



myCBR Project

# myCBR Tutorial

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**myCBR is a project at DFKI**

<http://www.dfki.de>

myCBR is open source, developed under the GPL license.

**For further information visit:**

<http://mycbr-project.net>

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## 1 About this Tutorial

This tutorial gives a short introduction to myCBR as a plugin for Protégé. Here you can get information on how to set up the plugin and getting started using myCBR. See how to import CSV files, model similarity, use the retrieval engine and execute queries. Everything explained here uses the Protégé project `used_cars_flat.pprj` which can be found in the directory `samples/Used Cars (flat)/` of the downloadable zip-file `myCBR-version-bin.zip`. Each directory listed is relative to the `myCBR-version-bin.zip`'s root directory.



A little screw-wrench marks short paragraphs, which should help new developers getting started. These paragraphs give special hints, which might be useful when trying to adapt or extend the myCBR plugin.

Since our aim is to give a short introduction to myCBR, there are a lot of things not described in this tutorial. For example, there are many ways to model string similarities with myCBR. Moreover, there is a possibility to use external similarity measures. There is a separate document on external similarities which can be found at:

<http://mycbr-project.net/external.html>

. Feel free to send questions to [cbr@dfki.uni-kl.de](mailto:cbr@dfki.uni-kl.de).

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## 2 Getting started

To run the myCBR plugin for Protégé download Protégé from

<http://protege.stanford.edu/index.html>

(basic release should suffice) and install it.

Then copy the myCBR plugin folder `de.dfki.mycbr` from `protege_plugin/de.dfki.mycbr` (and its content of course) into Protégé's plugins directory, for instance:

`/opt/Protege_3.4/plugins.`

After starting Protégé and opening a project you can enable the myCBR plugin as follows: Use the menu item `Project -> Configure` as shown in the picture below.

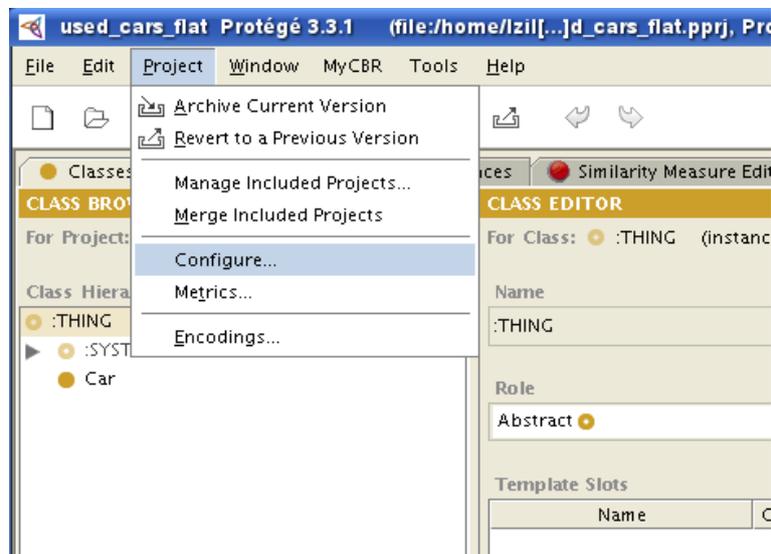


Figure 1: Configure Project

There are three myCBR items listed:

`MyCbr_Similarities_Tab`,

`MyCbr_Retrieval_Tab` and

`MyCbr_Explanation_Tab`.

You have to enable the first two tabs in order to use the myCBR functionality. The `MyCbr_Explanation_Tab` is optional and is not going to be discussed here.

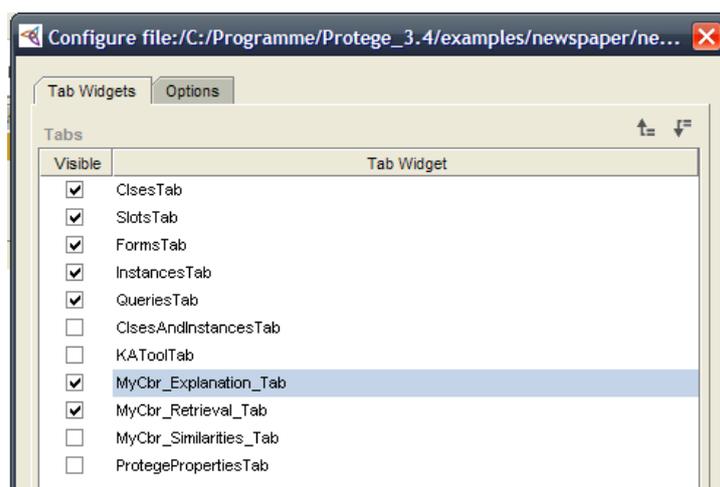


Figure 2: Enable myCBR Tabs

If the tabs are visible similar to **Figure 3**, you have successfully installed the myCBR plugin. Some had problems installing the myCBR plugin under linux, due to the fact that the pre-installed java version has been used. We recommend using a sun java.

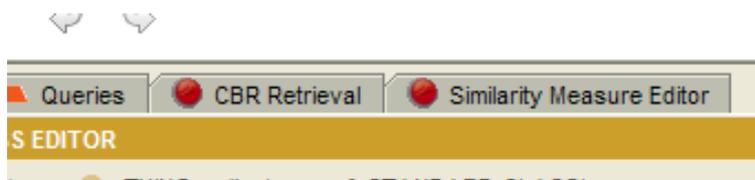


Figure 3: The myCBR Tabs



Note: If you are developing for the myCBR project, you might be interested in using ANT to copy program files into the plugin directories, start Protégé from eclipse, etc. For this purpose you have to customize the `build.xml` file by changing some directory properties.

There is a log file `mycbr_0.log` which is located in your Protégé folder. In case problems occur you can either look on the output of the Protégé's console or you can read the myCBR log.

### 3 Import CSV File

myCBR supports CSV import in order to generate an initial model from existing data and to create Protégé instances used as case base.

Use MyCBR -> Import instances from CSV in the main menu.

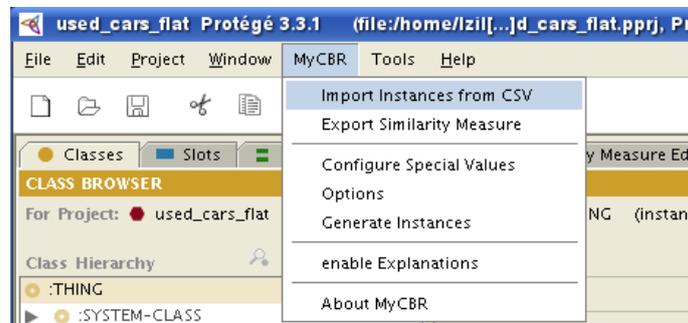


Figure 4: Import Menu Entry

Then choose the CSV file you want to import, e.g. samples/Used Cars (flat)/cars\_casebase.csv. The importer lists all datarows that are selected for the import. You are not able to edit them in the given table since this table is read-only. To be able to import the values, you have to specify a class in the Class Hierarchy.

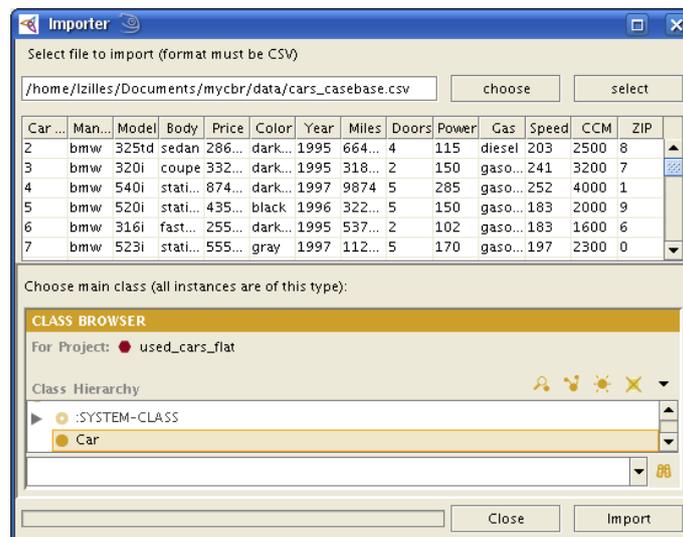


Figure 5: Importer

The datarows then become instances of this class. Choose a pattern from which the instances' names are going to be created. If you click don't care or choose a pattern that is not sufficient as a unique name for each slot, unique names will be generated.

The first line of the CSV file should specify the names of the slots. This means that there has to be one slot for each value listed in the first line of the CSV file. If there are values, that do not have a corresponding slot, they can be created automatically, otherwise, the file cannot be imported. Be aware that the slot types, the maximum, minimum, and allowed values for the

created slots are determined and may have to be edited.

If you try to import values that are not allowed for the corresponding slot (e.g. don't assume values in the given range), those values will be skipped and you get a message

Sorry, could not import some rows. The values which caused that error are now marked red. You are able to edit these cells either by double clicking on the cell to edit the value or by using the button "+" (adds the specified value to the allowed values of the slot).

Of course, you can manually add instances using Protégé's Instances Tab.

From now on, the imported instances are used as query and case values for our retrieval and we can start modelling local similarity measures for our slots.

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## 4 Similarity Modelling

Switching to the similarity measure editor, you see the settings for the global similarity measure function (SMF) of the current class. In our example this is the class `Car` which is selected in the class browser in the upper left hand side corner. The similarity measure for this class (our *global SMF*) is composed of local SMFs of each slot. For this reason, we start editing the local SMFs for each slot first.

### 4.1 Local Similarity Measures

There is the slot browser on the left hand side showing each slot currently specified. Choose one, to edit its local SMF.

You can only specify SMF for the following slot types:

- `integer`
- `float`
- `symbol`
- `string`
- `boolean`

So you cannot specify a similarity measure for `instance`, `class` or `any`.

In order to be able to edit the SMF you need to enter a minimum and maximum value for float and integer slots, which defines the range for the SMF.

First choose between the following similarity modes (depending on the type of your slot):

- Integer, Float:
  - standard
  - advanced
  - external
- Symbol:
  - table
  - taxonomy
  - ordered
  - external
  - String:
    - \* standard
    - \* word-based
    - \* character-based
    - \* external

There is an initial SMF for each slot. You can simply edit it. If you delete it and no SMF is defined, you get the info `no similarity measure defined`.

There is also a built-in transformer which tries to convert the old similarity function into the new one when changing the similarity mode.



You can easily add new function types if you want to use your own customized similarity measure. To do so, you must extend the class `EditorSMFunction.java`, implement all abstract methods as described and add it in `SMFunctionFactory.java`.

Now we want to edit the SMF of our slot `Price` which is of type `float`. Therefore, we want to use the *Advanced Editor* 4.1.1.

### 4.1.1 Advanced Similarity Mode

The *advanced* similarity mode can be chosen for the slot types `integer` and `float`. You should use *advanced* similarity mode in case your similarity measure function cannot be represented by the *standard* similarity mode. In the given example, the advanced similarity mode is used to define the local similarity of `Price`.

We use asymmetric similarity mode due to the fact that  $\text{sim}(x, y)$  (where the query value  $x$  is smaller than the case value  $y$ ) is higher than  $\text{sim}(x, y)$  (where the query value  $x$  is higher than the case value  $y$ ).

Consider the following example:

*CASE 1:* Let  $x = 10.000$  be the query value and let  $y = 20.000$  be the case value.

*CASE 2:* Let  $y = 20.000$  be the query value and let  $x = 10.000$  be the case value.

We would expect  $\text{sim}(x, y)$  to be higher in *CASE 1* than in *CASE 2* meaning that a car which is cheaper than our specified query value has a higher similarity than a more expensive one.

The idea using the advanced similarity mode is to create a measure that is based on the distance of the query and the case value. You can add similarity points and the result will be an interpolated function for your similarity measure. Each point consists of a distance and a similarity value. The distance is plotted against the x-axis and the similarity value is plotted against the y-axis. There are three basic points which are necessary for a correct SMF:

- min: the minimal distance (according to the slot's range)
- 0: meaning case value = query value (exact match)
- max: the maximal distance (according to the slot's range)

The distance is calculated by

$$\text{distance} := \text{query value} - \text{case value}$$

where the both values are possible values that may occur and fit the slot's range. Usually, the similarity of distance 0 is 1.0 just as in our example. Considering the example given above, the minimal distance is set to 0.0 and maximal distance is set to 0.8.

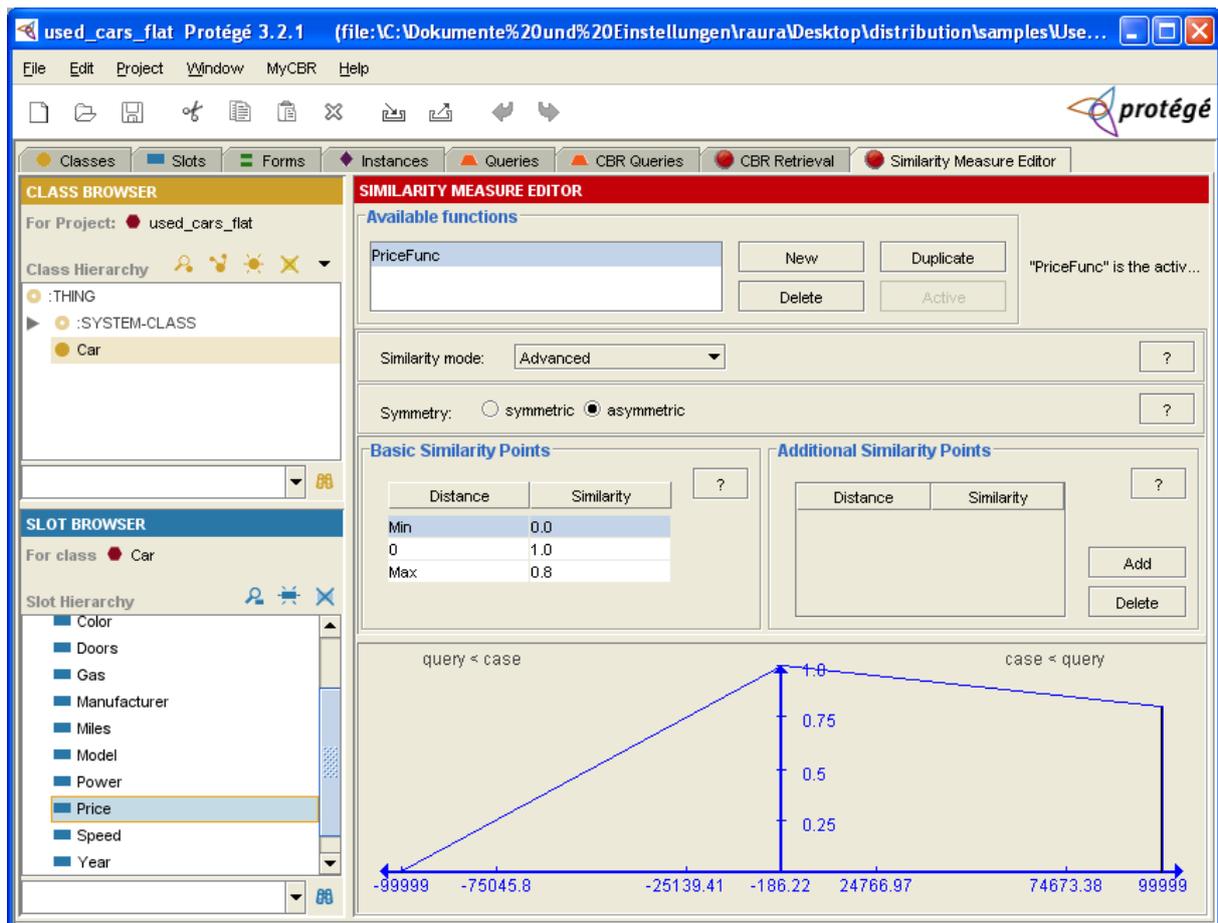


Figure 6: Advanced Similarity Mode

You are able to add further similarity points (optional), however, the basic similarity points are sufficient for our SMF. The SMF will be a linear interpolation over all similarity points (basic and optional).

Our example uses the *advanced* similarity mode for the slots CCM, Miles, Doors, Year, Power and Speed, too. Now we want to edit the SMF of our slot Body which is of type symbol. Therefore, we want to use *table* as similarity mode 4.1.2.

#### 4.1.2 Table Editor

The table editor is used to describe the similarity mode *table*. This similarity mode can be chosen for the slot type *symbol*.

If there are only a few values for your slot which can't be ordered absolutely or hierarchically, you should use the table editor. In the given example, the table editor is used to define the local similarity of *Body*.

First we specify the **symmetry mode**.

Choose *symmetric* so that every similarity between a case and a query value will be equal to the similarity between this case and this query value.

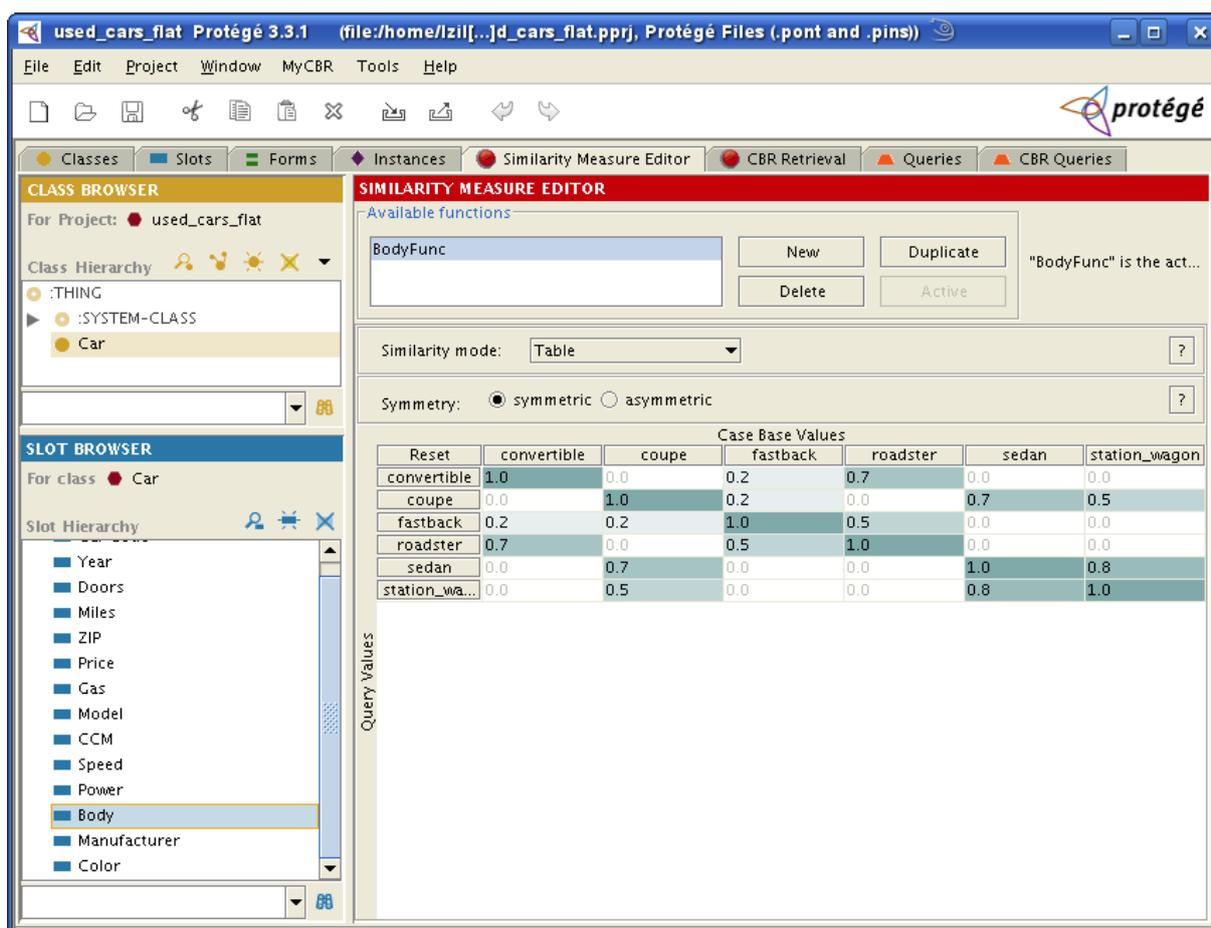


Figure 7: Table Editor

There is an initial table whose diagonal the value 1.0. Every other cell has the value 0.0. This is because of the reflexive relationship of a similarity measure. It is obvious that each slot is similar to itself with similarity 1.0.

To complete the initial table you can directly edit the similarity values between a case and a query value by double clicking on a cell. If you edit the similarity of query value  $x$  and case value  $y$  to  $\text{sim}(x,y) = 0.5$  then  $\text{sim}(y,x)$  will automatically be set to 0.5 (whereas in asymmetric mode, those two similarities can have different values)

As we define the similarity of a query and a case value as a value in range  $[0,1]$ , you cannot enter a value that is not included in this range.

The similarity described by the given table is highlighted by a blue background color of the cells. Darker blue means higher similarity. White means a similarity of 0.0.

By clicking on the first cell in a column, the rows are sorted by this column. If you click on the first cell in a row, the columns will be sorted by this row. The sorting is reset by clicking on 'reset' in the upper left cell of the table.

Our example uses *table* as similarity mode for the slots *Gas* and *Manufacturer*, too. Our next step is to edit the SMF of our slot *Color* which is of type *symbol*. Here we can use the Taxonomy Editor 4.1.3.

### 4.1.3 Taxonomy Editor

The taxonomy editor is used to describe the similarity mode `taxonomy`. This similarity mode can be chosen for the slot type `symbol`.

First of all, we want to point out, that a taxonomy is very powerful and that one cannot give some kind of “universal” explanation of how to represent similarity measures with it. The way of how to compute the similarity measure differs depending on the scenario your taxonomy is based on.

Here, we only want to give a short introduction and want to discuss possible interpretations. If you are interested in more details and other examples, there is a paper on the use of taxonomies by Ralph Bergmann<sup>1</sup>, which describes how to compute the similarity in the possible situations.

You could use `taxonomy` as similarity mode in case the slot’s values can be arranged in a hierarchical structure, such that:

- the nodes on same levels are disjoint sets
- nodes on the last level are real-world objects
- inner nodes consist of the real-world objects that follow in the hierarchical order

In our example the similarity mode of the slot `Color` is `taxonomy`.

The resultant structure specifies parent-child relations through the position of the objects in the taxonomy. This means, that a node has at least the same attributes its parent node has. For instance, “dark\_red” is also “red”. The real-world objects are e.g “dark\_red” and “orange”. So “red” is an abbreviation for all cars colored “dark\_red” or “orange”.

You can distinguish between *inner nodes*, *leaf nodes* (real-world objects) and a *root*. “red” and “green” are *inner nodes*, “dark\_green” and “dark\_red” are *leaves* and “color” is the *root*.

First we specify the **symmetry mode**.

Choose *symmetric*, so that every similarity between a case and a query value is equal to the similarity between this case and query value.

The similarity can be assessed by the parent-child relation of the query and case value in the taxonomy. Let  $c_1 = \textit{black}$  and  $c_2 = \textit{orange}$  be case values and imagine a query value  $q = \textit{dark\_red}$ . Then  $c_2$  is closer to  $q$ , such that the similarity should be higher than the similarity of  $c_1$  and  $q$  (cf. Fig.7).

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<sup>1</sup>The paper on the use of taxonomies by Ralph Bergmann can be found at <http://www.wi2.uni-trier.de/publications/BergmannGwabr98.pdf>

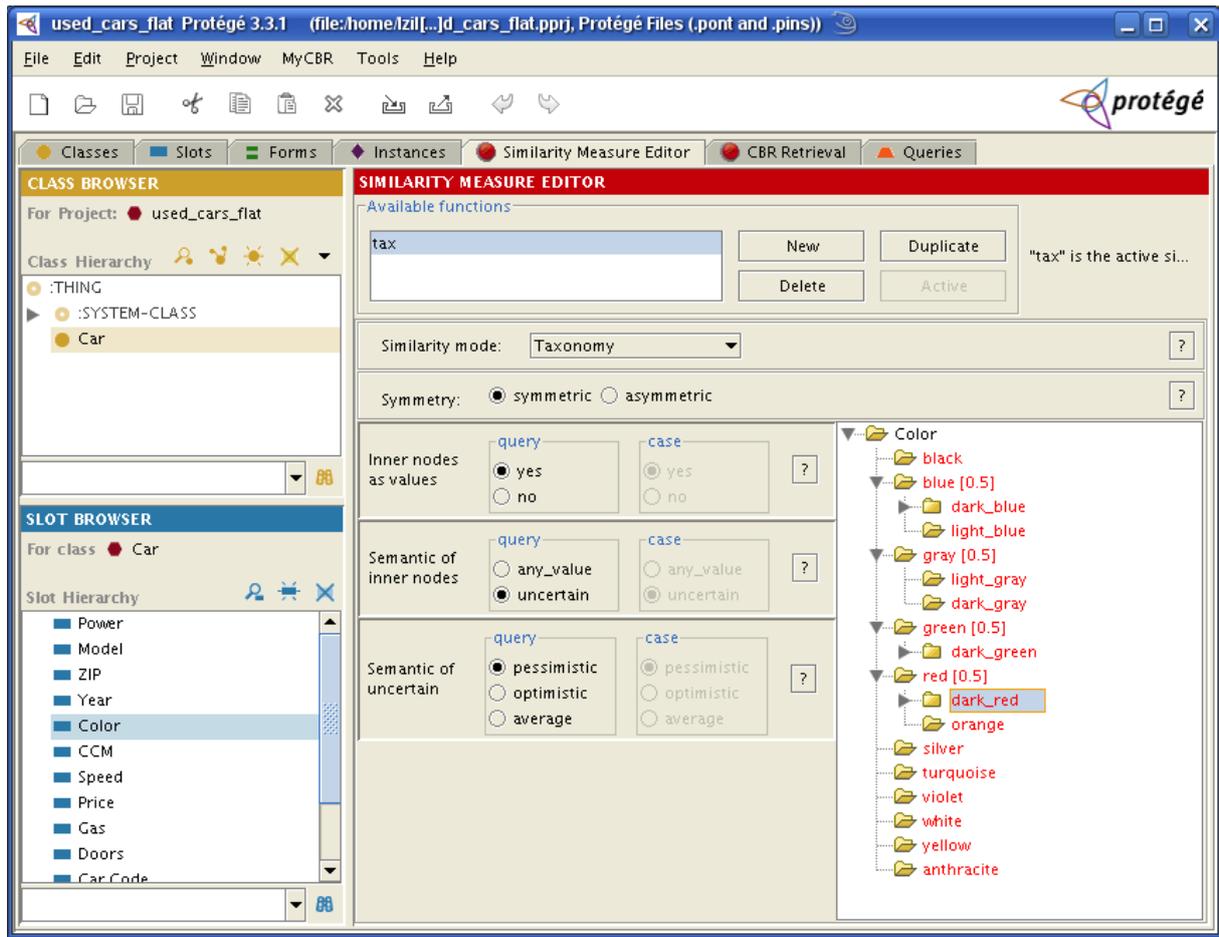


Figure 8: Taxonomy Editor

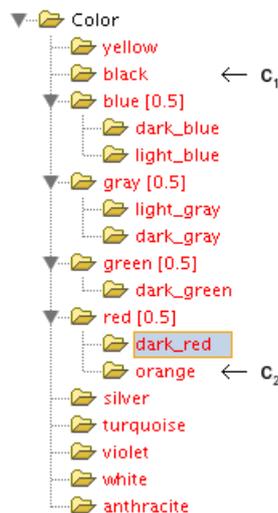


Figure 9: Taxonomy Example

The deeper symbols are located in the taxonomy, the more they have in common. For example, “dark\_red”, “orange” and “black” are all colors, however, the two first-mentioned are also “red”.

This is why the default similarity of inner nodes becomes higher the deeper your object is located in the taxonomy. It can be interpreted as: the leaf nodes, an inner node consists of, have at least the given similarity. This is why the similarity of the *root* and the *leaf nodes* is implicitly defined: You expect, that the leaf nodes have at least the similarity 0.0 (value defined for *root*) and since leaf nodes are the deepest nodes in the taxonomy the similarity is 1.0 (a *leaf node* is equal to itself).

You can change the default similarity by a double click on the inner node. Furthermore, you can easily edit the hierarchical structure by drag-and-drop. Try it and you will see, that the default similarity values will be adapted.

The **semantics of inner nodes** specifies whether inner nodes are allowed as query/case values or not. Allowing only leaf nodes as query and case values means that only the similarity of leaf nodes have to be computed. We allow inner nodes as values and now have to define the semantic of this.

There are two possibilities if the query value is “red”: It could be interpreted as “the user is looking for a car which is dark\_red or orange” (meaning all leaf values, the query value consists of, do lead to a similarity of 1.0). *any\_value* is associated with this interpretation. The other possible interpretation is that the user is actually looking for exactly one of “dark\_red” or “orange” colored cars, but is *uncertain* which of those values is the correct one.

**Semantics of uncertain** : we can distinguish between three different possible methods to compute the similarity between two taxonomy symbols.

- **pessimistic** : uses a lower bound
- **optimistic** : uses an upper bound
- **average** : uses some kind of expected value

The taxonomy editor automatically creates the table used for the table editor. So you can use the taxonomy editor to initially fill the table and then switch the similarity mode to *table* for manually edit the table. This is very useful in case you want to use the table editor but your project structure is very complex.

Our example uses *taxonomy* as similarity mode for the slot *Model*, too. Now we finished editing our *local SMFs* and can continue by editing the *global SMF 4.2*

## 4.2 Global Similarity Measure

Since our scenario does only have one class, we now want to edit its SMF. Switch to *Car* in the class browser in the upper left hand side corner. Then you will see the editor for the global SMF. At the beginning there is an initial SMF called “default”. If you delete it you will get the info “no similarity measure defined” so that you can simply edit it. You see a table where each row specifies similarity measure options for a slot. For each attribute (slot) you can specify:

- whether it is discriminant or not, meaning whether it should be included in the global similarity measure or not (e.g. the slots ZIP and Car code are not used)
- a weight, for specifying the importance of a single slot for the global SMF (e.g. the slot Price has a higher weight than Gas). For this weight you can use an arbitrary range which is unbounded.
- a local SMF, which can be either the current slot’s active SMF or another one of the slot’s SMF (we use the active SMF for each slot, since we do not have other SMFs)
- comment (optional)

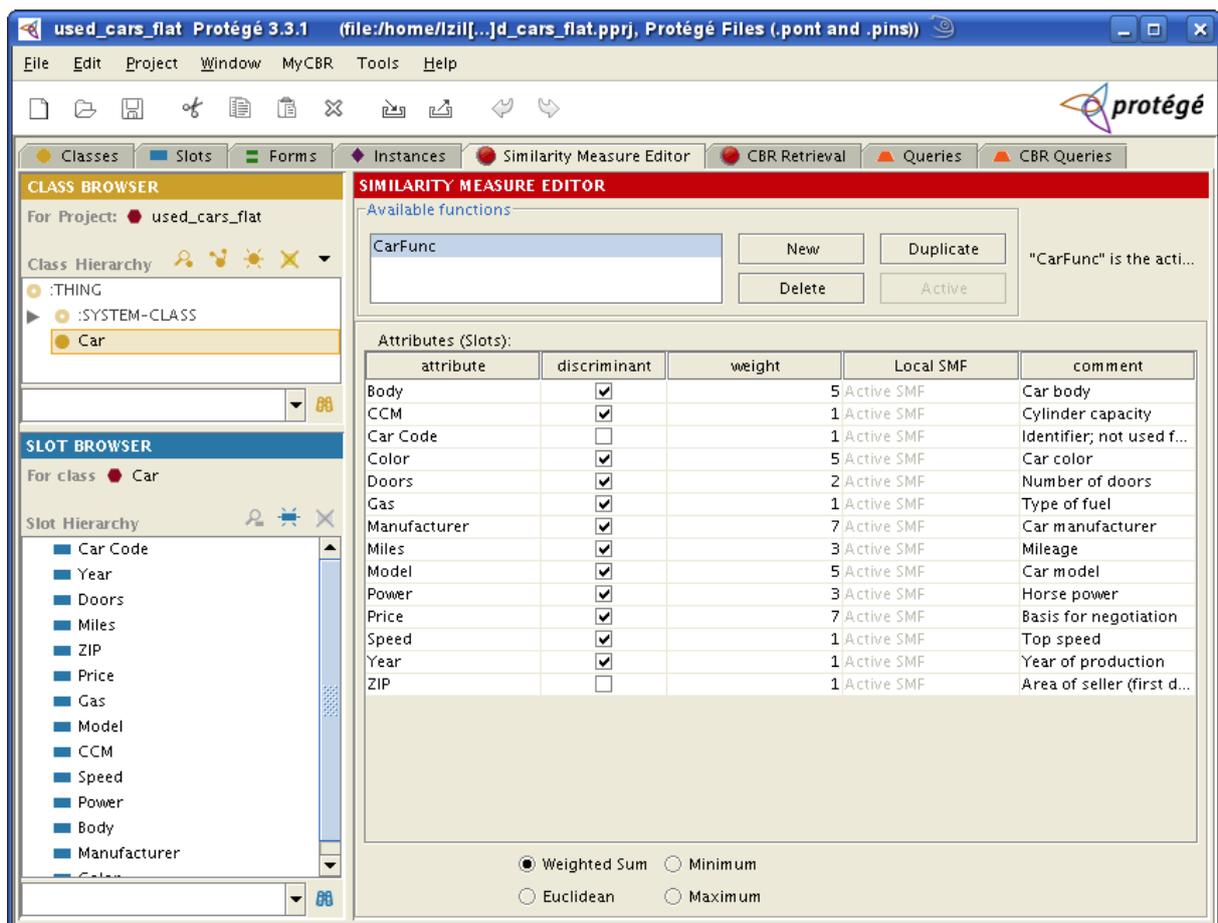


Figure 10: Similarity Measure Editor (Global Similarity)

In case a slot has no SMF, it is marked with “no similarity measure available” (as comment) and you are not able to check *discriminant*.

You can specify several SMFs for one class, but only one can be used at a time. This one must be marked as active using the “active” button. In our example, this is the SMF `CarFunc`. If the current SMF is already marked as the active SMF, the “active” button will be disabled.

The global SMF for the current class could be calculated using one of the following approaches:

- weighted sum
- euclidean
- minimum
- maximum

We use *weighted sum*, however, there is no rule which of the four possibilities to use best. This highly depends on your scenario and on the constraints your similarity measure has to fulfill.

We now finished editing our SMF and can start our retrieval by using the myCBR’s *Retrieval Engine 5*.

## 5 Retrieval Engine

After defining all necessary similarity measures we can start using the retrieval engine. The first column lists the slots in our class `Car`. The second column specifies the query values for each slot.

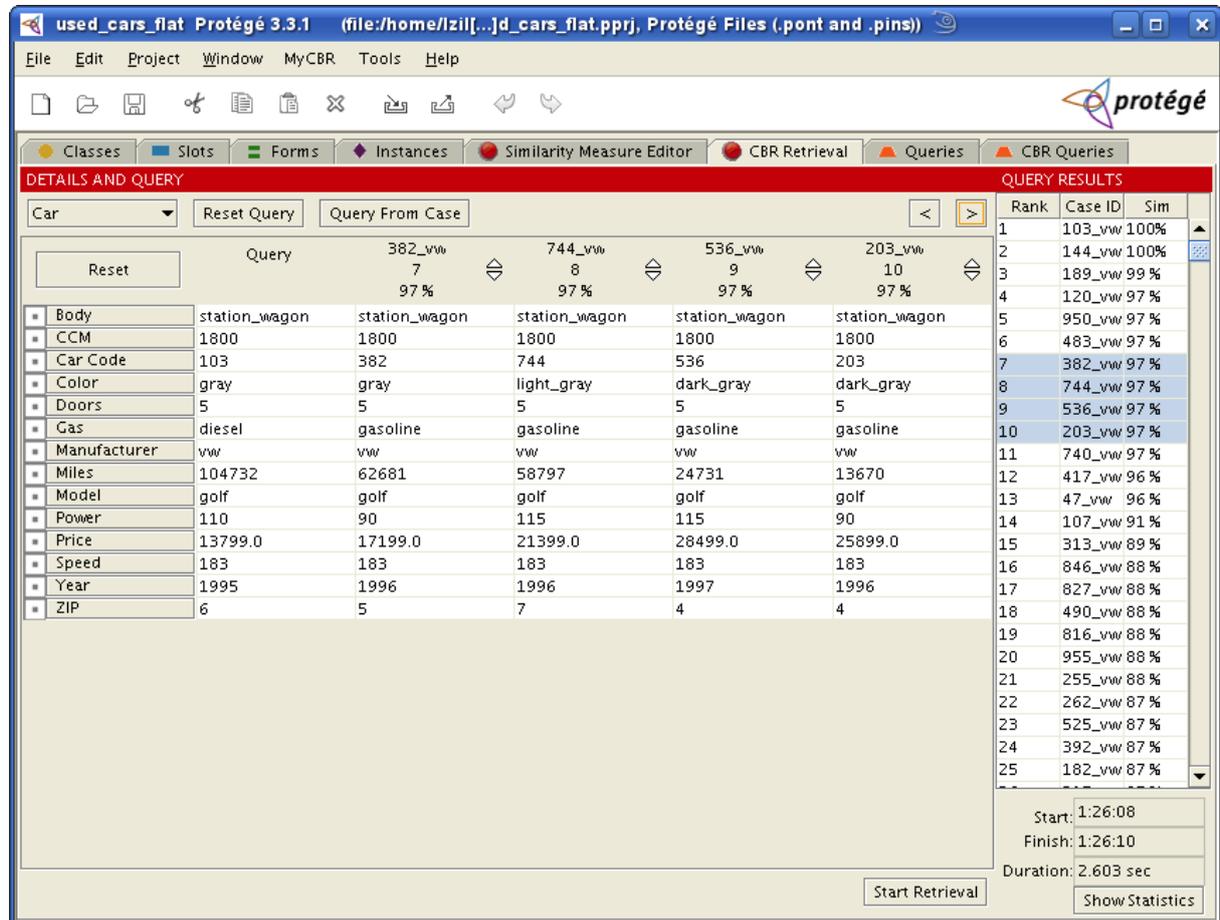


Figure 11: Retrieval Tab

**Query Generation** We can now either enter a query or perform a query based on a case. The first opportunity is to manually enter query values for each slot. Be sure to enter values that are consistent to the slots' constraints.

**Query From Case** On the other hand, you can use `Query From Case`. There is a popup showing the available cases. If you choose one, the query values will be filled with the values of the chosen case. You can edit these values or directly start the retrieval which will then give you the cases which are similar to the case you have chosen.

**Start Retrieval** Click `Start Retrieval` in the lower right hand side corner. The table then shows the cases which are most similar to your query values according to our above defined similarity measures.

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Now there is an additional list on the right hand side showing the cases which are ranked using the similarity they have to your query values. Furthermore, you get statistics for you retrieval.

The table on the left hand side now shows the first cases in the ranked list. Again there is a colored background. Darker color means higher similarity and white means similarity of 0.0. By clicking on the first cell in a column, the rows are sorted by this column. If you click on the first cell in a row, the columns will be sorted by this row. The sorting is reseted by clicking `Reset` in the upper left cell of the table.

Now you should be able to customize the example `Used Cars (flat)` or adapt it to your own projects. Moreover, the similarity measures introduced here can easily be extended to similarity measures for more complex structures (e.g. inheritance).