Controlling a sliding contact with computer vision and AI

Our world is changing. Extreme weather and drought is becoming more frequent, causing tremendous suffering and death. We need to act now by decreasing our emissions, or we will soon be living in a dystopia.

To reduce our carbon footprint we need to decrease our emission from ground vehicles, one way to achieve this is by using electricity from renewable sources instead of fossil fuel. Electric vehicles require big batteries to be capable of travelling the same distances as vehicles powered by fossil fuel. There are however problems with these batteries, they are heavy and expensive to produce. To reduce the need of big batteries, *Elonroad* is creating a way of charging ground vehicles while driving. This is done by putting electric rails in roads and sliding contacts underneath vehicles, see figure 1. For this to work the sliding contacts and the electric rail needs to stay aligned while driving.

Figure 1: Electric rail placed on a road, charging a bus.

In this thesis the problem with keeping the rail and sliding contact aligned is solved by using a PID controller together with a camera and a neural network. A pre-trained neural network called *MobileNet* is used to identify the electric rail in images, the benefit of using a pre-trained network is the performance and robustness. The calculations from *MobileNet* are then fed to the controller, that aligns the sliding contact with the electric rail.

The controller together with the neural network shows promising performance but can only process 2 frames per second, due to limited hardware. To make this solution feasible, for a vehicle driving at great speeds, the hardware need to be improved. With a dedicated graphic processing unit it should be possible to process at least 90 images per second with the current neural network. If this frame rate is achieved, it should be possible for the neural network do identify the electric rail fast enough for the controller to align the sliding contact and rail, even when the vehicle moves at high speeds.

By solving the problem of aligning the sliding contact with the electric rail, we are one step closer to having electric vehicles charging while driving. This could lead to a paradigm shift, turning ground vehicles using fossil fuel into a thing of the past. Hopefully leading to emissions close to zero for ground vehicles.