Resistor Sorter System

(Technical Paper)

Artificial Intelligence: An Analysis of Scientific and Societal Perception

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Introduction

Will artificial intelligence (AI) take over mankind? Given the evolving status of the topic, scientists and non-scientists alike possess different viewpoints on AI and how it affects society. In 2017, The Independent published an article called “Facebook’s artificial intelligence robots shut down after they start talking to each other in their own language” (Griffin, 2017). The title alone captures the attention of any reader. A large and influential software company developing robots to the point they are no longer controllable? Another article was published the following day titled “Facebook AI researcher slams ‘irresponsible’ reports about smart bot experiment.” This one particularly cited the changed parameters of the experiment and how it, “is not the same as unplugging or shutting down AI” (Novet, 2017). The given example does not attempt to display the ethics of biased or unbiased news articles. Instead, the vast differences in the perception of AI are highlighted. The main significance of the problem revolves around the variation in viewpoint and how this difference affects the progress of practical applications. In particular, potential legislation and the overall general societal awareness of AI could be limited as a result of the difference. Explicitly, the STS research project addresses the societal problem of existing differences in perception of artificial intelligence between different communities.

Engineers must stay organized in order to have success. The second proposed project targets electrical engineers and the sorting of the electrical component, the resistor. Oftentimes, these components end up in a mess of a pile and become entangled together. The importance of finding the correctly valued resistor for an electrical engineering project is crucial, so the proposed technical deliverable will use computer

vision to automatically sort resistors with common resistance values with each other. Ultimately the job of an electrical engineer will be made far easier and more seamless. The technical research project addresses the problem of having large piles of unsorted resistors by implementing computer vision and a sorting apparatus which will ultimately improve the productivity of an electrical engineer.

Technical Topic

Electrical Engineers often utilize resistors in their projects. The resistor, measured in "ohms," restricts and resists the flow of electrons through it, allowing for more control over the designed circuit.

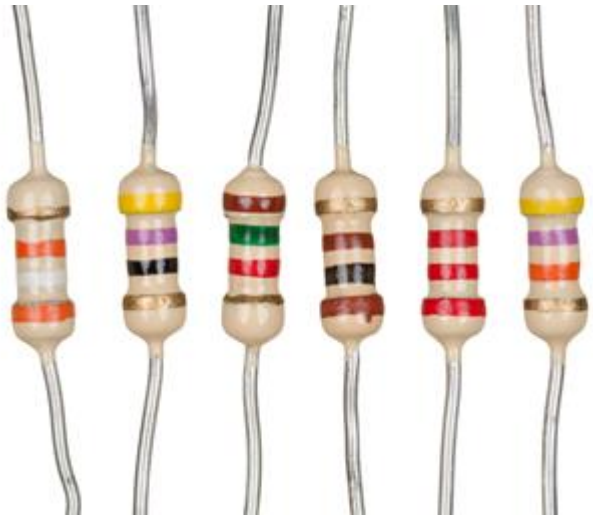

Figure 1: Examples of Resistors (Amos, 2018)

As shown above in Figure 1, a resistor has different colored bands representing the numeric value of its resistance. For a standard four color band resistor, the first two colors represent generic values and the third color band represents the multiplier (Zbacnik, 2017). The fourth band is a tolerance band, indicating that the true value of the resistor actually lies in the range of five to ten percent of the value extrapolated from the

previous colors. For example, a resistor with the colors brown, red, orange, and gold would be a 12,000 (plus or minus five percent) ohm resistor because the brown color represents a ‘1,’ the red color represents a ‘2,’ the orange color represents a multiplier of 1000 and the gold color represents a tolerance of five percent.

Normally, the electrical engineer utilizing such a component must determine its specific value. Due to the popularity and high importance of using a large number of resistors in many projects, they are generally left unsorted in large and messy piles. To combat this problem, the proposed resistor sorter system will assist electrical engineers in organization by resistance value, adding to the overall seamlessness and quickness of finding specific resistor values when designing new projects and building applications. The project will be designed and implemented by Joseph Laux, Robyn Guarriello, and Kiri Nicholson.

The sorting system is designed predominantly using computer vision to first determine the resistance value of the individual resistor being investigated. Computer vision functions by determining colors from an image, so a cell phone camera will be used to take a picture and analyze the four color bands on the outside casing of the resistor. After the information processes, the data containing the resistor value will be sent via Bluetooth to a TI MSP430 microcontroller, which interfaces with a small spinning stepper motor. The stepper motor will turn a particular angular distance based on the value of the resistor being analyzed and the resistor will then be dispensed into a sorting bin down a 3-D printed “slide” and connected to the top of the motor. The process will ultimately be repeated until all of the resistors are analyzed and sorted by the system. A diagram outlining the specifics of the project is shown below in Figure 2.

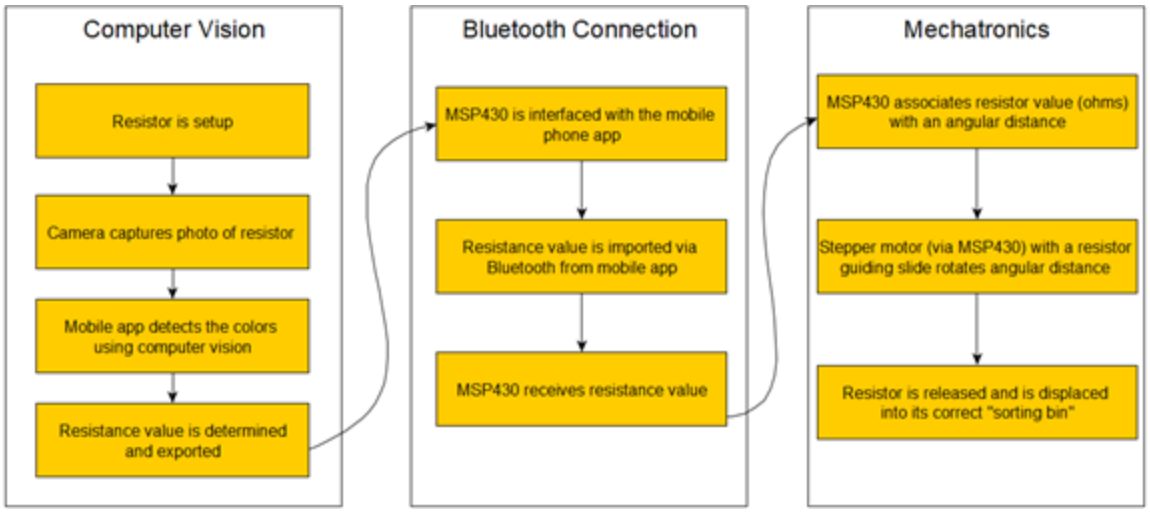

Figure 2: Flow Diagram of the Resistor Sorting System (Laux, 2019)

While the project specifically focuses on the sorting of an electrical component and has a primary purpose intended for electrical engineers, it can also be seen as a proof of concept for many other applications. The key to the success of any project is keeping needed tangible accessories organized. Therefore, any group of objects which need to be sorted for a more seamless application can effectively utilize the system.

STS Topic

AI takeover and robotics have been hot topics in science fiction for decades. A stigma has been created in the societal perception of AI as oftentimes movies and other forms of popular culture display artificial takeover in a negative light (Rosenberg & Markoff, 2016). In an online Vox article titled “AI disaster won’t look like the Terminator. It’ll be creepier,” the author draws a comparison of modern day advances in artificial intelligence to the science fiction movie, *The Terminator* (Matthews, 2019). Are science fiction representations realistic for the future of AI? In order to answer the

question more accurately, society must first have a stronger understanding of AI and its actual current state.

John McCarthy, a professor at Stanford University, resolves portions of the question regarding the differences between human and computers. His main argument exhibits the idea of AI not always reflecting the simulation of human intelligence. While the human brain itself displays a model of intelligence, according to McCarthy AI research happens in both biological and phenomenal ways. The biological side focuses on studying humans and the imitation of psychology or physiology, whereas the phenomenal side formalizes common sense facts about the world (McCarthy, 2007).

While the biological research side addresses the most transparent and visible side of AI seen in news outlets and online articles (robots thinking and acting on their own in a human like way, for example) the current status of the research is more multidimensional. Yanyao Deng and Hongfeng Jiang explore the complexity by first distinguishing a clear difference between AI and Natural Intelligence (NI). Their paper focuses on the current developments of an artificial mind and its three subcategories including: artificial perception, artificial emotion, and artificial consciousness (Deng & Jiang, 2018). Deng and Jiang conclude artificial perception as the current most utilized category, whereas artificial emotion and consciousness are not as developed in applications. The current state of artificial consciousness predominantly relies on the simulation of pre-existing consciousness (humans, for example). Additionally, the paper displays a clarification on AI's current state. Siri or Alexa exist as current applications (Adams, 2017) but the mimicking of human-like emotion and consciousness has not been made applicable. A clear distinction between these "categories" of AI must be established

in order to advance the technology as positively as possible because a better understanding allows for more alleviation of the fears of AI.

Concerns for the future development of AI are not limited to individuals who are not researching and developing the technology. Many famous scientists and entrepreneurs in the field have voiced mixed opinions on the technology. For example, Elon Musk has been particularly outspoken about the negatives of AI having been on the record of saying "cutting edge" AI is actually "far more dangerous than nukes" (Clifford, 2018). On the contrary Facebook founder Mark Zuckerberg and Harvard Professor Steven Pinker have both criticized the remarks made by Musk (Clifford, 2018). Microsoft co-founder Bill Gates has voiced a mixed opinion comparing AI to nuclear energy saying it can be "both promising and dangerous" (Clifford, 2019). The technology's future is vastly volatile as displayed through these differences of opinion of trusted professionals.

The STS theory of co-production will be utilized to frame AI and its positive advancement. Shelia Jasanoff defines co-production as: "Increasingly, the realities of human experience emerge as the joint achievements of scientific, technical, and social enterprise; science and society, in a word, are co-produced, each underwriting the other's existence."(Jasanoff, 2006). Science and social order are being co-produced as AI emerges. On one hand, scientists research and develop the newest and latest AI applications. On the other hand, society (including other scientists) keeps the development of applications in check due to an array of concerns regarding the potential negative outcomes of the technology. While this framework begins to aptly justify the extent of the problem addressed in this paper, co-production has its own criticisms. Co-production, on its own, is generally a broad theory and not a powerful enough framework

to fully explain a sociotechnical phenomenon. In order to fully frame the societal AI problem addressed in this paper, more specific attributes of how co-production is present will be analyzed.

The continuing development of AI applications into society has increasingly enormous potential to positively impact life. Two different problems continuously exist while various communities voice concerns and awareness on the topic. The first is a difference of opinion on the future and safety of the technology (primarily from experts in the field) and a misunderstanding of what the technology actually entails (primarily from, but not limited to non-experts). The main problem will be addressed by determining the best way to continue research and development of AI, while alleviating, and ultimately preventing the concerns regarding the dangers of the technology.

Research Question and Methods

The research question being investigated is: how does the varying level of perception in the current state of artificial intelligence shape societal and technological interactions? In order to address the question documentary research and interviews will be utilized.

Documentary research methods will assist in the investigation of the alleviation of concerns about the future of the technology. For example, Nate Soares and Benya Fallenstein have written a paper addressing the specific topic which aims to develop a "technical agenda that discusses three broad categories of research where we think foundational research today could make it easier in the future to develop super-intelligent systems that are reliably aligned with human interests"(Soares & Fallenstein,

2017). Additionally, Jacob Steinhardt details a proposal to tackle the long and short term challenges of ensuring the safety of AI in an academic paper (Steinhardt, 2015).

Secondly, an interview with Professor Lu Feng of the Computer Science department at the University of Virginia is planned. Her expertise in the field of AI will provide insight to this project, with planned questions revolving around her opinion of the current state of AI and how society may be affect by future developments of AI. This interview will take place early in the 2020 spring semester.

Conclusion

The deliverable for the technical project will be a sorting system using computer vision to electronically determine the values of resistors and then organize them into distinct bins of common values. Once completed, it will assist users in completing projects more seamlessly by addressing the problem of the organization of a commonly used technological component.

The deliverable for the STS research project sets out to fully articulate the intricacies to the problem of an existing disconnect in the perception of artificial intelligence in society. Many people have differing opinions on the topic which lead to a slower advancement (e.g. legislation) of the positive progress the technology could be used for.

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