Formal Concept Analysis

III Knowledge Discovery

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slides based on a lecture by Prof. Gerd Stumme

Agenda

Attribute Exploration: Goals

- compute the stem base interactively,
- without knowing the context beforehand,
- or knowing only parts of the context

Attribute Exploration: Approach

We modify $\textsc{Next Closure}$ for computing the stem base:

The context can be *modified* while the list $\mathcal{L}$ of implications is computed by taking into account *new objects*. If these objects *respect all implications* that have been computed so far, then the computation can be continued with the results obtained so far. This is the result of the following Lemma:

Lemma: Let $\mathbb{K}$ be a context and let $P_1, P_2, \ldots, P_n$ be the first n pseudo-intents of $\mathbb{K}$ with respect to the lectic order. If $\mathbb{K}$ is extended by an object g the object intent g' of which respects the implications $P_i \to P_i''$, $i \in \{1, \ldots, n\}$, then $P_1, P_2, \ldots, P_n$ are also the lectically first n pseudo-intents of the extended context.

Attribute Exploration: Approach

Therefore, if we have found a new pseudo-intent P, we can stop the algorithm and ask, *whether the implication $P \to P''$ should be added to $\mathcal{L}$?*

user answers yes: continue

user answers no: add counter example which does not contradict already confirmed implications

In the extreme case, the procedure can be started with a context the object set of which is empty. In this case, the user will have to enter all counter-examples, thereby creating a concept system with a given "attribute logic".

Attribute Exploration: Example

Instead of a detailed algorithm description:

Example

We compute the concept lattice for

$G = \mathbb{N}$

$M = \{$even, odd, prime, square, cubic, not prime, not square, not cubic$\}$

Suggestions for other contexts to play around with:

$G = \{$river, lagoon, puddle$\}$

$M = \{$natural, inland, flowing, temporary, stagnant, constant, artificial, maritime$\}$

$G = \{$, $\}$

$M = \{$overlap, parallel, disjoint, common vertex, common edge, common segment$\}$

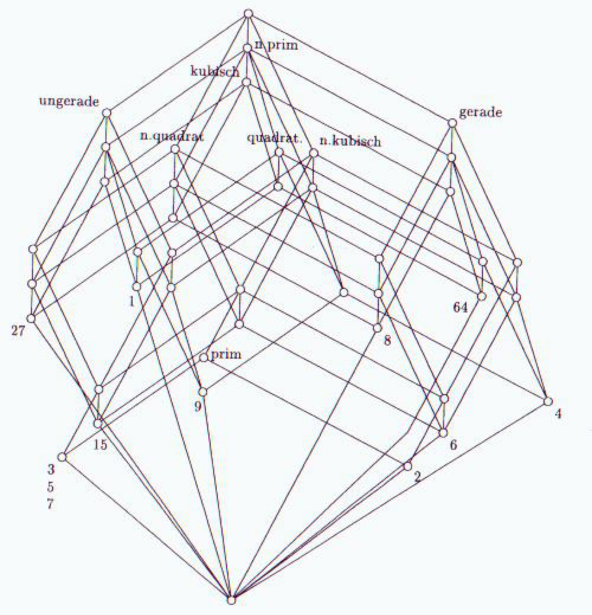
Attribute Exploration: Example

The accepted implications, i.e., the stem base, which holds for all natural numbers, looks this way:

1.:	cubic	$\rightarrow$ not prime
2.:	square	$\rightarrow$ not prime
3.:	prime	$\rightarrow$ not square, not cubic
4.:	cubic, not cubic	$\rightarrow \bot$
5.:	square, not square	$\rightarrow \bot$
6.:	prime, not prime	$\rightarrow \bot$
7.:	even, odd	$\rightarrow \bot$

Attribute Exploration: Example

The corresponding concept lattice. All implications that can be read off hold for *all* natural numbers.



Attribute Exploration

On the blackboard: another example

country	EU	€	Schengen	NATO	monarchy	inland	> 10M inhab.
Ireland							
Italy							
UK							