Subject

Most of the time, the statistician must build groups of individuals and want to characterize them. The main interest of this very simple approach is that the results are easy to read and understand.

In this tutorial, we show how to build groups with some (target) attributes, and describe them with other (input) attributes.

Dataset

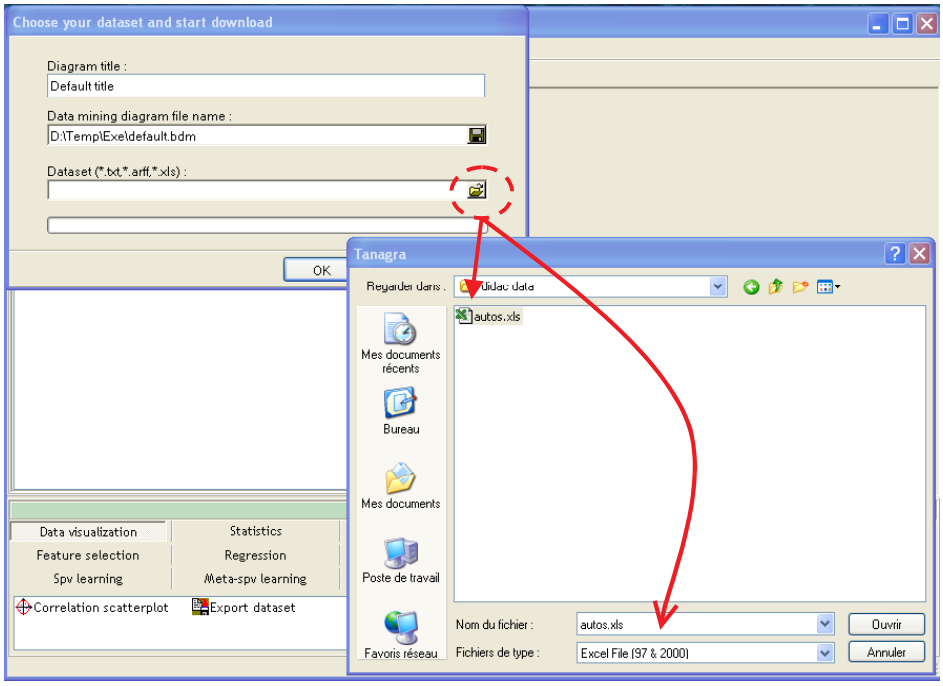
We use the « AUTOS.XLS » dataset with 205 examples.

We want to describe the cars starting from their consumption, price, horsepower and body-style according to their fuel-type (GAS or DIESEL) and aspiration (STD or TURBO).

Description and interpretation of groups with TANAGRA

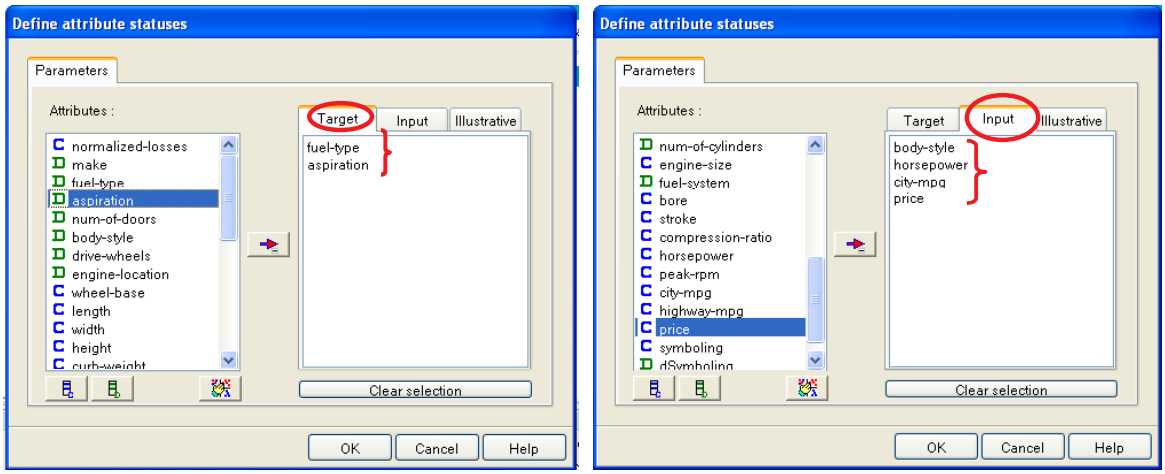
Download the dataset

First of all, we import the dataset. We use the FILE / NEW menu.



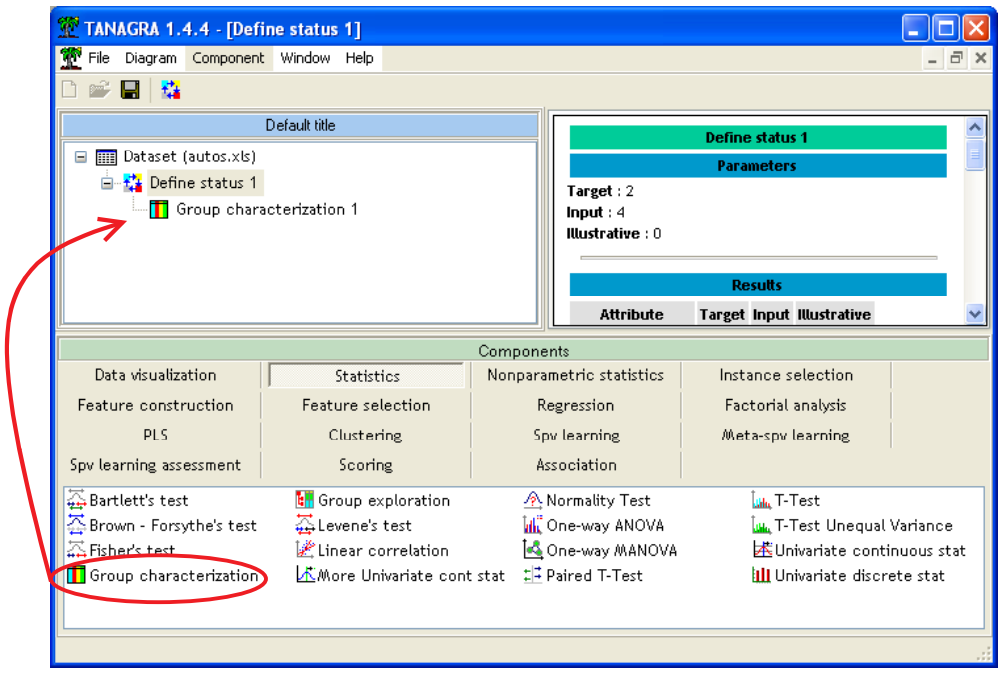
Attribute selection

We want to build groups according to FUEL-TYPE and ASPIRATION; we set these attributes as TARGET. We want to describe groups according to BODY-STYLE, HORSEPOWER, CITY-MPG and PRICE; we set them as INPUT.



Groups from one target attribute

We use the GROUP CARACTERISATION component for the construction of independent groups from the two target attributes.



This component gives two independent reports for each target attributes. They allow us to understand the specificities of each group.

Description of "fuel-type"

fuel-type=gas				fuel-type=diesel			
Examples			[90.2 %] 185	Examples			[9.8 %] 20
Att - Desc	Test value	Group	Overral	Att - Desc	Test value	Group	Overral
Continuous attributes				Continuous attributes			
horsepower	2.4	106.40	104.26	city-mpg	3.6	30.30	25.22
price	-1.6	12922.69	13207.13	price	1.6	15838.15	13207.13
city-mpg	-3.6	24.67	25.22	horsepower	-2.4	84.45	104.26
Discrete attributes				Discrete attributes			
body-style=hatchback	2.9	[98.6 %]	37.3 % 34.1 %	body-style=sedan	2.7	[15.6 %]	75.0 % 46.8 %
body-style=convertible	0.8	[100.0 %]	3.2 % 2.9 %	body-style=wagon	0.4	[12.0 %]	15.0 % 12.2 %
body-style=hardtop	-0.3	[87.5 %]	3.8 % 3.9 %	body-style=hardtop	0.3	[12.5 %]	5.0 % 3.9 %
body-style=wagon	-0.4	[88.0 %]	11.9 % 12.2 %	body-style=convertible	-0.8	[0.0 %]	0.0 % 2.9 %
body-style=sedan	-2.7	[84.4 %]	43.8 % 46.8 %	body-style=hatchback	-2.9	[1.4 %]	5.0 % 34.1 %

Description of "aspiration"

aspiration=std				aspiration=turbo			
Examples			[82.0 %] 168	Examples			[18.0 %] 37
Att - Desc	Test value	Group	Overral	Att - Desc	Test value	Group	Overral
Continuous attributes				Continuous attributes			
city-mpg	2.9	25.84	25.22	horsepower	3.4	124.43	104.26
price	-2.5	12554.06	13207.13	price	2.5	16172.44	13207.13
horsepower	-3.4	99.81	104.26	city-mpg	-2.9	22.41	25.22
Discrete attributes				Discrete attributes			
body-style=convertible	1.2	[100.0 %]	3.6 % 2.9 %	body-style=wagon	0.3	[20.0 %]	13.5 % 12.2 %
body-style=hardtop	0.4	[87.5 %]	4.2 % 3.9 %	body-style=sedan	0.2	[18.8 %]	48.6 % 46.8 %
body-style=hatchback	-0.1	[81.4 %]	33.9 % 34.1 %	body-style=hatchback	0.1	[18.6 %]	35.1 % 34.1 %
body-style=sedan	-0.2	[81.3 %]	46.4 % 46.8 %	body-style=hardtop	-0.4	[12.5 %]	2.7 % 3.9 %
body-style=wagon	-0.3	[80.0 %]	11.9 % 12.2 %	body-style=convertible	-1.2	[0.0 %]	0.0 % 2.9 %

FUEL-TYPE 90.2% of cars uses GAS, they are higher horsepower than the other cars (106.4 hp versus 104.2 hp for the whole dataset); they have higher consumption (24.67 mpg versus 25.22 mpg).

The TEST VALUE column shows the strength of the difference. The higher is the absolute value of this indicator, the higher is the difference between the mean computed in the subgroup and the mean computed on the whole dataset.

About the DISESEL cars, we see that they have lower consumption (30.30 mpg) and horsepower (84.45 hp) than the other cars. We see also that there is a significant presence of SEDAN (body-style) cars in this group: there are 46.8% in the whole dataset; there are 75% in

this subgroup [$P(SEDAN / DIESEL) = 0.75$, we can interpret this proportion as a **precision,** see the following cross-tabulation].

NB fuel-type	fuel-type		
body-style	diesel	gas	Total
convertible	0.00%	3.24%	2.93%
hardtop	5.00%	3.78%	3.90%
hatchback	5.00%	37.30%	34.15%
sedan	75.00%	43.78%	46.83%
wagon	15.00%	11.89%	12.20%
Total	100.00%	100.00%	100.00%

In another way, if the DIESEL represents 9.8% of the cars, we have 15.6% of SEDAN in this group: [$P(DIESEL / SEDAN) = 0.156$, we can interpret this value as a **recall**, see the following cross-tabulation].

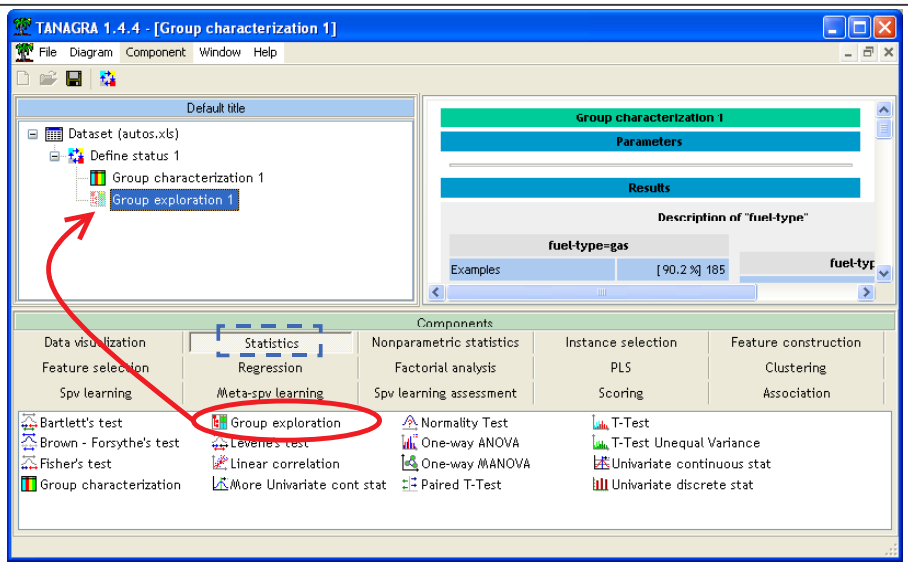
NB fuel-type	fuel-type		
body-style	diesel	gas	Total
convertible	0.00%	100.00%	100.00%
hardtop	12.50%	87.50%	100.00%
hatchback	1.43%	98.57%	100.00%
sedan	15.63%	84.38%	100.00%
wagon	12.00%	88.00%	100.00%
Total	9.76%	90.24%	100.00%

ASPIRATION TURBO represents 18% of the dataset. They have higher horsepower (124.43 hp), price (16172 $) and consumption (22.41 mpg).

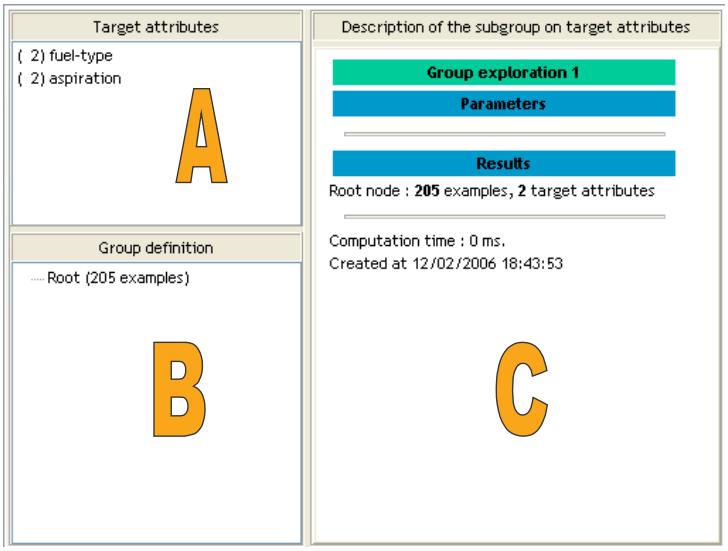
The main weakness of the component is that we cannot create subgroups with two or more attributes; we cannot see the effect of the interaction of various values of attributes. **GROUP EPLORATION** allows us to **manually build groups with the combination of two or more attributes** and see the specificities of subgroups with comparative descriptive statistics.

Build groups with two or more attributes

We want to explore the specificities of TURBO-DIESEL cars. We add the GROUP EXPLORATION component in the diagram.

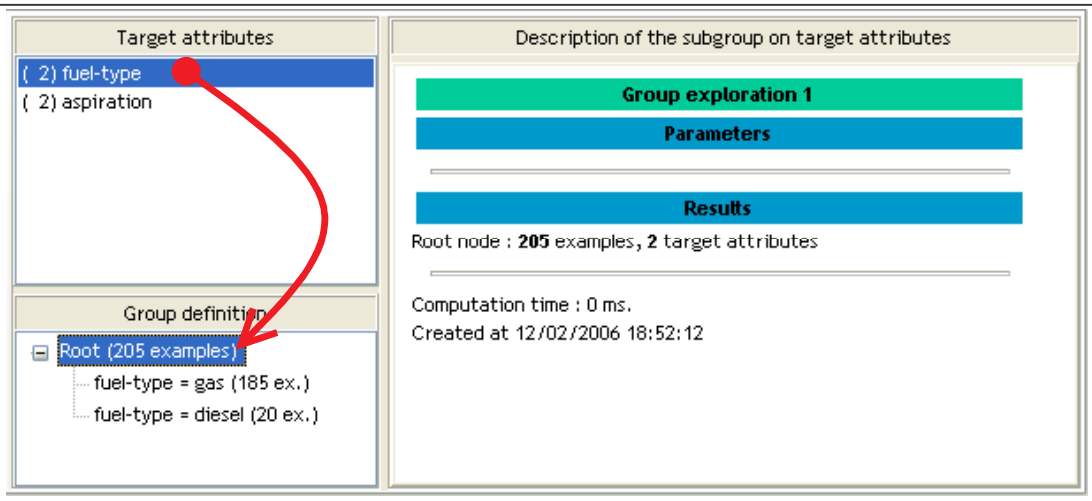


We see three areas in the visualization window.

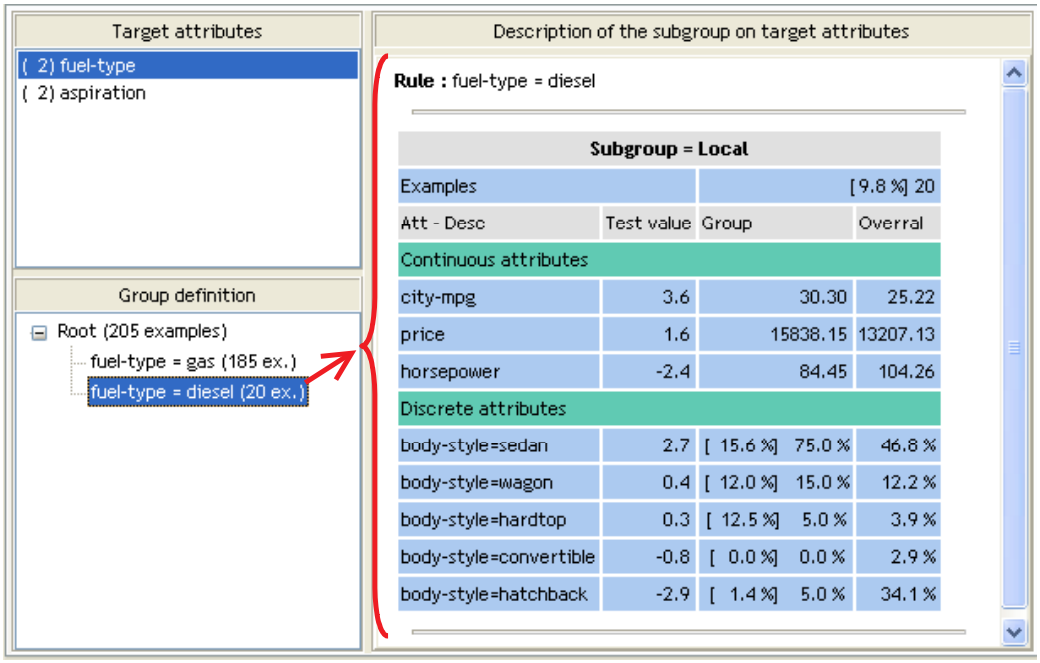


The area [A – TARGET ATTRIBUTES] shows the target attributes that allow us to build groups; the area [B – GROUP DEFINITION] shows in a tree the subgroups; the area [C – SUBGROUP DESCRIPTION] shows the comparative descriptive statistics of the selected group in the tree.

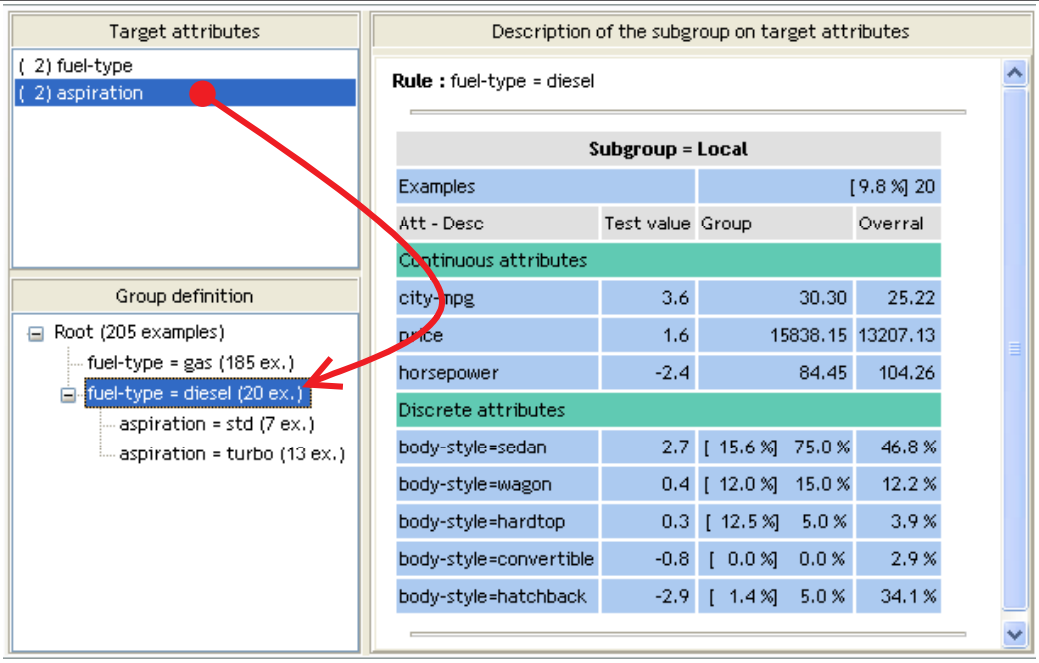
We have 205 examples (the whole dataset) in the root of [B]. To build groups, we use “drag-and-drop“ from the target attributes to the node we want to explore in the tree.



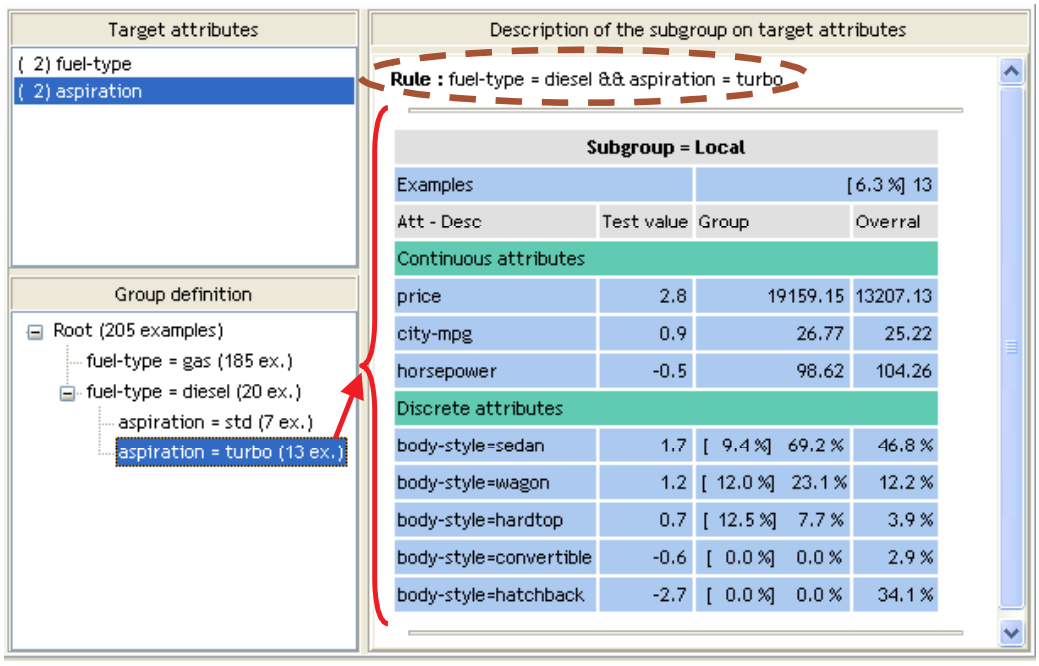
We find again the previous results: 90.2% (185) cars use GAS, 9.8% (20) use DIESEL. If we select the DIESEL node, we obtain the same descriptive statistics.



If we want to explore a new subgroup e.g. TURBO-DIESEL subgroup, we must add the ASPIRATION attribute on the FUEL-TYPE = DIESEL node of the tree.



We click on the new node to see the characteristics of the group.



There are 13 (6.3%) TURBO-DIESEL cars.

Of course, we can add more than two attributes in the tree; we can also remove uninteresting nodes. The only limitation of this component is that the target attributes must be discrete.