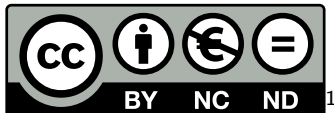


galactic architecture

The Galactic Organization <contact@thegalactic.org>

2018-2019

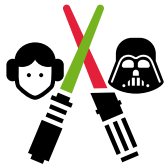


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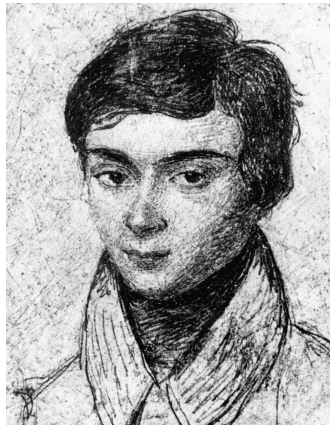
Acronym

GALACTIC stands for

GAlois
LAttices,
Concept
Theory,
Implicational systems and
Closures.



E. Galois



Purpose

Galactic Library

Develop a framework on:

- **Lattice** theory^a
- **Formal Concept Analysis**^b.

^aBARBUT, Marc et MONJARDET, Bernard. Ordre et classification, vols. 1 and 2. Hachette, Paris, France, 1970.

^bGANTER, Bernhard et WILLE, Rudolf. Formal concept analysis: mathematical foundations. Springer Science & Business Media, 1999.

FCA, Tools and Algorithms

In **FCA**, we talk generally about three structures, or data forms:

- **Reduced Context** (or data): is a two dimension table showing the relation between objects and attributes;
- **Lattice**: is a graph, where every node is a concept represent a set of object sharing the same set of attributes;
- **Basis of rules**: are implications, showing the relation between attributes.

These three structures represent the same information, but in different ways.

FCA, Tools and Algorithms

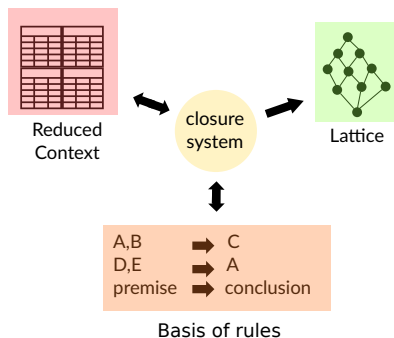


Figure 1: Closure system²

²Bertet, Karel and Demko, Christophe and Viaud, Jean-François and Guérin, Clément. Lattices, closures systems and implication bases: A survey of structural aspects and algorithms, Theoretical Computer Science, vol. 743, p. 93-109, 2018.

Pattern theory

- pattern structures allows to extend **FCA** algorithms to non-binary data when a *Galois connection* exists between objects and their descriptions;
- *the idea behind the use of pattern is that we don't have always disassociated attributes; patterns are some kind of descriptions that the objects have, and of course we need to have some kind of similarity function between descriptions telling at which point two objects are similar.* ³

³GANTER, Bernhard et KUZNETSOV, Sergei O. Pattern structures and their projections. In: International Conference on Conceptual Structures. Springer, Berlin, Heidelberg, 2001. p. 129-142.

Architecture

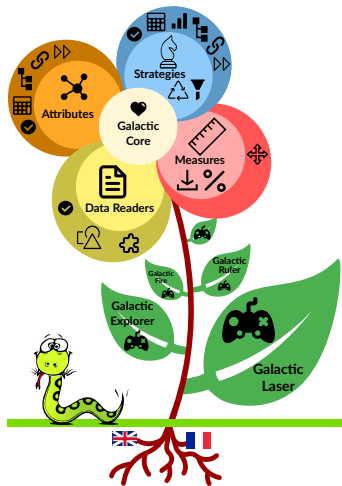
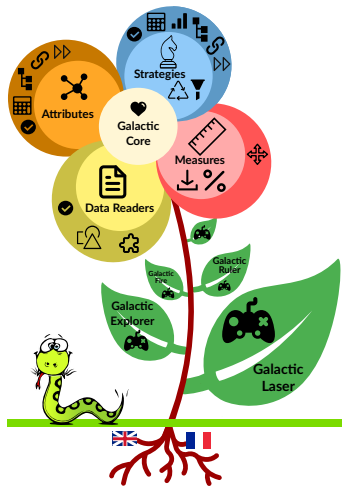


Figure 2: Galactic architecture

Architecture



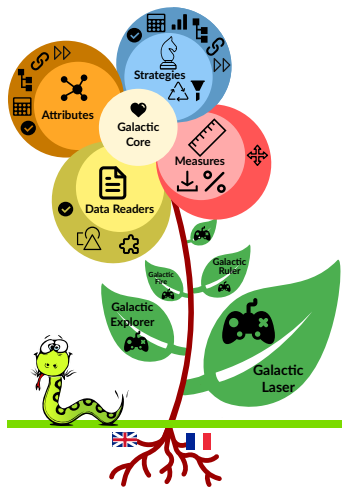
Written in python, Fully extensible

The Galactic project is architecturally designed with:

- a core library

Figure 2: Galactic architecture

Architecture



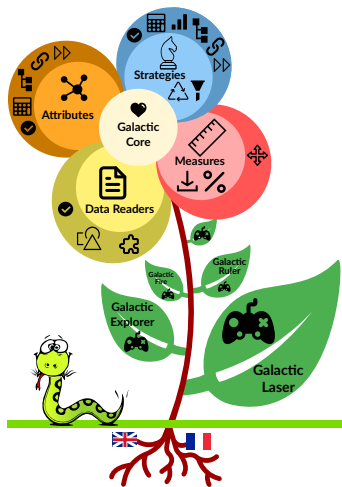
Written in python, Fully extensible

The Galactic project is architecturally designed with:

- a core library
- applications

Figure 2: Galactic architecture

Architecture



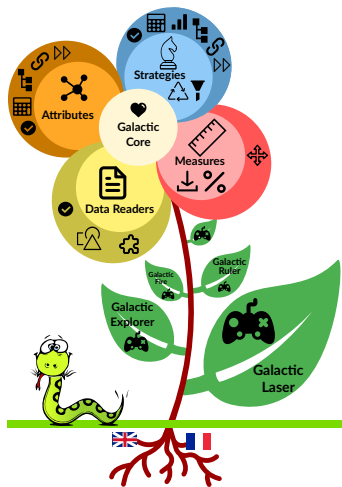
Written in python, Fully extensible

The Galactic project is architecturally designed with:

- a core library
- applications
- attribute plugins

Figure 2: Galactic architecture

Architecture



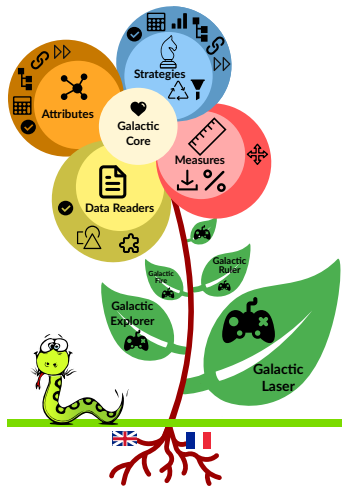
Written in python, Fully extensible

The Galactic project is architecturally designed with:

- a core library
- applications
- attribute plugins
- strategy plugins

Figure 2: Galactic architecture

Architecture



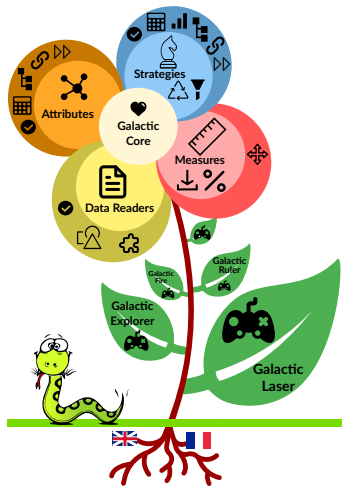
Written in python, Fully extensible

The Galactic project is architecturally designed with:

- a core library
- applications
- attribute plugins
- strategy plugins
- measure plugins

Figure 2: Galactic architecture

Architecture



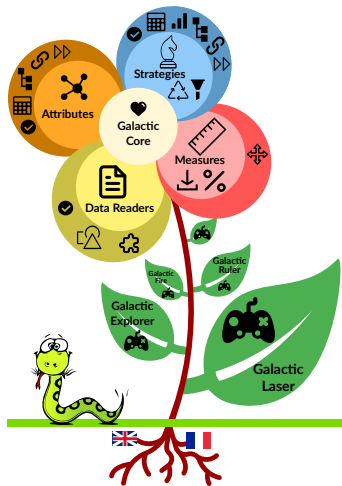
Written in python, Fully extensible

The Galactic project is architecturally designed with:

- a core library
- applications
- attribute plugins
- strategy plugins
- measure plugins
- data reader plugins

Figure 2: Galactic architecture

Architecture



Written in python, Fully extensible

The Galactic project is architecturally designed with:

- a core library
- applications
- attribute plugins
- strategy plugins
- measure plugins
- data reader plugins
- localization plugins

Figure 2: Galactic architecture

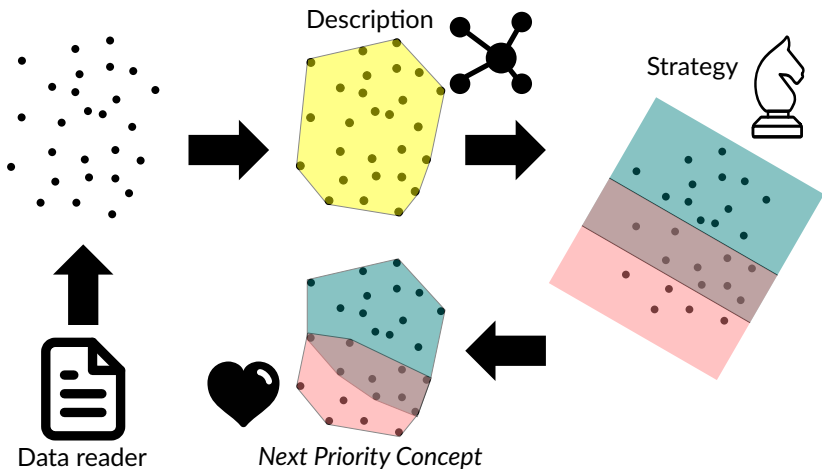
Architecture



Core

The ***galactic core*** defines the core library, it contains the basic operations and data structures and it implements the new generation algorithm (*Next Priority Concept*) inspired from pattern structures.

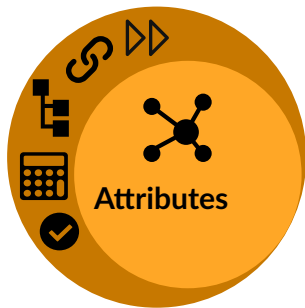
Resume






Attribute Plugins

Definition



Attributes plugins define attributes and descriptions used to represent and to define data precisely.




Existing attribute plugins are:

-  *Logical* attributes;
-  *Categorical* attributes;
-  *Numerical* attributes.

In progress:

-  *Chain* attributes;
-  *Sequence* attributes.

In preparation:

-  *Graph* attributes.

Strategy Plugins

Definition

Strategies define the way used to explore data, it uses descriptions to generate successors for each node in the lattice.



There exist 2 \triangleleft meta-strategies in the core library:

- ∇ *Limit filter* which limits the successors to those whose measure does not exceed the limit;
- ∇ *Selection filter* which select the best or the worst successors.

Strategy Plugins

Definition

Strategies define the way used to explore data, it uses descriptions to generate successors for each node in the lattice.



Existing strategy plugins are:

- ✓ *Logical* strategy;
- 📊 *Categorical* strategy;
- 📑 *Numerical basic* strategy;
- 📈 *Numerical quantile* strategy.

In progress:

- 🔗 *Chain* strategy;
- ⏩ *Sequence* strategy.

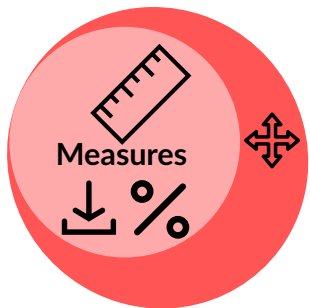
In preparation:

- 📐 *Graph* strategy.

Measure Plugins

Definition

Measures are parameters of the *filter strategies* predefined in the core library.



There are 3 measures in the core library:

- \Downarrow successor *Support*;
- \Uparrow predecessor *Support*;
- % *Support Ratio* between the successor and the predecessor.

One measure plugin has been developed:

- \bowtie *Entropy* of the successor relatively to the predecessor.










Data Reader Plugins

Definition

Data readers are plugins used to read different types of data files. The *core* engine detects the file type using its extension.




Existing data reader plugins are:

-  *YAML*
-  *JSON*
-  *CSV*
-  *TOML*
-  *INI*
-  *TXT*
-  *SLF*
-  *DAT*
-  *CXT*

Localization Plugins

Definition

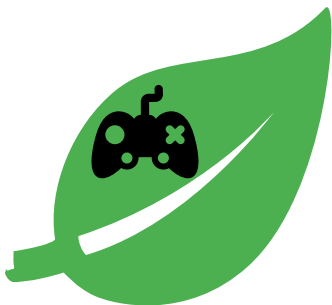
Localization Plugins are used for translating the applications to other languages. The basic language is English.

-  French translation of the *Galactic* applications.

Applications

Definition

Applications are developed for using the library; they are the interface of the user.



Existing applications are:

- **Galactic Laser**: for constructing the lattice and exploring data;
- **Galactic Explorer**: for exploring interactively the constructed lattice;
- **Galactic Ruler**: for extracting implication rules;
- **Galactic Fire**: for executing a system of rules.

Collaborative version control



- The library is developed using the collaboration tool `git`, in the `gitlab` of the university. We are using ***pylint*** for testing code quality and ***tox*** for generating tests.
- Using *`gitlab-runners`*, the code is automatically recompiled and rebuilt and tests are ran.
 - 4146 python lines;
 - 5261 comment lines;
 - 2015 blank lines
 - 89% unit test coverage;
 - 4 guides (installation, user, practice, developer).

Conclusion

- the version 0.0.7 was published on July 1, 2019;
- the galactic applications, the various manuals and documentation guides are available under certain conditions.