Aaron Saporito | Russel Kosovsky | Matthew Lee | Jay Nash | Derin Gezgin
COM316: Artificial Intelligence | Answers to Standard Questions #8
Meeting Date & Time: 11/04/24, 5:00-6:30 PM

What other types of problems can we solve using this method? In other words, the problem probably deals with a particular situation. Can we categorize what general category of problems this method can solve?

Frames

Frames can be used to understand the correlation between different identities. We can represent a large system with different attributes using frames, as they can represent slots.

We can represent a large grid and obstacles in it (such as *minefields*) that need to be avoided. For example, each grid cell can be represented as a frame and its connections as slots. The end result would be a set of connections of frames that form a graph. This is useful as it can represent non-uniform graphs, unlike grids.

Thematic-Role Frames

Agent-based systems are a strong use case for thematic role frames. We can use them to structure large information stacks and the actions that occur and manipulate them. For example, we can represent a robotic emotional system, where a "brain" can feel up to three emotions at a time, and actions can be applied to change these states in connection with other "brains."

We can use this for elementary sentiment analysis since thematic-role frames are good for representing sentences to a computer. While we cannot perform any large-scale reasoning, we can garner the causes and outputs of a given sentence and indicate if it is positive/negative.

We can utilize this to assign basic sentence understanding, such as agent or patient in a medical context. From here we can extrapolate meaning from the thematic-role frame.

Deciding tasks for a robot in the real world to interact with its environment. For example, if you give the robot a task as a casual sentence then it would figure out how to interact with the environment to complete the tasks.

Version Space Learning

We can learn general concepts from a set of very specific examples to narrow our hypothesis space. We can use this to do basic dataset analysis to determine a causation. For example, detecting the source of a virus, provided there is enough overlapping data or the most relevant features that define a certain concept

Version Space Learning can be used to determine a patient's disease or condition for medical diagnosis. It can also be used to determine where mines are when playing the game ‘minesweeper’

Assuming that this solution does not give us a fully autonomous artificial mind, what is holding us back?

Frames

Frames do not hold implicit information. For example, if we had the frame:

```
(eat
        (agent bob)
        (location mcdonalds)
        (object dinner))
```

This frame cannot answer the questions “where did bob get his food from?”, as the frame does not tell us that food and dinner could be connected nor that mcdonalds is likely where he got his food. It is difficult to rectify this as if we change location to be a restaurant it could mislead us as we could eat dinner in a part, which is not a restaurant.

- Static and Predefined Structures: Frames rely on predefined schemas to represent knowledge. They lack the flexibility to adapt to new, unforeseen situations without manual updates.
- Frames often struggle with context shifts and nuances, making it difficult for an AI to interpret information in dynamic environments.

Thematic-Role Frames

Thematic-Role frames can hold more accurate relationships between actions and state changes, but it still have the same flaws as frames. If we do not explicitly lay out every possible relationship, it is very difficult to infer certain facts that a human can easily realize.

Version Space Learning

Version space learning assumes noise-free data and well-defined hypothesis spaces, which are rare in real-world applications. It can struggle with inputs outside the predefined hypothesis space or when concepts evolve.

Aaron Saporito | Russel Kosovsky | Matthew Lee | Jay Nash | Derin Gezgin
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Can we restate this problem and/or add more tools to gain more ground in our search for the artificial mind? What small change will force us to develop a solution that is one step closer to a fully autonomous artificial mind?

Frames

Frames can include contextual possibilities. For example, a bird can normally fly unless it's in a small cage or hurts its wings. These possibilities provide a lot of detail about the property of the object; therefore, if they are embedded in frames as 'possibility slots,' they can be used for more complex reasoning. We can also make the frames time-dependent. At the same time, we can add emotional attributes to frames.

Thematic-Role Frames

We could add more dynamic links to the thematic-role frames by making everything a linked frame. For example, instead of just having action and state-change frames, we would also have a frame for every variable in each frame:

```
(action1
        (verb walk1)
        (agent bob)
        (destination park1))
(walk1
        (type movement)
        (speed fast))
(bob
        (species human))
(park1
        (size large))
Etc
```

In this way we could encode far more information, assuming we spent the time to thoroughly encode everything we ever used.
Similarly to frames, we can add relationships that depend on time. For example, do a specific action for X duration, etc. Similarly, we can fire an action with a certain probability to have an aspect of randomness.

Version Space Learning

We can combine version space learning with deep learning to handle complex, noisy data.

- Algorithms that update the model incrementally as new data arrives (like online learning methods)

The version space learning structure can have a confidence value of its examples.