

Course Assignment



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“RECIPE ADVISOR & FOOD DESCRIPTION”

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Abstract

This document deals with the

“RECIPE ADVISOR & FOOD DESCRIPTION” -TOOL

This is a report about the purpose of the above mentioned tool, describing the structure and functionality as well as the target user and the system output. In addition, the according knowledge representation is introduced, in form of a hybrid of a frame- and rule-based system. The reason why this kind of knowledge representation system is used will also be explained, analysing advantages and limitations looking at the two criteria expressive adequacy and reasoning efficiency. At last the tool is explained, its user interface and the way of implementing it using PROLOG.

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Declaration of Academic Honesty

I hereby certify to have written the internship report on my own, using only the listed resources.

Stafford, Nov. 28th 2003

Location, Date

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1 Introduction

This report is the result of a coursework of the “Artificial Intelligence“-lecture that has had the task to produce a knowledgebase representation system using PROLOG. Its domain is based on recipes and food descriptions given out to express the reaction on user inputs.

2 Purpose, target user and knowledge domain

The purpose of this system is the output of recipes and food description according to the user wants, i.e. to give requirements about recipes (e.g. the recipe of a white bread) or information about food (e.g. calling different sorts of cheese and list them with a small description – “gouda contains(cow milk) and tastes(mild)”). Furthermore the user can specify his wishes for lunch and gets an according recipe output if his specifications are known to the system. According to the systems purpose the target user is someone who is interested in recipes or several information about breakfast or dinner attributes (e.g. spread, or lining of bread). The user does not necessarily need any knowledge about either the tool or the knowledge domain, the way through the program is guided by either providing all input possibilities or explaining by example. The knowledge domain covers some information about cooking or food. There are some quite simple facts as the information about spread that contains e.g. just margarine, brunch and various types of butter, but there are also some recipes that the user can access and apply.

3 Knowledge representation

For the knowledge representation in this system a hybrid is used basing upon frames and rules. The knowledge base is realized with two frame works that look like follow. The first one containing the definition breakfast, lunch and dinner is built like *event(name(Event),isa(Parent),Attributes)*. The second frame is not very different, it has just a different name and looks like *frame(name(Name),isa(Parent),Attribute)*. While the attributes of the frame named “event” contain the names of the Names of the frames named “frame” (see Figure 1: Framework and relation of event), latter ones contain several attributes describing the frame more exactly (see Figure 2: Framework and relation of frame with example “egg salad”).

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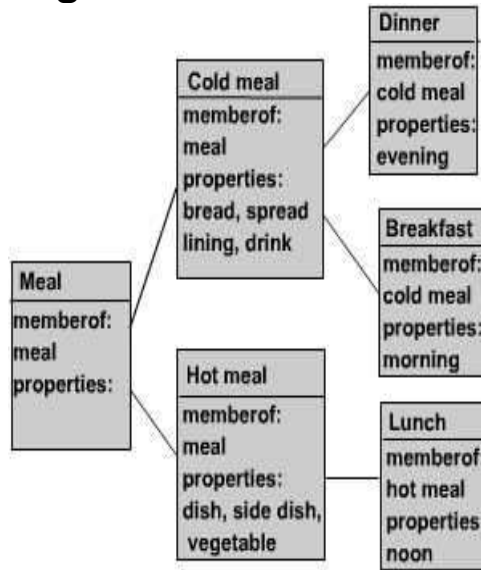


Figure 1: Framework and relation of event

As shown in figure 1 the frames named “Dinner” and “Breakfast” have nearly the same attributes, therefore another frame namely “Cold meal” has been created and serves as parent for both, containing the equal data of them. According to both figures you can assume that “egg_salad” is or can be one item of cold meal, because it is a member of “lining”, which itself is a property of “Cold meal”.

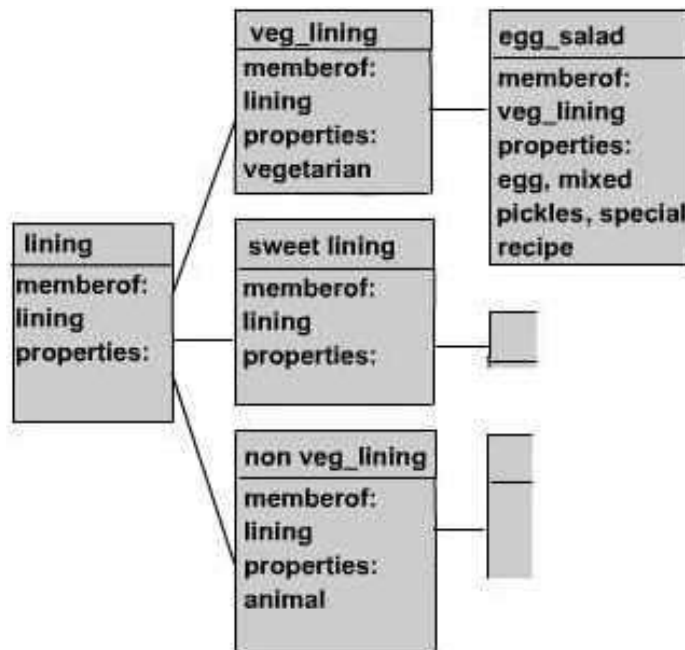


Figure 2: Framework and relation of frame with example “egg salad”

However no frame can express that relation properly, because there is no direct connection between the frames of both figures. Due to this fact, a set of rules has to be introduced describing the exact relation. A similar situation is the “egg salad

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recipe” that is displayed as a special property of “egg_salad”; this attribute represents the recipe or the output of the same. This output or access to this attribute can also only be realized by writing the attribute in a rule.

4 Advantages and limitations

Using frames means using inheritance to traverse the “Parent - Child” hierarchy as it is with every semantic network. Frames differ in point of data representation, i.e. the data are collected in an equally framework, using the same slots. The slots define each single frame, describing the attributes by using list and associate indirect with upper frames. Frames are semantic networks that use less description, because the general rules used to describe the “is and has relations” are put together in one expression. That does save lines of code and the programmer has a lot better overview and can realize the indirect connections at once. Inheriting the attributes of the “Parent” frame just means to merge the attributes of this frame with the ones from the “Parent”. Due to the fact that inheritance has to be possible the number of slots within each frame has to be equal, furthermore it is only possible to inherit the whole attributes of the “Parent” frame, i.e. if there is a frame system that differs between “Childs” and “Parents” by only one attribute at one time, the system swells produces a lot of overhead and loses its beneficial aspect. Frames are not capable of representing connections between indirect related systems. In case of this tool, there is a good example displaying this difficulty. Taking the example frame, *event(name (breakfast),isa(cold_meal),[bread,spread,lining,drink])*, that contains four attributes, i.e. these attributes describe the event breakfast, but it cannot be shown, how the attributes and the event are related. Do the Attributes altogether define the breakfast or is one enough to have a breakfast? According to this question a set of rules has to be implemented that works like the ones of general semantic networks, where the you can define the relation between the attributes regarding to the frame they are contained.

5 User interface

The user interface is a simple command prompt. The program has to be started calling “meal.”. The program represents itself by stating its name and provides the user with the first question as well as the possibilities the user can choose in between. In case of figure 3(see 6 Test runs and program listing) the program has

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been started, the user has written "no.", which has been recognized as a not suitable input and to the program breaks, providing the user with the information about his input failure and ask if the want to try it again or finish the program.

During the program application flow the user walks through a kind of menu, realise by simple ASCII characters and information how to go on to proceed to the next step. The user can repeat single steps as often as he wants to do, depending on the level of progress within the program. So, it is possible that the user can see and choose the item of the lining menu infinite time, whereas the menu for the bread ends with the output of a bread recipe and goes on next to the next item of the according event. Each time the user can repeat a level, he can manually go on to the next level by typing "none.". The request for user action is represented by an arrow ("->"), followed by the blinking cursor. At the end before the question of repeating the whole procedure, the user is wished a good day, according to the chosen meal. The choice of breakfast would result in a "That's it. Good morning".

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6 Test runs and program listing

The first test run displays a wrong input and the finish of the program.



```
SWI-Prolog -- e:/5.Semester/AI/assignment/recipes.pl
File Edit Settings Run Debug Help
31 ?- meal.
+++++ Recipe Advisor & Food Description +++++
Name the wish for your dish
( breakfast, lunch or dinner )
->none.

Sorry that mealtime is unknown to me...

Wanna search for another constellation?(yes/no)
->no.
*****
Thanks, have fun with cooking and eating!
*****
Yes
32 ?- █
```

Figure 3: User interface, "Wrong input, finish program"

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The next two figures belong to one test run that collect data about the lunch the user want to have and searches for an applicable match, found one and prints out the appropriate recipe for the users wishes.

```
File Edit Settings Run Debug Help
+++++ Recipe Advisor & Food Description +++++
Name the wish for your dish
( breakfast, lunch or dinner )
->lunch.

What kind of dish you like?
->pork, beef, chicken, or vegetarian?!
|: pork.

What kind of side dish you want?
-----
->potatoes, rice, or noodles?!
|: potatoes.

What kind of vegetable do you wish?
-----
->peas, beans, carrots, brussels_sprouts, or cauliflower?!
|: cauliflower.

-----
Your choice for lunch is as followed; you want to have
pork, potatoes, and cauliflower
-----

searching.... ..complete
```

Figure 4: Part 1: Input of meal data

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```
#####
##      Pork medallions with cauliflower and parsley potatoes  ##
#####
## Ingredients: 800g pork, 1 cauliflower, 0.8-1kg potatoes, salt  ##
##      parsley, pepper, paprika, 1 glove Garlic  ##
## Instructions:  ##
## Peel the potatoes, quater them and put them into a pot.  ##
## Fill the pot with water that each potatoes is covered.  ##
## Add 2 tablespoon full of salt as well as 2 teaspoon parsley.  ##
## Also add the peeled and quatered garlic.  ##
## Clean the cauliflower and put it into a pot with salted  ##
## water as well and boil both veggies.  ##
## Spice the pork medallions with salt, pepper and paprika as  ##
## hot as you like. Melt some butter in a pan and put in the  ##
## medallions, when the butter is hot. Roast the meat on both  ##
## sides, equally. When the cauliflower is ready, melt some  ##
## butter (100g) in a small pot, add breadcrumbs and roast it  ##
## until it has a nice brown color. Put cauliflower on a plate  ##
## and put the roasted breadcrumbs-butter mix over it.  ##
## Serve everything as long as it is still warm...  ##
##  ##
##      Enjoy your meal!  ##
##  ##
#####

#####
That's it. Good noon!
#####

+++++
+++++
#####
Wanna search for another constellation?(yes/no)
#####
->no.
*****
Thanks, have fun with cooking and eating!
*****

Yes
18 ?- ■
```

Figure 5: Part 2: Recipe printout, request for repeat

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```

recipe([rye],
      '## use rye flour instead of wheat flour
      ##').
recipe([wheat,beer],'## use wheat flour & use warm beer instead of warm water
      ##').
recipe([wheat],
      '## use wheat flour
      ##').

recipe(bread,Attr):-
    recipe(Attr,Descr),frame(name(Bread),_,Attr),
    write
    ('#####'),nl,
    write(' '),write(Bread),write(' bread recipe'),nl,
    write
    ('#####'),nl,
    write('## Ingredients: 1kg Flour, 30g Sugar, 30g Salt,
    ##'),
    nl,
    write('## 21g Yeast, 630ml Warm Water
    ##'),nl,
    write('## Instructions:
    ##'),
    nl,
    write(Descr),nl,
    write('## Put flour in big bowl, use fist to make a big hole in the centre.
    ##'),
    nl,
    write('## Dissolve sugar and yeast 300ml of the warm water.
    ##'),
    nl,
    write('## Put it together with the salt in the hole.
    ##'),
    nl,
    write('## Use 4 fingers to mix(stir) the flour and fluid,
    ##'),
    nl,
    write('## from inside to outside until it is a whole mass, add remaining water
    ##'),
    nl,
    write('## knead 5 minutes, add flour if dough is too sticky. Mould a leaf and
    ##'),
    nl,
    write('## put dough in a dark, warm place for 45-90 Minutes.
    ##'),
    nl,
    write('## After that knead again to release,mould leaf the air,
    ##'),
    nl,
    write('## make 3-4 incisions, put plenty of flour on it,
    ##'),
    nl,
    write('## put it another 40-60 Minutes at the dark, warm place.
    ##'),
    nl,
    write('## Preheat oven to 225°C and baking time is 20-30 Minutes.
    ##'),
    nl,
    write('## For crispy crust put cup with water in oven, 5-10 Minutes before end.
    ##'),nl,
    write
    ('#####'),nl.
recipe(Bread):-
    Bread\=='bread',frame(name(Bread),isa(Parent),Ingredient),
    recipe(Parent,Ingredient).

```

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#####

#####

#####

Subsection: lining recipes

#####

recipe(egg_salad):-

```
write('#####'),nl,
write('## Egg Salad with mixed pickles ##'),nl,
write('#####'),nl,
write('## Ingredients: 5 boiled eggs, 3 normal sized mixed pickles, 1 onion, ##'),nl,
write('## 1 glove of garlic, 50ml single cream, ##'),nl,
write('## several herbs and spices ##'),nl,
write('## Instruction: ##'),nl,
write('## Boil eggs upto 10 minutes, until the yolk is almost not runny anymore. ##'),nl,
write('## Peel eggs and cut\'em into small cubes as well as the mixed pickles. ##'),nl,
write('## Cut onions in tiny pieces or as big as it pleases you. ##'),nl,
write('## Mix herbs like parsly or chives or basil with the single cream ##'),nl,
write('## add spices as salt, pepper, paprika. ##'),nl,
write('## Put all ingredients into a small bowl, ##'),nl,
write('## the single cream herbs&spices mix at last. ##'),nl,
write('## Mix it alltogether, cover the bowl with a plate or foil ##'),nl,
write('## and let the salad steep some time to intense its flavour. ##'),nl,
write('## Of course, you can eat it also directly. ##'),nl,
write('## It serves as linging like cheese or sausage. ##'),nl,
write('## Bon Appetit. ##'),nl,
```

write('#####'),nl.

recipe(cheese):-

```
write('#####'),nl,
```


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```
write('#####'),nl,
write('##      Pork medallions with cauliflower and parsley potatoes      ##'),nl,
write('#####'),nl,
write('## Ingredients: 800g pork, 1 cauliflower, 0.8-1kg potatoes, salt ##'),nl,
write('##      parsley, pepper, paprika, 1 glove Garlic      ##'),nl,
write('## Instructions:      ##'),nl,
write('## Peel the potatoes, quater them and put them into a pot.      ##'),nl,
write('## Fill the pot with water that each potatoes is covered.      ##'),nl,
write('## Add 2 tablespoon full of salt as well as 2 teaspoon parsley. ##'),nl,
write('## Also add the peeled and quatered garlic.      ##'),nl,
write('## Clean the cauliflower and put it into a pot with salted      ##'),nl,
write('## water as well and boil both veggies.      ##'),nl,
write('## Spice the pork medallions with salt, pepper and paprika as      ##'),nl,
write('## hot as you like. Melt some butter in a pan and put in the      ##'),nl,
write('## medallions, when the butter is hot. Roast the meat on both      ##'),nl,
write('## sides, equally. When the cauliflower is ready, melt some      ##'),nl,
write('## butter (100g) in a small pot, add breadcrumbs and roast it      ##'),nl,
write('## until it has a nice brown color. Put cauliflower on a plate      ##'),nl,
write('## and put the roasted breadcrumbs-butter mix over it.      ##'),nl,
write('## Serve everything as long as it is still warm...      ##'),nl,
write('##      ##'),nl,
write('##      Enjoy your meal! ##'),nl,
write('##      ##'),nl,
write('#####'),nl,
```


#####

#####

#####

Subsection: break or no match conditions

#####

recipe(none).

recipe:-write('Sorry that sounds unfamiliar to me.').

#####

#####

#####

Framework Definition Section

#####

Subsection: daytime or so called events

#####

%general meals are breakfast, lunch and dinner - general recipes

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```
event(name(cold_meal), isa(meal), [bread, spread, lining, drink]).
event(name(hot_meal), isa(meal), [dish, side_dish, vegetable]).
event(name(breakfast), isa(cold_meal), [morning]).
event(name(dinner), isa(cold_meal), [evening]).
event(name(lunch), isa(hot_meal), [noon]).
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% % % %
```

```
    % % % %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% % % %
```

```
% % %                               Subsection: Derivation of events and frames
% % %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% % % %
```

```
events(Content, Event):- event(name(Event), _, Content).
events( Descr, Event):- event(name(Event), isa(Parent), _) , events(Descr, Parent).
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% % % %
```

```
    % % % %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% % % %
```

```
% % %                               Subsection: Framework
% % %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% % % %
```

```
%Bread recipes consist
%frame(name,superclass,ingredients).
frame(name(bread), isa(basicbread), [flour, yeast, sugar, salt, water]).
frame(name(white), isa(bread), [wheat]).
frame(name(beer), isa(bread), [wheat, beer]).
frame(name(rye), isa(bread), [rye]).
frame(name(brown), isa(bread), [rye, wheat]).
```

```
%spread can be something like butter or margarine
%that is put between the bread and the lining
%frame(name,superclass,ingredients).
frame(name(butter), isa(spread), [butter]).
frame(name(spiced_butter), isa(butter), [salt]).
frame(name(herbs_butter), isa(spiced_butter), [parsley, chives]).
frame(name(garlic_butter), isa(spiced_butter), [garlic]).
frame(name(margarine), isa(spread), [margarine]).
frame(name(brunch), isa(spread), [brunch]).
```

```
%lining describes food than can put on a bread e.g. cheese, salami, jam...
%frame(name,superclass,description).
%differentiation between non ~ and vegetarian lining
frame(name(veg_lining), isa(lining), [vegetarian]).
frame(name(egg_salad), isa(veg_lining), [eggs, mixed_pickels]).
%describing some varieties of cheese
frame(name(cheese), isa(veg_lining), [savoury]).
frame(name(gouda), isa(cheese), [contains('cow milk'), tastes(mild)]).
frame(name(edamer), isa(cheese), [contains('cow milk'), tastes('very mild')]).
frame(name(tilsiter), isa(cheese), [contains('cow milk'), tastes(medium)]).
frame(name(emmentaler), isa(cheese), [contains('cow milk'), has(holes), tastes(strong)]).
frame(name(sheep_cheese), isa(cheese), [contains('sheeps milk'), tastes(medium)]).
```

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```
frame(name(goat_cheese),isa(cheese),[contains('goat milk'),tastes(medium)]).
```

```
%describing some varieties of sweet lining (will be hardly chosen in case of dinner)
```

```
frame(name(sweet_lining),isa(lining),[sweet]).
frame(name(marmalade),isa(sweet_lining),[bitter]).
frame(name(orange_marmalade),isa(marmalade),[orange]).
frame(name(lemon_marmalade),isa(marmalade),[lemon]).
frame(name(jam),isa(sweet_lining),[sweet]).
frame(name(strawberry_jam),isa(jam),[strawberry]).
frame(name(raspberry_jam),isa(jam),[raspberry]).
frame(name(peach_jam),isa(jam),[peach]).
frame(name(nutella),isa(sweet_lining),[chocolate, nutty]).
```

```
%describing non vegetarian linings
```

```
frame(name(nveg_lining),isa(lining),[animal]).
frame(name(sausage),isa(nveg_lining),[]).
frame(name(salami),isa(sausage),[fatty,pork]).
frame(name(chicken_roll),isa(sausage),[chicken]).
frame(name(turkey_breast),isa(sausage),[turkey]).
frame(name(ham),isa(sausage),[pork]).
frame(name(liverwurst),isa(sausage),[pork]).
```

```
%describing drinks
```

```
frame(name(warm),isa(drink),[warm]).
frame(name(cold),isa(drink),[cold]).
frame(name(coffee),isa(warm),[bitter, caffein]).
frame(name(tea),isa(warm),[]).
frame(name(juice),isa(cold),[]).
frame(name(orange),isa(juice),[orange, vitamin, sweet]).
frame(name(apple),isa(juice),[apple,sweet]).
frame(name(grapefruit),isa(juice),[grapefruit, bitter, vitamin]).
```

```
%describing side dishes
```

```
frame(name(potatoes),isa(side_dish),[potatoes]).
frame(name(roast_potatoes),isa(potatoes),[bacon, onions]).
frame(name(salt_potatoes),isa(potatoes),[boiled, parsley]).
frame(name(croquette),isa(potatoes),[fried]).
frame(name(french_fries),isa(potatoes),[fried]).
frame(name(rice),isa(side_dish),[]).
frame(name(noodles),isa(side_dish),[]).
```

```
%describing vegetables
```

```
frame(name(peas),isa(vegetable),[small]).
frame(name beans),isa(vegetable),[small]).
frame(name(carrots),isa(vegetable),[sweet]).
frame(name(brussels_sprouts),isa(vegetable),[delicious]).
frame(name(cauliflower),isa(vegetable),[]).
```

```
%describing dishes
```

```
frame(name(pork),isa(dish),[pork]).
frame(name(beef),isa(dish),[beef]).
frame(name(chicken),isa(dish),[chicken]).
frame(name(vegetarian),isa(dish),[vegetarian]).
```

```
%lunch recipes
```

```
frame(name(porkiflower),isa(recipe),[pork,potatoes,cauliflower]).
```


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Bibliography