Visualizing Conceptual Structures Using FCA Tools Bundle

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Motivation

- most of the data gathered from real life applications are many-valued, while some data have an inherent triadic structure;

- ToscanaJ Suite is no longer updated => including all its features in our tool lies at hand;

- making FCA more popular outside its natural community;

- revival of software development for FCA.

FCA Tools Bundle

- contains a collection of tools that enable the user to analyze FCA contexts;

- is a web based open access collaborative platform;

- users can:
  - share data;
  - create public and private groups;
  - enter virtual conceptual exploration rooms.

Description & features

- One may:
  - create dyadic or triadic contexts;
  - import polyadic contexts and generate the correspondent concept set;
  - build and view concept lattices;
  - find a concept in a polyadic context without generating all its concepts;
  - local navigation in triadic concept sets;
  - **import many-valued contexts and build conceptual scales;**
  - **find Weak Analogical Proportions in concept sets.**

Description & features

- Create a scale in `FCA Tools Bundle`
  - **Select a source:**
    - database and csv;

Create a new scale

Step 1: Select Database   **Step 2:** Provide General Scale Data   **Step 3:** Provide Type Specific Scale Data

Source Type: Database ▼

Database Connection: Select the database connection to use ▼

Cancel   Next

Description & features

- Create a scale in `FCA Tools Bundle`
  - **Select a source:**
    - database and csv;
  - **Provide General Scale Data**:
    - the name of the scale, the table for the scale and the type of the scale.

Create a new scale

Home / My Scales / Create Scale

Step 1: Select Database   **Step 2: Provide General Scale Data**   **Step 3:** Provide Type Specific Scale Data

Scale Name:

Table: Select a table

Scale Type: Select the scale type

Cancel   Back   Ne

Select the scale type
Nominal
Ordinal
Inter-Ordinal
Grid
Custom

Description & features

- Create a scale in `FCA Tools Bundle`
  - **Select a source:**
    - database and csv;
  - **Provide General Scale Data**:
    - the name of the scale, the table for the scale and the type of the scale.
  - **Provide Type Specific Data:**
    1. *Nominal scale*
       - select the column on which to build the scale.

Description & features

- Create a scale in `FCA Tools Bundle`
  - **Select a source:**
    - database and csv;
  - **Provide General Scale Data**:
    - the name of the scale, the table for the scale and the type of the scale.
  - **Provide Type Specific Data:**
    2. *Ordinal scale*
       - define the column on which to build the scale;
       - define the order of the scale (`increasing` or `decreasing`);
       - define the bounds of the scale (`include` or `exclude`);
       - define the actual values.

Column: RAM

Order: ◉ Increasing   ○ Decreasing

Bounds: ◉ Include   ○ Exclude

Add Value   Type in a value...

3000   Remove

4000   Remove

5000   Remove

Cancel   Back   Submit

Description & features

- Create a scale in `FCA Tools Bundle`
  - **Select a source:**
    - database and csv;
  - **Provide General Scale Data**:
    - the name of the scale, the table for the scale and the type of the scale.
  - **Provide Type Specific Data:**
    3. *Interordinal scale*
       - define the column on which to build the scale;
       - define which side includes the bounds;
       - define the actual values.

Step 1: Select Database | Step 2: Provide General Scale Data | Step 3: Provide Type Specific Scale Data

Column: RAM

Which side includes the bounds? ● Increasing side ○ Decreasing side

Add Value | Type in a value...

1000 — Remove
2000 — Remove

Cancel | Back | Submit

Description & features

- Create a scale in `FCA Tools Bundle`
  - **Select a source:**
    - database and csv;
  - **Provide General Scale Data**:
    - the name of the scale, the table for the scale and the type of the scale.
  - **Provide Type Specific Data:**
    4. *Grid scale*
       - define the two columns on which to build the scale;
       - define the order for each of the two columns;
       - define the bounds for each of the two columns;
       - define the values for each of the two columns.

Description & features

	price < 2500	price < 3000	price < 3500	price < 4000	price < 4500	price < 5000	Add attribute.
price < 2500	X	X	X	X	X	X	
price < 3000		X	X	X	X	X	
price < 3500			X	X	X	X	
price < 4000				X	X	X	
price < 4500					X	X	
price < 5000						X	
price >= 5000							
Add object...							

Cancel   Back   Submit

- Create a scale in `FCA Tools Bundle`
  - **Select a source:**
    - database and csv;
  - **Provide General Scale Data**:
    - the name of the scale, the table for the scale and the type of the scale.
  - **Provide Type Specific Data:**
    5. *Custom scale*
       - create an incidence table defining the custom scale;
   - they are generally used for advanced cases where the elementary scale types are not expressive enough.

Description & features

- Analogical complexes
  - Use analogy between four subsets of objects in place of the initial binary relation;
  - they are subset of objects and attributes that share a maximal analogical relation;
  - it reveals relations between concepts that are not directly linked in a concept lattice.
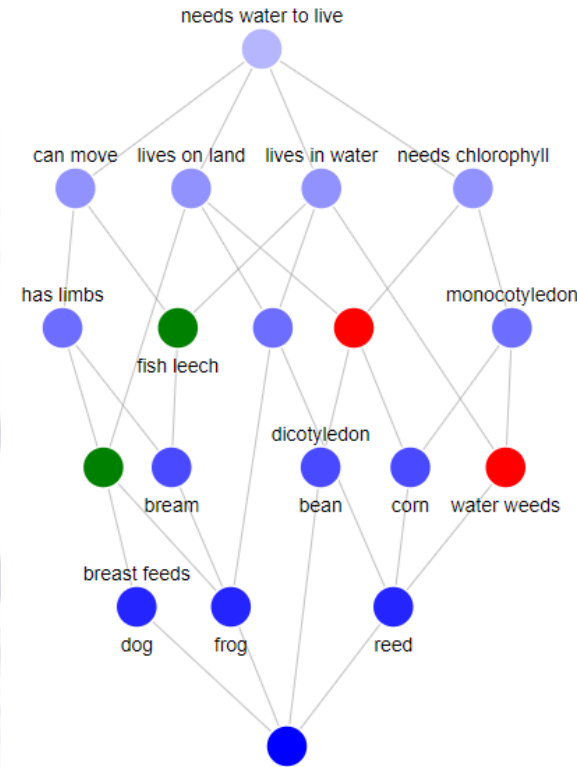
Conclusions

- `FCA Tools Bundle:`
  - offers visualization and navigation for polyadic FCA;
  - improves concept lattices generation using a detection collision algorithm;
  - show how concept lattices can be used for a triadic navigation paradigm based on appropriately defined dyadic projections;
  - compute analogical proportions between formal concepts.

Future Work

- develop an AI assistant for navigation in large concept lattices;
- develop a Temporal Concept Analysis tool;
- include a 3D navigation feature by using specific VR hardware.