Case-based reasoning is a methodology not a technology

—— Ian Watson

Presented by Chen WANG

- Case-based reasoning
- CBR applications:
  - CBR using nearest neighbour
  - CBR using induction
  - CBR using fuzzy logic
  - CBR using database technology
- Conclusion

Case-based reasoning

"A case-based reasoner solves problems by using or adapting solutions to old problems."

(Riesbeck and Schank)

* It is "***what*** ", not "***how*** "

CBR-cycle

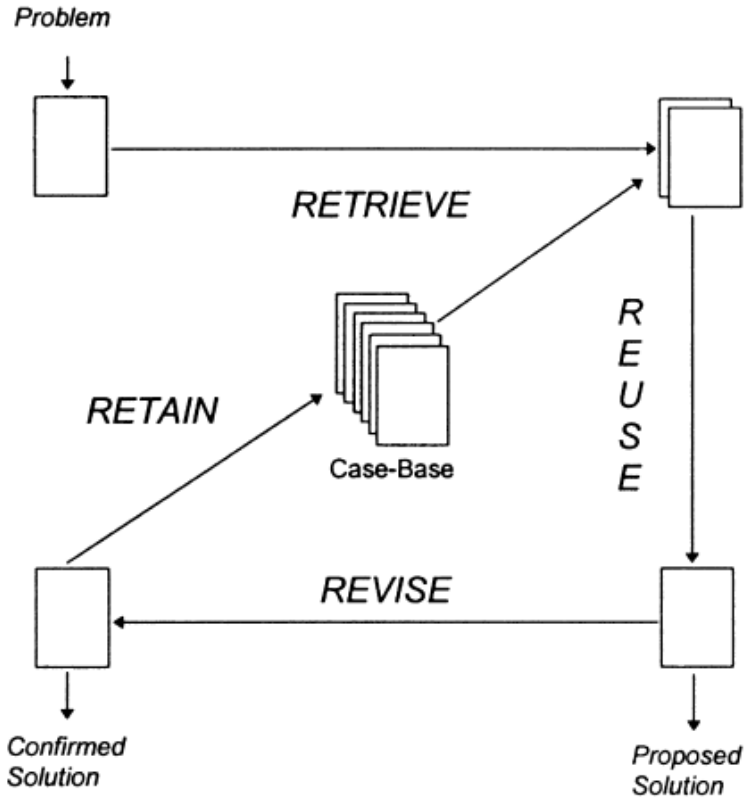

Fig. 1. The CBR-cycle after Aamodt and Plaza [6].

1. **Retrieve** similar cases to the problem description.
2. **Reuse** a solution suggested by a similar case.
3. **Revise** or adapt that solution to better fit the new problem if necessary.
4. **Retain** the new solution once it has been confirmed or validated.

Methodology

"an organised set of principles which guide action in trying to 'manage' (in the broad sense) real-world problem situations."

(Peter Checkland)

CBR using nearest neighbour

$$\text{Similarity}(T, S) = \sum_{i=1}^{n} f(T_i, S_i) \times w_i$$

T – the target case
S – the source case
n – number of attributes in each case
i – an individual attribute from 1 to *n*
f – a similarity function for attribute *i in cases T and S*
w – the importance weighting of attribute *i*

Application:

Wayland—setting up aluminium die-casting machines

CBR using induction

It is assumed (usually correctly) that cases with similar problem descriptions will refer to similar problems and hence similar solutions.

Application:

Troubleshooting CFM 56-3 engines on Boeing 737s

CBR using fuzzy logic

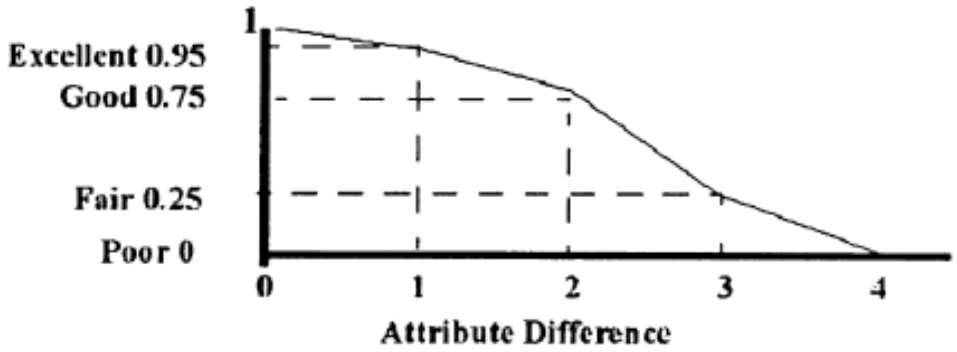

Fig. 3. A fuzzy preference function (after Cheetham and Graf [13]).

A fuzzy preference function is used to transform a quantifiable value for each attribute into a qualitative description of the attribute that can be compared with the qualitative description of other attributes.

Application:

Colour matching plastics at General Electric

CBR using database technology

Databases are efficient means of storing and retrieving large volumes of data.

- If problem descriptions could make well formed queries it would be straightforward to retrieve cases with matching descriptions.

Wild cards —— a way to get not 100% exact matched data

Application:

squad—*sharing experience at NEC*

CBR guiding principles

- each explicitly attempts to solve problems by reusing solutions to old problems
- the retrieval of past problems (cases) involves assessing the similarity of the problem to cases in a case-library
- once a new problem is solved it is added to the case library to retain the problem solving experience for future reuse

Again

"A case-based reasoner solves problems by using or adapting solutions to old problems."

(Riesbeck and Schank)

Methodology

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Challenge!

There will be more technologies added to the cycle.

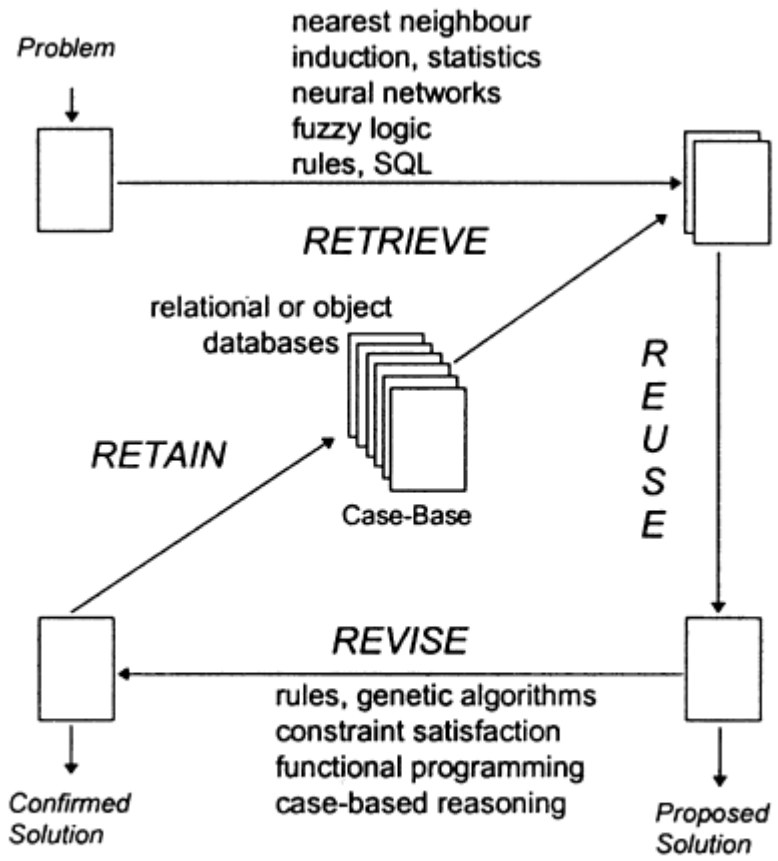

Fig. 5. Technologies and the CBR-cycle.