ALC Tableaux Visualization Website

John McKeown

University of Miami

Abstract. Online visualizations have proven their usefulness in teaching in recent years. Brilliant.org has been making interactive visualizations to make learning fun online. The YouTube channel 3Blue1Brown has almost entire courses devoted to "The Essence of Linear Algebra" and "The Essence of Calculus" where it uses well-crafted animations to demonstrate complex ideas. In order to make teaching the ALC Tableaux algorithm easier and more effective, I am attempting to make an instructive visualization of how the algorithm works.

Keywords: Semantic Web · Visualization.

1 ALC Tableaux Visualization

I plan to visualize the ALC Tableaux algorithm as it is presented here:

`https://www.cs.miami.edu/home/visser/csc751-files/understanding_dl_sroiqd.pdf`

The algorithm involves updating sets which correspond to variables and individuals ($\mathcal{L}(a)$), as well as sets which correspond to pairs of them ($\mathcal{L}(a, b)$). Because of this, I want the visualization to revolve around showing these sets being filled according to the algorithm. I'm sure the actual nature of the visualization may change as I realize what is possible with the tools I'm using, but for now my basic idea is the following:

1. Visualize translation into negative normal form.
2. Visualize reduction of problem to that of determining unsatisfiability.
3. Initialize the Tableaux sets.
4. Visualize the non-deterministic application of rules from the algorithm.

Now, let us discuss the technologies I will use to make these visualizations. Web pages are a very portable and flexible medium for creating visualizations. For this project I plan on making a web page. It will probably make use of MathJax or something similar to allow rendering LaTeXin the browser. I will see what how far I can get using only HTML and CSS transforms for the animations, but I might end up using HTML5 canvas elements to draw and position things more precisely. Either way, it'll be a lot of JavaScript. In addition to the JavaScript

to perform the animations, I will probably need to create my own model for representing formulae.

For simplicity, I'm thinking of hard-coding a few different problems instead of parsing arbitrary user-entered problems. If I have time, I'll expand it to use custom problems.

2 Related Work

Visualization of algorithms is a very common thing to find online. My YouTube recommendations never fail to include a visualization of sorting algorithms. Almost every algorithm which a student sees in their undergraduate algorithms and data-structures course has been visualized here by David Galles: `https://www.cs.usfca.edu/~galles/visualization/Algorithms.html` [1] Although there are countless visualizations of common algorithms, I have not seen a visualization of this particular algorithm before.

Also, the version of the ALC Tableaux algorithm which I will try to visualize is not very applicable to real world applications without modifications which would perhaps make it less easy to visualize. Because of this, it is unlikely that people would even think to make such a visualization unless you were teaching a class where you needed to explain the algorithm with a visualization.

There have been visualizations of various things related to the semanic web. For instance, WebVOWL [2] is a tool for visualizing the classes and relationships of an ontology. The closest thing I was able to find online to this project is something called SIVA [3], which also attempts to visualize the ALC tableaux algorithm. Their visualization tool is accessible here: `http://siva.6f.sk/`. Although it seems way more professional than what I can make in a few weeks, I hope that mine will be less dependent on understanding of their program upon arrival (a lower barrier to understanding.)

References

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