# Relevance to Superintelligence and Future Direction

AI models have managed to outperform humans in a wide array of fields, such as manufacturing, data analysis and games. However, AI models usually need orders of magnitude more training examples than humans to reach human-level performance. As shown in this project, AI struggles to recognize a traffic sign even after observing it tens of times. In contrast, most humans would be able to reliably recognize a traffic sign after only a handful of examples. This highlights one of the major hurdles in AI reaching superintelligence: AI tends to be much slower learners than humans (source 1). Being a slow learner is not necessarily a major issue when there is ample time and training examples available to the learner, but in many real-world situations that is not the case. For example, it is crucial that a self-driving vehicle is able to adopt to new (variations in) traffic sign designs based on few or no prior training examples. As discussed in chapter 1, a failure to learn new traffic signs quickly could ultimately lead to fatal accidents. K-shot learning is, effectively, a way to try solve such problems.

While the concept of superintelligence encompasses a wide range of skills, it is notable that humans spend a considerable amount of time (and intelligence) on the task of driving: according to the AAA Foundation’s American Driving Survey, Americans spend 61.3 minutes driving per day on driving ( source 2). As such, it can be argued that AI reaching human-level of performance in driving, and, as a function thereof, recognizing traffic signs, is an essential step on the path to superintelligence. The results of our project don’t mirror human-level learning/ intelligence, but we have shown that good weight initializations using meta learning can make computer vision fairly accurate at detecting a wide array of traffic signs based on a small number of training examples (k<=32).

Future work might focus on expanding the generalizability of our results. As previously discussed, our dataset only contains 43 of the more than 600 different types of traffic signs found in Germany, and, as a such, caution should be taken when extrapolating our findings to deployment-settings. However, we hope that our project can inspire further research by researchers and practitioners with access to more comprehensive datasets. It would also be interesting to explore other meta-learning algorithms, and/or ensemble methods that combine several k-shot learners. Finally, it should be noted that the meta-training in our project focused on a very narrow set of related tasks: traffic signs within a single geographic region. We hypothesize that model-performance could be improved by expanding the meta-training process to include traffic signs from other languages/ regions, in particular other European. This hypothesis is collaborated by the fact that European countries have several common standards in place for the shapes, colors and symbolic signs of traffic signs (source 3). Another option would be to expand the meta-learning to tasks outside the realm of traffic signs. For example, it is plausible that doing meta-learning on shapes, words and numbers commonly found in traffic signs could improve performance.

Sources for chapter on superintelligence and future direction:

Source 1: https://ar5iv.labs.arxiv.org/html/1904.05046v1

Source 2: <https://aaafoundation.org/american-driving-survey-2020-2021/#:~:text=Drivers%20reported%20making%20an%20average,substantial%20increases%20relative%20to%202020>

Source 3: https://unece.org/DAM/trans/conventn/E-ECE-812-EARSS.pdf