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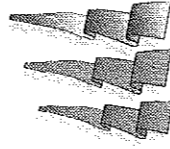
CBR2

CBR Express[®]
for Windows

***Reference
Manual***

Inference[®]

YAH0021062



CBR Express[®] 2.0 for Windows
Reference Manual

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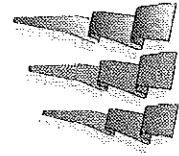
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Preface

This is the *CBR Express* Reference Manual. The purpose of this manual is to provide information that will assist you in modifying the *CBR Express* authoring environment. The reader of this manual is expected to be a fairly experienced programmer. (Chapter 10, *Customizing CBR Express*, begins with a discussion of software tools and programming skills required in order to perform various types of modifications to *CBR Express*.)

The topics covered in this manual include:

***CBR Express* Architecture:** The overall interaction of *CBR Express* components viewed at a high level.

Matching Algorithms: How *CBR Express* makes use of the ART-IM kernel case-base matching algorithms.

Function Library: A listing and explanation of the functions and handlers in the ToolBook scripts of the *CBR Express* interface.

Case-Bases Schema: Description of the central case-base object representation within ART-IM.

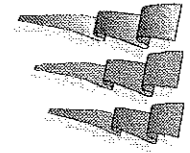
Case-Base Database Interface: The application programming interface between the *CBR Express* ToolBook file and the case-base database.

Tracking Database Interface: The application programming interface between the *CBR Express* ToolBook file and the tracking database.

need to rearrange or resize the customized objects to make them blend in with the new panels.

- Enhancements in *CBR Express* may have occurred in some of the scripts that you copied and modified. If you want the enhancements, there will be some editing to be done.

There is no perfectly-painless magic to permit upward migration of customizations to succeeding versions of *CBR Express*, but the path described here eases the transition.



Matching Algorithms

The case-base matching functions of ART-IM are discussed in detail in the ART-IM Reference Manual. This discussion describes a subset of the capabilities of ART-IM as they pertain to default match scoring in *CBR Express*.

The main sections of this chapter are:

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General Approach

In general, the task is to take a single *search case*, consisting of data from the Search Panel, and develop a numerical similarity score versus an unknown and potentially large number of *stored cases*. Both the search case and the stored cases are characterized by a set of *features* consisting of a description string together with a number of answered questions.

Description Scoring

The scoring of each case takes place in two separate parts. The case descriptions are scored separately from the case questions. This lets us assign the description a fixed percentage of the total score, regardless of the number of questions in play in each case. This was a feature that many users requested.

Of the 100 points that may be allocated to a case's score, the default percentage for descriptions is set at 20%, meaning a maximum of 20 points may come from the description. Users frequently raise that figure substantially. You are permitted to raise it to 100% if you want to ignore questions completely.

So if you set the description percentage to 50%, for instance, a perfect match of the description will result in the case's score being *at least* 50 points. The remaining 50 points of the case will be allocated as a composite of the matches of the questions.

Question Scoring

To do this, the questions of the search case are each individually scored against corresponding questions of the stored cases. Generally speaking, if a search feature exactly matches a stored feature (both questions answered "Yes") the raw score of the stored case is incremented by the *match weight* of the question. This weight is an integer set by the user on the Question Panel. For features that may result in partial matches (such as the text or numeric answers) the raw score of the stored case will be incremented by some fraction of the feature's defined weight, depending on how close the match is. It is also possible to define a *mismatch weight* for a feature. In this case, failure to match a feature of the search case results in decrementing the stored case's raw score.

The raw score is totaled up for each case, and is then normalized into the range of points left over after scoring the description. For instance, if the description percentage is set to 50% (or 50 points), the contribution from the questions will be some scaled proportion of the remaining 50 points.

The normalization confines the final values to a range of 0 to 100 in *CBR Express*.¹ A normalized score of 100 indicates a perfect match. Lesser scores may be made up of combinations of match and mismatch weights, making it more difficult to describe their significance.

In addition to the contributions of the match and mismatch weight of each feature, there may also be an *absence penalty* applied to each stored case's raw score. This is a small decrement applied for each feature of the search case that is not shared by the stored case. In other words, if the search case has many more features (more answered questions) than the stored case, the stored case will be unable to attain a perfect match score, although it may come close.

Finally, it is possible to designate a question in a case as having an *absolute* score. We use this for answers that absolutely confirm or absolutely disqualify a case.² This feature is limited to Yes/No and List questions in *CBR Express*, since the other types of questions produce partial scores and usually cannot be said to have wholly matched or wholly mismatched a case.

The following discussions describe in more detail the techniques used to calculate the raw score contributions of each type of question in *CBR Express*. Note that the actual formulas defining each scoring method are presented in the ART-IM Reference Manual.

¹ Strictly speaking, in ART-IM the range is -1.0 to 1.0. *CBR Express* maps this range into a match score of -100 to 100, and in search mode one usually does not see scores of zero or below.

² The archetypical example involves Jose's regular stomach pains. It really doesn't matter that the pains are regular and five minutes apart. If Jose is known to be male, this datum *absolutely* disqualifies "Patient in Labor" as a contending case.

String Matching

String matching is the default algorithm for scoring Yes/No questions and List questions in *CBR Express*.

If the search case's answer (Yes or No) *exactly matches* a stored-case answer, then the stored case's raw score will be incremented by the match weight of the question; otherwise the stored case's raw score will be decremented by the mismatch weight of the question.

If the question is one which absolutely confirms a case, and the search case's answer is identical to the stored case's answer, the normalized score for the stored case will be set and held at 100.

If the question is one which absolutely disqualifies a case, and the search case's answer is not identical to the stored case's answer, the normalized score for the stored case will be set and held at 0.

When two absolute questions conflict, one confirming and one disqualifying the same case, *CBR Express* confirms the case and presents it to the user. Technically, this situation is considered a user error. Therefore, we place the case on display for the user to examine.

Number Matching

Number matching is the default algorithm for scoring numeric questions in *CBR Express*.

At first glance one might assume that matching numbers would be trivial. The search number and the case number are either equal or they are not. That's fine, but if you want that strict an interpretation you should use a Text question (below) instead of a numeric one. Number matching is not for finding exact matches; it is for finding near-misses.

Number matching measures the similarity of two numbers, and awards raw score points (a proportion of the question's

weight) based on how near the search number is to the number in the stored case. To make this comparison, *CBR Express* needs to know the range of values the number may take. It then takes an interval of 10% of this range and uses it as an acceptance window as described below:

- If the search number and the case number are exactly equal, the raw score for the case is incremented by the match weight of the question.
- If the two numbers are more than 10% apart (10% of the total range) the raw score of the case is decremented by the mismatch weight of the question.
- If the search number is within 10% of the case number, raw score points are awarded in linear proportion to the proximity of the two numbers.

This latter point, the linear proportion scoring, has interesting implications. One can strike a balance between the question's match weight and its mismatch weight to effectively narrow the acceptance window below the 10% default. In effect, the larger the mismatch score is, the narrower the acceptance window becomes.

We refer you to the ART-IM Reference Manual for the deep details of number matching in ART-IM.

Absolute scoring does not apply to numeric matching in *CBR Express*.

Character Matching

Character matching is the default algorithm for scoring search descriptions in *CBR Express*.

Character matching involves preprocessing the description string to remove as much "noise" text as possible. *CBR Express* keeps a list of ignored words which are removed by the string preprocessor. Then all recognizable suffixes are removed from the remaining words. There is a pass to substitute synonyms, if any are defined. Punctuation marks (called "separators") are removed. Finally the string is converted to uppercase throughout to eliminate case-sensitive distinctions.

At this point the remaining text is broken up into *trigrams*, which are three-character fragments of the string. The trigrams of the search string are compared to the trigrams of each stored case description. The raw score for each case is then incremented by a fraction of the description weight for each trigram that the search description and the case description have in common.

Absolute scoring does not apply to character matching of descriptions.

Word Matching

Word matching is the default algorithm for scoring text questions in *CBR Express*. The approach is similar to character matching but is more economical of time and memory.

Word matching is generally similar to character matching in that the answer string is preprocessed to remove noise words and suffixes, and synonyms are substituted if necessary. Then the remaining text is divided up into words, rather than into trigrams. The raw score for each case is then incremented by a fraction of the description weight for each word that the search answer and the case answer have in common.

Absolute scoring does not apply to word matching of answers in *CBR Express*.