Bachelor Project Jan Rezelman
Research proposal

When a highway lane closes, all vehicles on the closing lane must merge into the remaining lanes. This merging often causes congestion due to several causes, such as merging vehicles not merging in time, or vehicles in the open lanes not making enough room for the merging vehicles. This congestion can be eased by making the vehicles behave more efficiently and have a better understanding of their surroundings.

As human drivers are prone to error, the most efficient way of merging will probably be achieved if all vehicles are autonomous. I made a similar model in collaboration with Nousha van Dijk during the Collective Intelligence course, which simulates behavior of human-controlled vehicles on a highway. An option to close a lane is implemented into this model. I would like to expand and adjust this model to have it simulate the behavior of autonomous vehicles on a highway.

I would like to research ways of communication between autonomous vehicles on a highway, and try to find the way the vehicles can move the most efficiently, that is, with as little congestion as possible. The question I would like to answer with my research is: how can a swarm of autonomous vehicles on a highway move as efficiently as possible during the closing of a lane?

To find the most efficient way, I would like to implement multiple organising algorithms into the existing model, to compare their performance in preventing congestion. An algorithm's performance can be measured in several ways, such as the number of vehicles passing every minute, the mean speed of vehicles, or the percentage by which the average speed decreases when a lane is closed.

I would like several parameters to be adjustable to answer this question: the number of vehicles is an important factor, but the maximum speed on a highway might affect efficiency as well, because the minimal safe distance between two vehicles is decreased when their speed is lower, which makes more room for other vehicles. Some algorithms might be more efficient than others at high vehicle speeds, while other algorithms could perform better at lower vehicle speeds. Other parameters may be adjusted as well to see if they affect performance.