Case-based Learning

Figuring it out through what other people have done

What is Case-Based Learning?

Case-Based Learning, or CBL, is a way for students to learn from examples that have already been completed. The "how it was solved" is removed so that the student can examine and think about how it was completed, whether or not it was solved.

This doesn't mean that they only take a look at a case and take the answer and apply it to the new case, there is a lot more thinking, reasoning, and remembering involved.

What is involved?

- Reasoning

- Similarity

- Remembering

- Performance behaviors

CBL Behaviors

- Reducing storage requirements

- Tolerating noisy cases

- Learning feature importance

- Context

The Cases

- Have to be complete cases

- Have to be a consistent theme

- Have to be memorable

Failure counts too!!!

Not all of the cases in case-based learning have to be solved.

Failure isn't always a bad thing when concerning case-based learning.

All the cases go into a "case index" which is a fancy name for a system in memory.

The algorithm by David W. Aha

- Pre-processor – preparing input

- Similarity – assesses the similarities of a given case with previously stored cases

- Prediction- inputs the similarity assessments and generates a prediction for the value of the given cases' goal feature.

- Memory Updating – updates the stored case-base

Sample Algorithm

$$\text{Similarity}(C_1, C_2, P) = \frac{1}{\sqrt{\sum_{i \in P} \text{Feature\_dissimilarity}(C_{1_i}, C_{2_i})}} \tag{1}$$

where P is the set of predictor features and

$$\text{Feature\_dissimilarity}(C_{1_i}, C_{2_i}) \begin{cases} (C_{1_i} - C_{2_i})^2 & \text{if feature } i\text{'s values are numeric} \\ 0 & \text{if } C_{1_i} = C_{2_i} \\ 1 & \text{otherwise} \end{cases} \tag{2}$$

Not everything works

- Some domain specific information can not be easily learned through this algorithm.

- Can not yet automate learning in knowledge rich applications.

Learning Goal

- One learning goal in the Curriculum is for a student to analyze and pinpoint major aspects of a case, analyze how the end result came to be, and then apply what was learned to a new case.

- This moves out into how the student will take aspects of CBL and apply it to cases that they encounter

In a virtual world

- What type of world would be created?

- How would the information be presented?

- How would the students be engaged in the learning?

- How well would they remember the cases?

The sky is the limit

For this type of learning, multiple worlds or one world with many room or buildings could be presented. In this situation many things would have to take place.

- Each world/room/building will have its own case so that the students can explore each one on their own.

- Have a main point to start from and then let the students explore each case on their own. Have one central room with corridors or portals leading to the different cases.
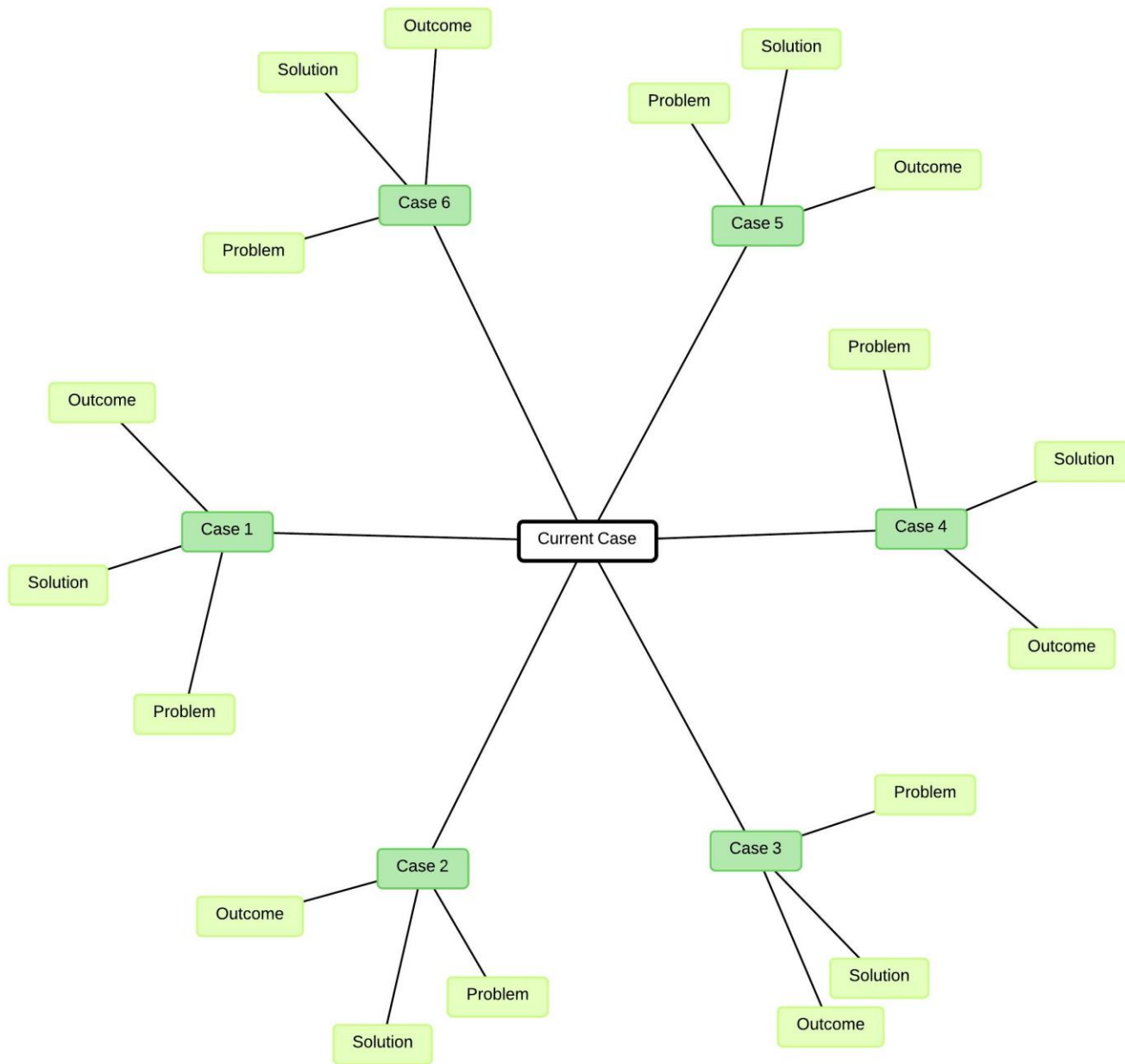
Each case is its own separate environment for a student to explore and think about how the case was solved and experience the case themselves