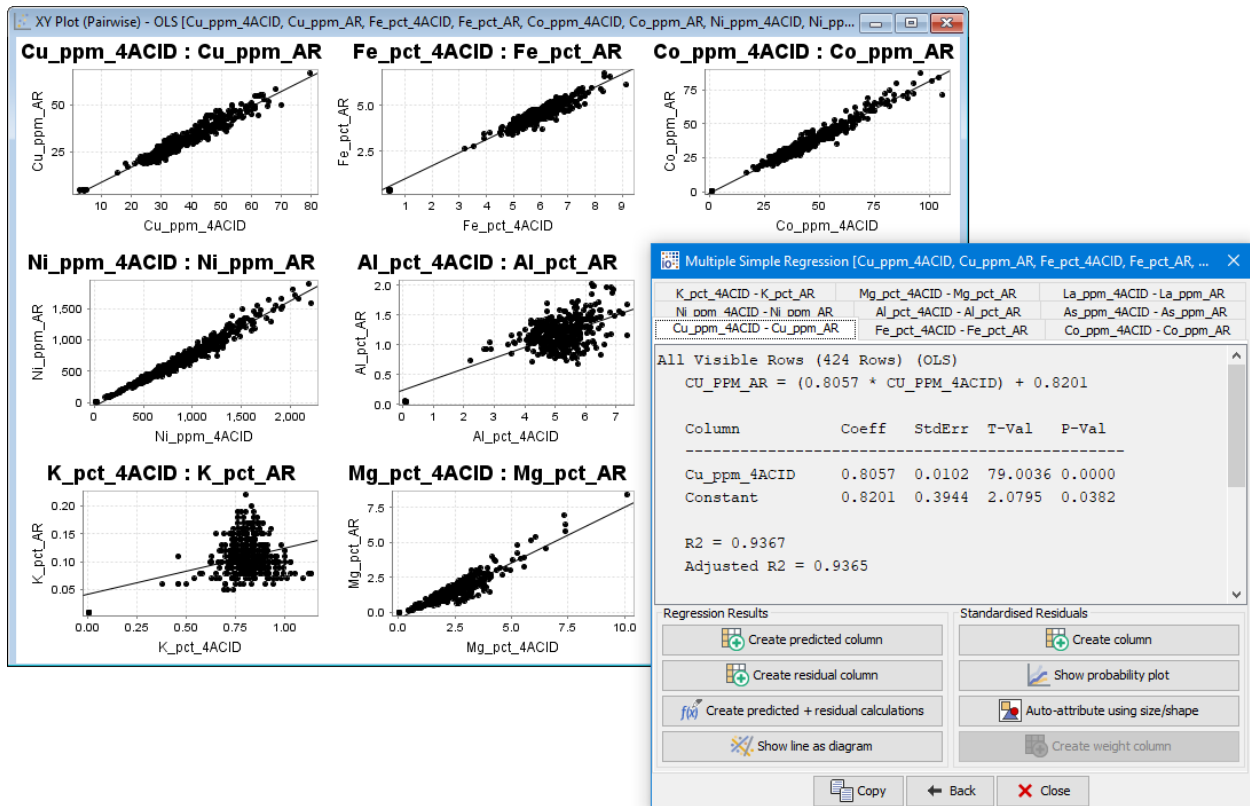
Regression analysis

The simple regression tool in ioGAS™ uses a single explanatory variable to predict values for the response variable. In 7.2, this has been expanded to enable multiple simple regressions to be performed at the same time. Using the order of the selected variables and the XY/YX paradigm used in other tools the following options are now available:

- **XY** - first selected variable used as the explanatory (X) variable and second or subsequent variables as the response (Y) variable/s.
- **YX** - first selected variable used as the response (Y) variable and the second or subsequent variables as the explanatory (X) variable/s.

Pairwise versions of the above are also available. These require an even number of variables to be selected with regressions calculated for each pair of variables, e.g.

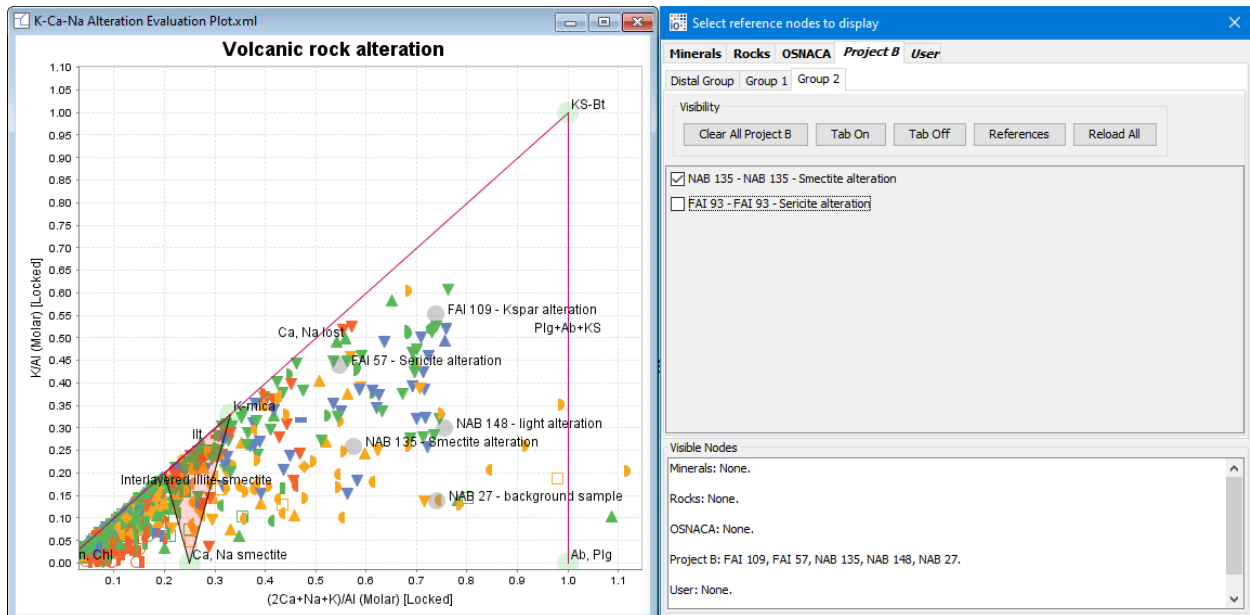
variable 1 vs variable 2, variable 3 vs variable 4, etc. Useful for displaying data collected by different analytical methods or for XRF calibration.



➔ User nodes

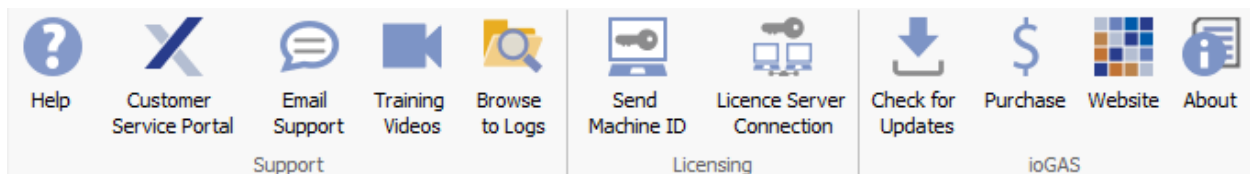
Add custom mineral and rock compositions to the existing ioGAS™ node library. **User nodes** may include new minerals or minerals with different compositions to those already provided under the Minerals tab or rock samples collected over company project areas and local deposits.

User nodes are read into the library via one or more specially formatted excel spreadsheets. New nodes can be manually entered into a spreadsheet or exported directly from the **User Nodes** tool on the File ribbon in ioGAS™ into the required file format.



IMDEX customer service portal

Existing ioGAS™ users can access the IMDEX Customer Service portal on the Help ribbon. Search the ioGAS™ knowledge base, obtain technical support or request an enhancement. The support portal can also be used to lodge licence requests. A one-off registration is required.



Improvements

Save and append

- append .gas file to current session
- append data to open plot windows
- insert imported filename when saving as native .gas file

SQL Server database

- support Microsoft Windows authentication

Legend window

- option to show label column

Attribute manager

- select group colour directly from screen

User interface

- display ioGAS™ windows and dialogs underneath other open applications
- open Attribute Manager in screen top right
- display current installer details in Help>About dialog

Wavelet tessellation

- filter %, interpolation, line and colouring modes added to plot titlebar
- display group names in count vs Sum of Squares plot

Discriminant projection analysis

- display number of unused colour groups due to multivariate constraints

Biplots

- specify render order

User diagrams, calculations and templates

- automatically added to user and recent lists

Mineral and rock nodes

- resize settings dialog
- reset nodes to default selection

Select variables

- Bi added to provided porphyry Cu-Au deposit group

Downhole plots

- updated default colour sequence

Analysis ribbon

- new Supervised and Unsupervised bands

Favourites list

- add window display options as favourites