## **Case-Based Reasoning: Reasoning using Experience**

by Nemecio R. Chavez, Jr.

### What is Case-Based Reasoning (CBR)?

• A model of reasoning based on stored knowledge or experiences called cases that gives computers the appearance of reasoning like a human.

#### • Some feel that it is also a cognitive model of how we reason.

Maybe we should drive? But the last time we drove Sam was sick the whole way.

Alright, maybe we should fly? Sarah really enjoyed the flight to our vacation spot last summer and I don't recall that Sam had any trouble with it.

Now where should we go? We could visit relatives but we saw almost everyone just a few weeks ago at the family reunion. Except we didn't see uncle Ed. He lives in Alaska though and the only one of us that likes the outdoors is Tricia.

Ah, I remember seeing Sam and Sarah looking through a magazine that had an article on Disney Land. Tricia said she went to Disney Land as a young adult. She didn't say if she liked it our not but I got the distinct impressions she didn't have a very good time. But Disney World is in Florida. Tricia said once that she would love to visit Florida and there are lots of outdoor things to do.

• Pioneered by Schank and Kolodner in the early 80's.

# • The CBR model comes in two flavors: interpretive CBR and problem solving CBR.





### The CBR Model (cont.)

- Situation Assessment What features of the current situation are relevant?
- Case Retrieval the recalling of relevant cases.
- Similarity Assessment at this step the CBR reasoner must assess or evaluate the relevant cases to see which best apply or which are most similar.
- Adaptation the process of taking the relevant cases and adapting them to fit the current situation.
- Evaluation the goodness of candidate solutions.
- Learning can be broken up into two categories: success driven learning and failure driven learning.
- Memory Updating how the case is stored in memory.



### An Example Case-Based Reasoning System

• See "A Simple Example" at the link in [1].

**Case-Based Reasoning: Reasoning using Experience** 



The Future of CBR	
•	CBR typically focuses on reasoning within a single domain. How would a cross domain CBR system work?
•	Similarity is typically based on the euclidean distance. Are there other measures?
	$\sigma(USA, Mexico) > \sigma(Mexico, USA) \tag{1}$
•	Current CBR uses adaptation methods that rely on hardcoded domain specific knowledge. Is there an alternative?
•	Interesting applications: Document Retrieval (Textual CBR)

### References

- [1] Bergmann, R., Introduction to Case-Based Reasoning, http://www.cbr-web.org/ CBR-Web/cbrintro/index.html,1998.
- [2] Bergmann, R. and Wolfgang, W., On the role of Abstraction in Case-Based Reasoning. Advances in Case-Based Reasoning, Volume 1168 of Lecture Notes in Artificial Intelligence, Springer, 1996, Pages 28-43.
- [3] Gentner, D., Markman, A. B. (1997). Structure mapping in analogy and similarity. American Psychologist, 52, Pages 45-56.
- [4] Kolodner, J., Case-Based Reasoning, Morgan Kaufmann Publishers, Inc., 1993.
- [5] Kolodner, J., Retrieval and Organizational Strategies in Conceptual Memory, Lawrence Erlbaum, Hillsdale, New Jersey, 1984.
- [6] Leake, D.B., Case-Based Reasoning: Experiences, Lessons, and Future Directions, AAAI Press/MIT Press, 1996.
- [7] ResearchIndex, Scientific Literature Digital Library, http://citeseer.nj.nec.com.
- [8] Schank, R.C., *Dynamic Memory: A Theory of Learning in Computers and People*, Cambridge University Press, New York, 1982.