galactic architecture

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GALACTIC stands for

GAlois
LAttices, Concept
Theory, Implicational systems and Closures.
Galactic Library

Develop a framework on:

- **Lattice** theory\(^a\)
- **Formal Concept Analysis**\(^b\).


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 representing a set of objects 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 system

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.\(^3\)

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A written-in-python, fully extensible project, Galactic is architecturally designed with:

- A core library
- Applications
- Attribute plugins
- Strategy plugins
- Measure plugins
- Data reader plugins
- Localization plugins

Figure 2: Galactic architecture
Written in python, Fully extensible

The Galactic project is architecturally designed with:
- a core library

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Figure 2: Galactic 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.
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.
**Definition**

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

There exist 2 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.
**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:

- \( \uparrow \downarrow \) *Entropy* of the successor relatively to the predecessor.
**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.
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).
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.