Homework 7 Reviews

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Selfridge and Vannoy Review

In *A Natural Language Interface to a Robot Assembly System*, researchers Mallory Selfridge and Walter Vannoy propose a system that uses natural language processing and image recognition to allow a human to train a robot to assemble parts. The system works via coordination of its four major subsystems including a vision and manipulation component (A), a natural language interface (B), a learning system (C), and a flow of control system (D). The robot is equipped with a camera that that system B can use to find and classify the parts that it can see. Some of this information is output to a monitor that the human can interpret. With this information the human can tell the robot what to do next with a terminal. Subsystem B is used to figure out necessary low-level controls that the robot must do to accomplish a task. Then subsystem C can be used to learn and remember how to do these tasks. Subsystem D coordinates all of this to happen.

Overall I thought this was an interesting proposal but I'm sceptical that this system would work as seamlessly as the researchers propose. I feel like the domain of robotic parts assembly requires a particularly high degree of precision that might be difficult to convey through natural language. The researchers actively avoid this issue but I think that the accuracy and precision of assembly is critical here. Additionally, I don't think the researchers realized how annoying it can sometimes be to try to get a computer to do something through natural language. This paper was written in 1986, well before people had smartphones with natural language processors built in to them like Apple's Siri. Oftentimes finding the correct set of words that correspond to a specific command can be quite frustrating. With the CAD software of today, most of the nitty-gritty of actually programming the robot with code can be avoided without sacrificing any precision.

Despite my negativity, I do think this paper has a lot of value, just maybe not in the domain of parts assembly. This system would potently work great for a home assistance robot, perhaps for the elderly or disabled. It would be very convenient to be able to tell a robot how to load a dishwasher or take out the trash. In this situation we are not shooting for thousandth of an inch tolerances, so natural language commands might be viable here.

While I didn't particularly like this paper, I can still find many inspirations from it. It is fairly unusual to see natural language recognition, image recognition, and learning all be used under one project. Selfridge and Vannoy were able sting together these sometimes distant disciplines into one coherent system, and the process that they used to be able to do this is widely applicable to the design of any large and complex system. If this system was to be implemented it would certainly look like magic. I would love to be able to design a similarly complex system in the future, hopefully tricking people into thinking that it is running on magic as well.

Lauria et al. Review

In *Mobile Robot Programming Using Natural Language*, Lauria et al. propose an instruction-based learning (IBL) model that can allow people to program a domestic robot via natural language. This approach translates natural language instructions down to a set of procedures understandable by a robot. This process is done using a set of primitive instructions that the robot can already understand. When a new instruction is spoken to the robot it is broken down into the primitive instructions and a name is given to this new instructions. The researchers go on to build a robot that can actually follow natural language instructions using their method.

This paper seems to understand the use case of natural language robots more than the last paper. Most of my issues with the last paper were with that of precision and a lack of the ability of natural language to express precision better then other tools can. This research moves away from the idea that these robots should be programmed for assembling parts and more into the domestic robot realm. I liked that this paper had come focus on actually building this robot. Another thing that the last paper lacked was real world experiments. While I understand the limitations of the 80s, it certainly didn't help that their method was practically untestable at the time.

Overall I don't really have any issues with this paper. It wasn't a really eye opening paper to me, so it doesn't stand out much, but it is an interesting bit of research none the less. One critique that I have is that the learning requires some human interaction. While this may be fine for a simple robot such as this one, it may eventually become too time consuming to train a robot this way. If larger and more complicated tasks are used the training might become prohibitively long or arduous. I wonder how this fairs in terms of programming time to more traditional methods? This question is, of course, well beyond the scope of the paper.

I feel that the method described here is more general than just the domain of programming robots. If IBL could potentially be applied to a programming language it could allow anyone to program with ease using their own language/terms. I would also love to see some more advanced versions of these robots be put to use assisting the elderly and disabled.

Chiang et al. Review

In *The language of music: Common neural codes for structured sequences in music and natural language*, Jeffrey Chiang et al. present evidence that music and language share sections of the brain that are commonly used for processing structured relationships. The researchers recruited 21 musicians and had them perform a verity of tasks that were meant to highlight the cognitive difference in processing structured verses unstructured language and music. The different structures of language involved active/passive voice sentences verses repetitions of a verb and the different structures of music were root/second-inversion position ascending triads versus repetitions of a note.

Overall I enjoyed this paper. Admittedly, I am not a neuroscientist, so many of the specifics of the paper went clear over my head. However, my non-neuroscientist brain and I have always felt a strong connection between language and music. Many of my favorite musicians are also exceptionally talented poets, so it comes to little surprise that music and language are so interconnected. Maybe this is just confirmation bias but I enjoy the thought that these two art forms are structured together in such a way.

Most of what I didn't like about the paper can be boiled down to my own lack of understanding of neuroscience and/or the brain. I don't really have any real critiques of this paper because I could barely understand half of it. On a more serious note, I would like to see this study repeated on a much larger scale. The sample of 21 English speaking, right handed, competent musicians currently enrolled in the UCLA Herb Alpert School of Music is an incredibly small subset of people. I would like to know if non-English speakers who do not study music would share these traits.

I have found many inspirations in this paper. First I was inspired to never use the colors green and yellow to show contrasting areas in a diagram. On a more serious note, I think that understanding how human cognition works and is structured is vitally important in artificial intelligence and natural language processing. Understanding that the structure of language can have more meaning than the sum of it's parts is important in figuring out how to process it. Additionally, I would be very interested to see the melding of language and music in an AI. I don't think I have seen an AI be able to produce music with lyrics before, but I think it would be an interesting experiment.