# Types of attributes and methods of the SpectralAnalyzer class

## Notation

- $I$ denotes the number of items.
- $C$ denotes the number of separate categories associated with the items.
- $V_c$ denotes the number of separate values in the category $c$.
- $N$ denotes the number of nodes.
- $P$ denotes the number of patterns.
- $Y$ denotes the number of years for which observations exist.
- $+$ denotes public attributes and methods (i.e. exported attributes and methods).
- $-$ denotes private attributes and methods (i.e. attributes and methods not exported).

## Class attributes

$-$ ***STATUS_PERSISTENT***: character

$-$ ***STATUS_DECLINING***: character

$-$ ***STATUS_EMERGENT***: character

$-$ ***STATUS_LATENT***: character

$-$ ***NODES***: character

$-$ ***PATTERNS***: character

$-$ ***RULES***: character

$-$ ***NODES_OR_PATTERNS***: character

$-$ ***NODES_PATTERNS_OR_RULES***: character

## Attributes

$+$ **observations**: list

| CODE | vector(character) or vector(numeric) | YEAR | numeric | … | … |
|------|--------------------------------------|------|---------|---|---|
| CODE | vector(character) or vector(numeric) | YEAR | numeric | … | … |
| … | … | … | … | … | … |
| CODE | vector(character) or vector(numeric) | YEAR | numeric | … | … |

$+$ **items**: named vector(character) or named vector(numeric)

+ **items_categories**: data.frame

| | category 1 | category 2 | … | category C |
|---|---|---|---|---|
| **item 1** | factor | factor | … | factor |
| **item 2** | factor | factor | … | factor |
| **…** | … | … | … | … |
| **item I** | factor | factor | … | factor |

+ **categories_colors**: list(named vector(character))

$category1

| | |
|---|---|
| **value 1** | character |
| **value 2** | character |
| **…** | … |
| **value $V_1$** | character |

$category2

| | |
|---|---|
| **value 1** | character |
| **value 2** | character |
| **…** | … |
| **value $V_2$** | character |

…

…

$categoryC

| | |
|---|---|
| **value 1** | character |
| **value 2** | character |
| **…** | … |
| **value $V_C$** | character |

+ **status_colors**: vector(character)

+ **parameters**: list(**target**: character,
                      **count**: numeric,
                      **min_length**: numeric,
                      **max_length**: numeric,
                      **status_limit**: numeric)

+ **nodes**: data.frame

| node | length | weight |
|---|---|---|
| vector(character) | numeric | numeric |

+ **nodes_per_year**: matrix

| | year 1 | year 2 | … | year Y |
|---|---|---|---|---|
| **node 1** | numeric | numeric | … | numeric |
| **node 2** | numeric | numeric | … | numeric |
| **…** | … | … | … | … |
| **node N** | numeric | numeric | … | numeric |

+ **n_links**: matrix

| | node 1 | node 2 | … | node N |
|---|---|---|---|---|
| **node 1** | numeric | numeric | … | numeric |
| **node 2** | numeric | numeric | … | numeric |
| **…** | … | … | … | … |
| **node N** | numeric | numeric | … | numeric |

+ **nodes_links**: data.frame

| endpoint.1 | endpoint.2 | items | weight |
|---|---|---|---|
| numeric | numeric | character | numeric |

+ **obs_patterns**: matrix

|  | pattern 1 | pattern 2 | ... | pattern P |
|---|---|---|---|---|
| **node 1** | logical | logical | ... | logical |
| **node 2** | logical | logical | ... | logical |
| **...** | ... | ... | ... | ... |
| **node N** | logical | logical | ... | logical |

+ **patterns**: data.frame

| pattern | year | frequency | weight | order | specificity | status |
|---|---|---|---|---|---|---|
| vector(character) | numeric | numeric | numeric | numeric | numeric | character |

+ **patterns_per_year**: matrix

|  | year 1 | year 2 | ... | year Y |
|---|---|---|---|---|
| **pattern 1** | numeric | numeric | ... | numeric |
| **pattern 2** | numeric | numeric | ... | numeric |
| **...** | ... | ... | ... | ... |
| **pattern P** | numeric | numeric | ... | numeric |

+ **p_links**: matrix

|  | pattern 1 | pattern 2 | ... | pattern P |
|---|---|---|---|---|
| **pattern 1** | numeric | numeric | ... | numeric |
| **pattern 2** | numeric | numeric | ... | numeric |
| **...** | ... | ... | ... | ... |
| **pattern P** | numeric | numeric | ... | numeric |

+ **patterns_links**: data.frame

| endpoint.1 | endpoint.2 | items | weight | year |
|---|---|---|---|---|
| numeric | numeric | character | numeric | numeric |

# Methods

+ **spectral.analyzer(observations**: see attribute **observations**, **items**: see data.frame below, **target**: character, **count**: numeric, **min_length**: numeric, **max_length**: numeric, **status_limit**: numeric, **verbose**: logical**)**: SpectralAnalyzer

| item | name | category 1 | category 2 | ... | category C |
|---|---|---|---|---|---|
| character | character | factor | factor | ... | factor |

+ **reset(object**: SpectralAnalyzer, **from**: numeric, **verbose**: logical**)**

− **list_obs_per_year()**: see attribute **nodes_per_year**

− **list_separate_obs()**: see attribute **nodes**

− **count_links(entities**: character**)**: see attributes **n_links** and **p_links**

— **search_links(entities**: character**)**: see attributes **nodes_links** and **patterns_links**

— **list_separate_patterns(target**: character, **count**: numeric, **min_length**: numeric,
    **max_length**: numeric**)**: data.frame

| pattern | weight |
|---|---|
| vector(character) | numeric |

— **list_patterns_by_obs()**: see attribute **obs_patterns**
— **list_patterns_per_year()**: see attribute **patterns_per_year**
— **compute_patterns_characteristics()**: see attribute **patterns**

— **compute_specificity(patterns**: list(vector(numeric)), **frequencies**: vector(numeric),
    **weights**: vector(numeric)**)**: vector(numeric)
— **compute_ksi_threshold(reporting_indexes**: vector(numeric)**)**: numeric
— **compute_ri_threshold(reporting_indexes**: vector(numeric), **ksi**: numeric**)**: numeric
— **compute_reporting_indexes(patterns**: list(vector(numeric)), **t**: numeric, **period**: numeric**)**:
    data.frame

| pattern | Ri |
|---|---|
| vector(character) | Numeric |

— **check_params_for_RI(t**: numeric, **period**: numeric**)**: list

| t | numeric |
|---|---|
| period | numeric |

— **compute_reporting_indexes_limits(patterns**: list(vector(numeric)), **first_limit**: numeric,
    **t**: numeric, **period**: numeric**)**: data.frame

| pattern | ri_2 | ri_period |
|---|---|---|
| vector(character) | numeric | numeric |

— **define_dynamic_status(patterns**: list(vector(numeric)), **status_limit**: numeric, **t**: numeric,
    **period**: numeric**)**: data.frame

| pattern | Status |
|---|---|
| vector(character) | character |

+ **spectrum_chart(pc**: character or see attribute **patterns**, **identifiers**: character, **sort**: logical,
    **title**: character, **path**: character, **name**: character**)**: data.frame

| ID | Pattern | frequency | weight | order | specificity | status |
|---|---|---|---|---|---|---|
| numeric | vector(character) | numeric | numeric | numeric | numeric | character |

— **plot_spectrum_chart(pc**: see attribute **patterns**, **weights_by_node_type**: see data.frame below,
    **title**: character**)**

| complex_nodes | simple_node |
|---|---|
| numeric | numeric |

— **compute_pattern_distribution_in_nodes(patterns**: list(vector(numeric)**))**: list

[["weight_distribution"]]:

| 1 | vector(numeric) |
|---|---|
| 2 | vector(numeric) |
| … | … |
| P | vector(numeric) |

[["length_distribution"]]:

| 1 | vector(numeric) |
|---|---|
| 2 | vector(numeric) |
| … | … |
| P | vector(numeric) |

+ **spectrosome_chart(nopc**: character or see attribute **nodes** or **patterns**, **identifiers**: character,
   **nb_graphs**: numeric, **min_link_weight**: numeric,
   **vertex_size**: character or numeric or vector(numeric),
   **size_range**: vector(numeric), **vertex_col**: character or vector(character),
   **clusters**: numeric, **highlight**: numeric, **use_names**: logical, **n.cutoff**: numeric,
   **c.cutoff**: numeric, **display_mixt**: logical, **title**: character, **path**: character,
   **name**: character, **…)**: list

[["vertices"]]: data.frame

| ID | node | length | weight | degree |
|---|---|---|---|---|
| numeric | vector(character) | numeric | numeric | numeric |

or (depends on the type of entities contained in **nopc**)

| ID | pattern | frequency | weight | order | specificity | status | degree |
|---|---|---|---|---|---|---|---|
| numeric | vector(character) | numeric | numeric | numeric | numeric | character | numeric |

[["edges"]]: data.frame

| ID | endpoint.1 | endpoint.2 | items | weight |
|---|---|---|---|---|
| numeric | numeric | numeric | character | numeric |

or (depends on the type of entities contained in **nopc**)

| ID | endpoint.1 | endpoint.2 | items | weight | year |
|---|---|---|---|---|---|
| numeric | numeric | numeric | character | numeric | numeric |

[["coords"]]: list(matrix)

| | x | y |
|---|---|---|
| vertex 1 | numeric | numeric |
| vertex 2 | numeric | numeric |
| … | … | … |
| vertex P | numeric | numeric |

— **cluster_text(graph**: see matrix below, **links**: see attributes **nodes_links** and **patterns_links**,
   **display**: numeric, **highlight**: numeric, **use_names**: logical, **cutoff**: numeric**)**

|  | x | y |
|---|---|---|
| **vertex 1** | numeric | numeric |
| **vertex 2** | numeric | numeric |
| **…** | … | … |
| **vertex P** | numeric | numeric |

+ **cluster_chart(nopc**: character or see attribute **nodes** or **patterns**, **item**: numeric,
        **identifiers**: character, **use_name**: logical, **n.cutoff**: numeric,
        **vertex_size**: character or numeric or vector(numeric),
        **size_range**: vector(numeric), **vertex_col**: character or vector(character),
        **c.cutoff**: numeric, **display_mixt**: logical, **title**: character, **path**: character,
        **name**: character, **…)**: list

[["vertices"]]: data.frame

| ID | node | length | weight | degree |
|---|---|---|---|---|
| numeric | vector(character) | numeric | numeric | numeric |

or (depends on the type of entities contained in **nopc**)

| ID | pattern | frequency | weight | order | specificity | status | degree |
|---|---|---|---|---|---|---|---|
| numeric | vector(character) | numeric | numeric | numeric | numeric | character | numeric |

[["edges"]]: data.frame

| ID | endpoint.1 | endpoint.2 | items | weight |
|---|---|---|---|---|
| numeric | numeric | numeric | character | numeric |

or (depends on the type of entities contained in **nopc**)

| ID | endpoint.1 | endpoint.2 | items | weight | year |
|---|---|---|---|---|---|
| numeric | numeric | numeric | character | numeric | numeric |

[["coords"]]: matrix

|  | x | y |
|---|---|---|
| **vertex 1** | numeric | numeric |
| **vertex 2** | numeric | numeric |
| **…** | … | … |
| **vertex P** | numeric | numeric |

+ **network_density(links:** see attribute **nodes_links** or **patterns_links)**: numeric

+ **degree(ID:** numeric**, links:** see attribute **nodes_links** or **patterns_links)**: numeric

+ **pattern_chart(pc**: character or see attribute **patterns**, **identifiers**: character, **use_names**: logical,
        **n.cutoff**: numeric, **display_status**: logical, **display_text**: character,
        **c.cutoff**: numeric, **sort_by**: character, **title**: character, **path**: character,
        **name**: character**)**: data.frame

| ID | pattern | frequency | weight | order | specificity | status |
|---|---|---|---|---|---|---|
| numeric | vector(character) | numeric | numeric | numeric | numeric | character |

− **plot_pattern_chart(pc**: see attribute **patterns, items_category:** see data.frame below,
       **category:** character, **c.cutoff:** numeric, **use_names:** logical, **n.cutoff:** numeric,
       **display_status:** logical, **display_text:** character, **title:** character**)**

| item | category |
|------|----------|
| character | character |

+ **category_tree_chart(category**: character or numeric, **items**: see attribute **items**,
       **use_names**: logical, **n.cutoff**: numeric, **c.cutoff**: numeric,
       **vertex_size**: numeric, **vertex_alpha**: numeric, **leaf_size**: numeric,
       **leaf_alpha**: numeric, **leaf_margin**: numeric, **label_size**: numeric,
       **label_margin**: numeric**)**: ggplot2 graph

+ **co_occurrence_chart(items**: see attribute **items**, **category**: character or numeric,
       **min_occ**: numeric, **max_occ**: numeric, **use_names**: logical, **n.cutoff**: numeric,
       **c.cutoff**: numeric, **sort_by**: character, **vertex_size**: numeric,
       **vertex_alpha**: numeric, **vertex_margin**: numeric, **label_size**: numeric,
       **label_margin**: numeric, **edge_tension**: numeric, **edge_alpha**: numeric,
       **palette**: character or numeric, **palette_direction**: numeric**)**: ggplot2 graph

+ **extract_rules(from**: character or list, **pruning**: logical, **arules**: logical, **as_sets**: logical, **…)**: rules
(class object from arules package) or data.frame

| antecedent | | consequent | support | confidence | lift | count |
|-----------|----|-----------|---------|-----------|------|-------|
| vector(character) | => | character | numeric | numeric | numeric | numeric |

or (**antecedent** and **consequent** types depend on the value of **as_sets**. Presence of **count** or **itemset** depends on the value of **from**)

| antecedent | | consequent | support | confidence | lift | itemset |
|-----------|----|-----------|---------|-----------|------|---------|
| factor | => | factor | numeric | numeric | numeric | numeric |

+ **rules_chart(rules**: see method **extract_rules**, **items**: see attribute **items**, **parameters**: list,
       **display**: character, **threshold**: numeric, **use_names**: logical, **n.cutoff**: numeric,
       **category**: character or numeric, **c.cutoff**: numeric, **sort_by**: character,
       **vertex_size**: numeric, **vertex_alpha**: numeric, **vertex_margin**: numeric,
       **label_size**: numeric, **label_margin**: numeric, **edge_tension**: numeric,
       **edge_alpha**: numeric, **palette**: character, **palette_direction**: numeric**)**: list
[["graph"]]: ggplot2 graph
[["rules"]]: see method **extract_rules**

+ **save_characteristics(characteristics**: character or see attribute **nodes** or **patterns** or return of
       function **extract_rules**, **…)**

+ **get_nodes(nc**: character or see attribute **nodes**, **element**: character or numeric,

　　　　**value**: numeric or vector(numeric) or character or vector(character),

　　　　**condition**: character**)**: see attribute **nodes**

− **get_nodes_from_items(nc**: character or see attribute **nodes**, **items**: vector(numeric),

　　　　**condition**: character**)**: see attribute **nodes**

− **get_nodes_from_characteristic(nc**: character or see attribute **nodes**, **characteristic**: character,

　　　　**value**: numeric, **condition**: character**)**: see attribute **nodes**

− **get_nodes_from_category(nc**: character or see attribute **nodes**, **category**: character or numeric,

　　　　**value**: character, **condition**: character**)**: see attribute **nodes**


+ **get_patterns(pc**: character or see attribute **patterns**, **element**: character or numeric,

　　　　**value**: numeric or vector(numeric) or character or vector(character),

　　　　**condition**: character**)**: see attribute **patterns**

− **get_patterns_from_items(pc**: character or see attribute **patterns**, **items**: vector(numeric),

　　　　**condition**: character**)**: see attribute **patterns**


− **get_patterns_from_characteristic(pc**: character or see attribute **patterns**,

　　　　**characteristic**: character, **value**: numeric, **condition**: character**)**:

　　　　see attribute **patterns**

− **get_patterns_from_status(pc**: character or see attribute **patterns**, **value**: vector(character),

　　　　**condition**: character**)**: see attribute **patterns**

− **get_patterns_from_category(pc**: character or see attribute **patterns**,

　　　　**category**: character or numeric, **value**: character,

　　　　**condition**: character**)**: see attribute **patterns**


+ **get_links(nopc**: character or see attribute **nodes** or **patterns)**: see attribute **nodes_links** or

　　　　**patterns_links**

+ **get_isolates(nopc**: character or see attribute **nodes** or **patterns)**: see attribute **nodes** or **patterns**

+ **get_non_isolates(nopc**: character or see attribute **nodes** or **patterns)**: see attribute **nodes** or

　　　　**patterns**

+ **get_complexes(nopc**: character or see attribute **nodes** or **patterns**,

　　　　**category**: character or numeric, **condition**: character, **min_nb_values**: numeric**)**:

　　　　see attribute **nodes** or **patterns**


− **check_access_for_category(category**: character or numeric, **value**: character, **stop**: logical**)**: logical

− **get_nopc(nopc**: character or see attribute **nodes** or **patterns**, **entities**: character**)**: see attribute

　　　　**nodes** or **patterns**

− **which_entities(npr**: see attribute **nodes** or **patterns** or return of function **extract_rules**,

　　　　**entities**: character**)**: character