Research Assessment #3

Date: 16 September 2021

Subject: Machine Learning and Computer Vision in Autonomous Driving

MLA Citation:

Karkera, Thejas, and Chandra Singh. “Autonomous Bot Using Machine Learning and Computer Vision.” *SN Computer Science*, Springer Singapore, 30 Apr. 2021, link.springer.com/article/10.1007/s42979-021-00640-6.

Assessment:

Depending on the area that it is applied in, artificial intelligence systems can have various limitations. This sounds obvious on the surface, but it was something that I didn’t realize until I read the article. Over the last two assessments, I’ve learned about how various artificial intelligence algorithms require different quality processors. However, I didn’t think about the integration of the algorithm with the rest of the project. ML systems aren’t made just to exist on their own— there wouldn’t be much of a point if they did. This means that there needs to be a way for these systems to be integrated with the actual product it is used in and, especially with engineering applications, the quality of materials can be a big barrier-to-entry.

For example, the authors of the article used a Raspberry pi and Arduino to process images and translate the output from the algorithm to the actuators used to move the vehicle (Karkera and Singh 1). The costs for these parts could add up, especially if extras of each part need to be ordered for testing purposes. As a result, cost optimization is something that I really will have to consider. This means that I will

likely have to trade off top-of-the-line quality for lower cost if I end up making a physical product. In what ways could I design the ML system itself to help facilitate this cost optimization so that I wouldn't need to have incredibly expensive materials? The strategy of the authors in the article, who used an ANN when classic image processing failed with low-quality video, has given me some insight on this question (Karkera and Singh 2). The thoroughness and complexity of the algorithm could help mitigate lower-quality cameras with regards to computer vision, since the extra variables and interconnectedness could help it analyze images better even if the image is of a porter quality. At the same time, too complex of an algorithm with too many inputs could easily exacerbate the problem of dimensionality, so a balance must be kept in this respect as well.

The biggest takeaway that I have from this article is the concept of edge detection (Karkera and Singh 2). By utilizing this method of image analysis, I could have more success in delineating the borders of objects and allowing systems to *respond* to objects, since it can recognize that something is there and react accordingly. As a result, implementing this method would be very helpful in a computer vision system.

Speaking of computer vision, I found splitting the actual algorithm for image analysis through computer vision and the processing of the data from the analysis into two different steps was a good idea. This way, the processor isn't overloaded and is able to cope with the amount of images and data being sent its way.

Learning OpenCV for the image analysis portion will be crucial to any type of project that I make. As I've researched, I have found that I really enjoy learning about

both computer vision and machine learning algorithms, so combining these two will be an effective and enjoyable way for me to create my original work or final product.

Where do I start learning how to use OpenCV (which is open source, so it seems to be a good place to start)? What would be some good projects for me to start creating ML algorithms? I think that these are questions that I could continue to research, either through articles, books, or even questions in my research interviews. What are some of the areas that are experiencing the most innovation or where ML and CV could be implemented? Which areas do I feel a strong desire to improve? I will continue to sift through these questions and think about potential final products so that I can use my original work as an effective step towards it. As I continue learning, I keep finding that there is so much *more* to learn, and that is an exciting feeling.