
Knowledge representation

Part 2

Elements of formal representation

AKT terminology

Formal representation

Entering unitary statements into a knowledge base using the AKT grammar

Objects, processes, actions, links, comparisons

5 main elements of formal representation

Attributes, values

Elements of formal representation that enable description of an object, action or process

Creating a statement

Statements are created by combining objects, processes, actions, attributes and values in various ways according to the rules of the AKT grammar

There are 4 options for creating a statement:

- Causal statements
- Attribute value statements on their own or as part of a causal relationship
- Link statements
- Comparison statements

All statements can have conditions (IF) attached to them

Objects

The main thing being referred to in a statement is usually an *object* which can be associated with particular processes, actions, as well as various attributes and values.

- Material objects:
 - e.g. pests, fields, cows, trees
- Conceptual objects:
e.g. niche, policy, household

Example statement:

att_value(process(part(trees,leaves),decomposition),rate,increase) IF
att_value(part(trees,leaves),texture,soft)

Processes

Processes can be either associated with an object or on their own when used within a statement, for example, 'soil *erosion*' is an object with a process and '*rainfall*' is a process on its own.

- Changes or fluxes in nature that happen without the direct intervention of humans:
 - e.g. erosion, infiltration, growth, decay

Example statement: process(microbes,eating,leaf_litter) causes1way process(leaf_litter,decomposition)

Actions

Actions can be either associated with an object or on their own when used within a statement, for example, '*cutting trees*' is an action with an object and '*ploughing*' is an action on its own.

- Actions are essentially processes that are carried out by humans and are usually used to describe agricultural activities:
 - e.g. ploughing, harvesting, pruning, planting

Example statement: `att_value(action(planting,coffee_plants),location,contour_line) causes1way att_value(process(water,run_off),rate,decrease)`

Attributes

Attributes are used in attribute value statements that can be entered on their own or as part of a causal relationship, for example, 'oak trees *height* is tall' or 'oak trees *height* is tall causes sunlight infiltration *level* is high'

- Attributes *describe* an object, process or action
 - e.g. height, rate, colour, frequency, gradient
- They are usually measurable

Example statement: att_value(eucalyptus_trees,growth_rate,fast)

Values

Values are used in *attribute value statements* that can be entered on their own or as part of a causal relationship, for example, 'oak trees height is *tall*' or 'oak trees height is *tall* causes sunlight infiltration level is *high*'

- Values are *always* associated with an attribute:
 - e.g. tall, yellow, steep, expensive, 5_kg, 7_ha
- or
- e.g. increase, decrease, change, no_change

N.B. underscores are used instead of a space to combine multiple words in AKT

(User defined) links

Links are user defined terms that are used in *link* statements to show a direct interaction between two objects or a process and an object, for example, ‘cows *eat* grass’ or ‘nesting of parrots *in* fruit_trees’

- Links are used when the relationship cannot be easily represented by other forms of statement:
 - e.g. eats, nests_in, visits, pollinates, kills

Example statement: link(attract,part(white_stopper,flowers),bees)

Comparisons

Comparison statements are usually used when comparing the attributes of one object with another object, for example, 'the size of loquat_leaves is *greater_than* peach_leaves'

- The reserved terms in AKT for comparison statements are 'greater_than', 'less_than', 'same_as', and 'different_from'
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Object, process, action, attribute or value?

- land
 - germination
 - amount
 - dry
 - cricket
 - leaf_shedding
 - branch
 - disease
 - lodging
 - weeding
 - duration
 - '6_years'
 - length
 - nutrient
 - mulching
 - soft
 - yield
 - size
 - green
 - infertile
 - texture
 - weed
 - uprooting
 - burning
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Attribute, causal, comparison or link statement?

- Podocarpus falcatus growth rate is slow.
- The use of inorganic fertiliser reduces the fertility of soil over time.
- Black soil retains water for longer than white soil.
- Red ants feed on crop roots.
- Millet tolerates shade better than maize.
- Feeding bamboo to goats causes a decrease in the worm infestation of the goats.
- Hairy caterpillars feed on crop leaves.
- Eucalyptus globulus is a tall tree.