Select Topics: 2pm

June 19, 2017

Wolfram Summer School 2017

Agenda

1. What you should get out of this School

2. Resources

3. Neural Nets

4. Universal Symbolic Languages

5. Teaching

6. Notes

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1   What should you get out of this School?

1.1   Thinking Computationally

1.1.1   What does is mean to think about things computationally?

- There's raw computation, but also human ideas of computation

- What is computation capable of?

  - Simple rules, but complex results
  - But what can we as humans make of this?
    * What can we achieve?
    * What is meaningful?
  - What is computation capable of?
  - Simple rules, but complex results
  - But what can we as humans make of this?
    * What can we achieve?
    * What is meaningful?

- Role of computer language design in serving as the interface between computation itself and human practice and application

  - Thinking in terms of the language, as a way to organize one's thoughts, is powerful
    * This sort of discipline is a kind of focusing method, and is useful
    * This is a kind of experience and intuition

1.1.2 For those who haven't done original projects before This is a good place to start!

- Usually, school projects already have a known ending. This is boring!

1.1.3 How do you ACTUALLY PROUCE OUTPUT?

- Doing something in order to write a paper is different from creating a shippable product

1.2 Something to achieve:

1. Get to have an awesome profile page on the community wiki!
2. Main thing is the project.
3. Homework project

1.3 Homework project: "Topic exploration"

This should be a kind of exercise in communication.

1.3.1 Guidelines

Want it to be intuitive, interesting.

2 Resources

2.1 Data

The Wolfram Data Repository has plenty of data that is "lightly curated" - that is, not heavily processed, but okay.

Interesting thing to do: Curate-a-thon - Take a bunch of data and curate them in nice ways!

2.2 Challenges

Challenges can be found in the programming lab.

SW wants to hand out prizes for establishing facts about rule 30.

Ideas:

1. Do a simple classification - which rules is it most like?

2. Sequential parsing? That is, instead of just of the whole image?

Challenge 2: Try to understand and explain Proof of Wolfram's Axiom for Boolean Algebra.

Ideas:

1. Turn it into a network or graph, with different colors for different variables

2. Think about the meaning of the equals sign

3   Neural Nets

What kinds of primitives can we create symbolic forms for in order to build up neural nets?

Science likes to have a narrative for humans to follow, so that it's meaningful. Does there exist a kind of narrative fallacy in science?

4   Universal Symbolic Languages

Is there a way to have a language that could understand every human utterance?

E.g., consider the sentence "I want a piece of chocolate". Right now, WolframAlpha can understand 'piece of chocolate', but not 'I want'.

How do we establish some kind of symbolic representation of human desires/emotions/ideas?

This is all just a matter of specifying exact meanings of words and symbols. English is too fuzzy.

SW thinks that this has an interesting use case in AI communication - that is, how do we communicate a kind of ethical statement that is precise? This seems to be hopping around similar things as Constructer Theory (Evan)? That is, some sort of codification of morality...?

5   Teaching

We're at a unique point in education right now where we can change the way the future generations think about computer science. Mathematics unfortunately was taught in a way that was boring, and now, the tradition has carried on and there are few mathematicians. This might start happening with CS. But right now is the time to change that.

6   Notes

SW thinks that deep learning and cellular automata are fundamentally linked. There's a problem, though, since the CAs are finite and discrete in structure. Okay, well, just limit your weights and gradients to integers. Perhaps if you add enough layers, you can get something complex. This would be very nice.

Then, gradient descent would be finding neighbors that are discrete, rather than continuous.

Question: Are there limits to what humans can automate?
– This is a codification problem. If you can define it, make it precise, it can be automated. So this goes back to the Universal Symbolic Language idea. The fundamental problem is all one of codification, of definition.

7   Stuff to do here!

SW is setting up some conferences and talks and random little projects.

1. Talking about the Logic proof

2. Thinking about the Cellular Automaton theory of Quantum Mechanics

3. David Deutsch (Constructer Theory) is SW's friend– Why am I not surprised?

4. Setting up a cool 3D cellular automaton.

5. What should you do if you're going to write something that should be understandable by some future, post-apocalyptic society?