AUTONOMOUS VEHICLES ON THE ROADS OF THE FUTURE

Overview

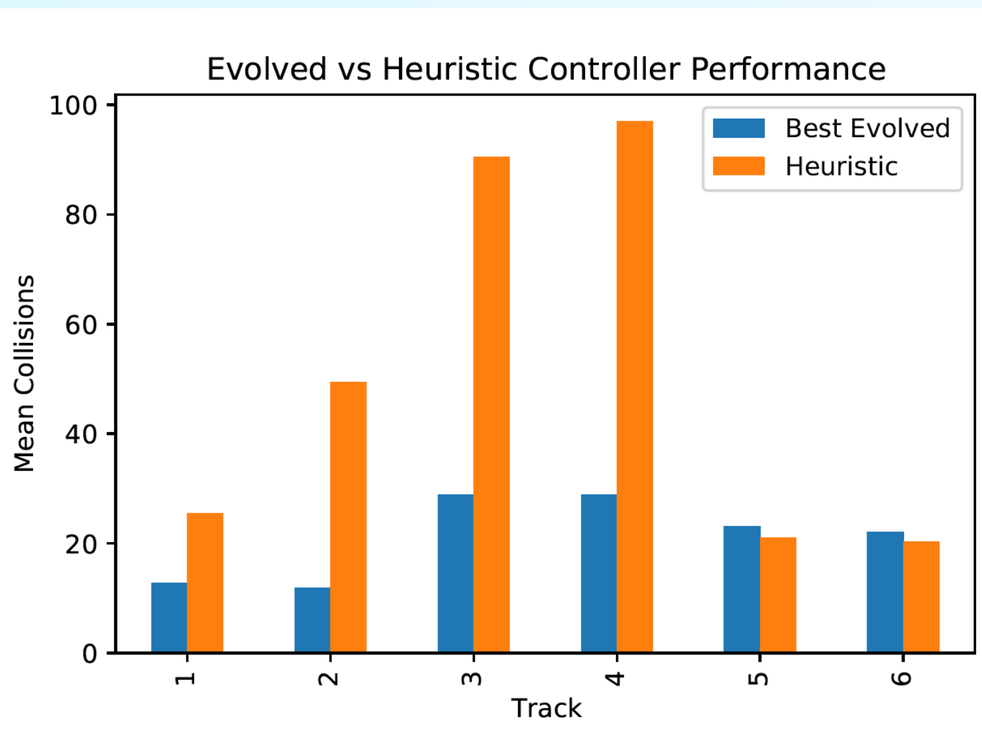
With the advent of autonomous vehicles (AVs), one of the most complex problems facing the widespread adoption of these vehicles is their ability to safely navigate intersections, where there are many moving obstacles.

The three projects shown here aim assess the efficacy of different methods through which neuroevolution can be applied to the creation of vehicle controllers to navigate these complex areas.

Neuroevolution in Shared Space

NeuroEvolution of Augmenting Topologies (NEAT) was used to evolve controllers for AVs traversing intersections based on the shared space road architecture. These controllers were then assessed against a heuristic controller for use in both standard and shared space intersections and on unseen intersections to determine generalization ability.

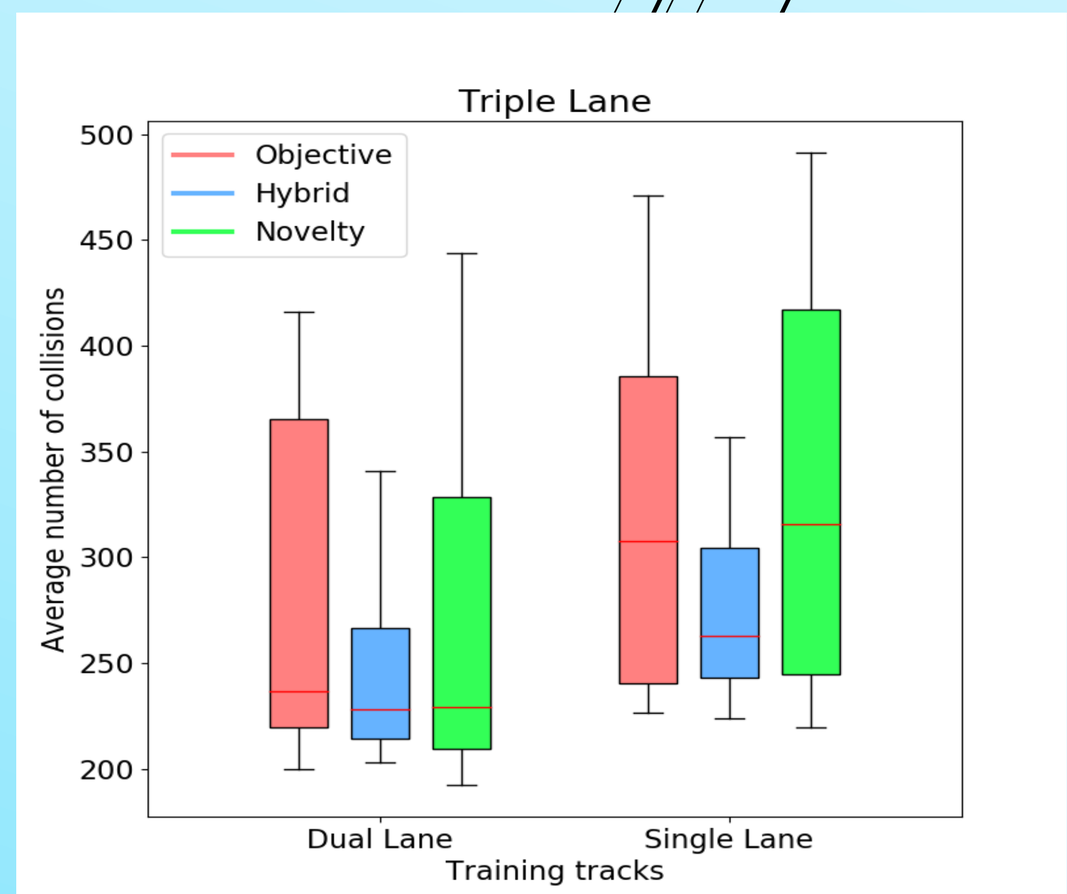
The results (right) indicate that NEAT typically shows similar or better performance a heuristic controller while also generalizing well across unseen intersections. The evolved controllers, however, displayed strange behavior when observed and had higher variance performance than would be ideal.



Novelty-driven Evolution of Controllers

Novelty Search was used alongside NEAT to evolve vehicle controllers that could traverse various standard intersection, alongside an objective technique and a hybrid of the two techniques, to create multiple sets of controllers. The traversal performance of these controllers was then compared to determine which was most effective.

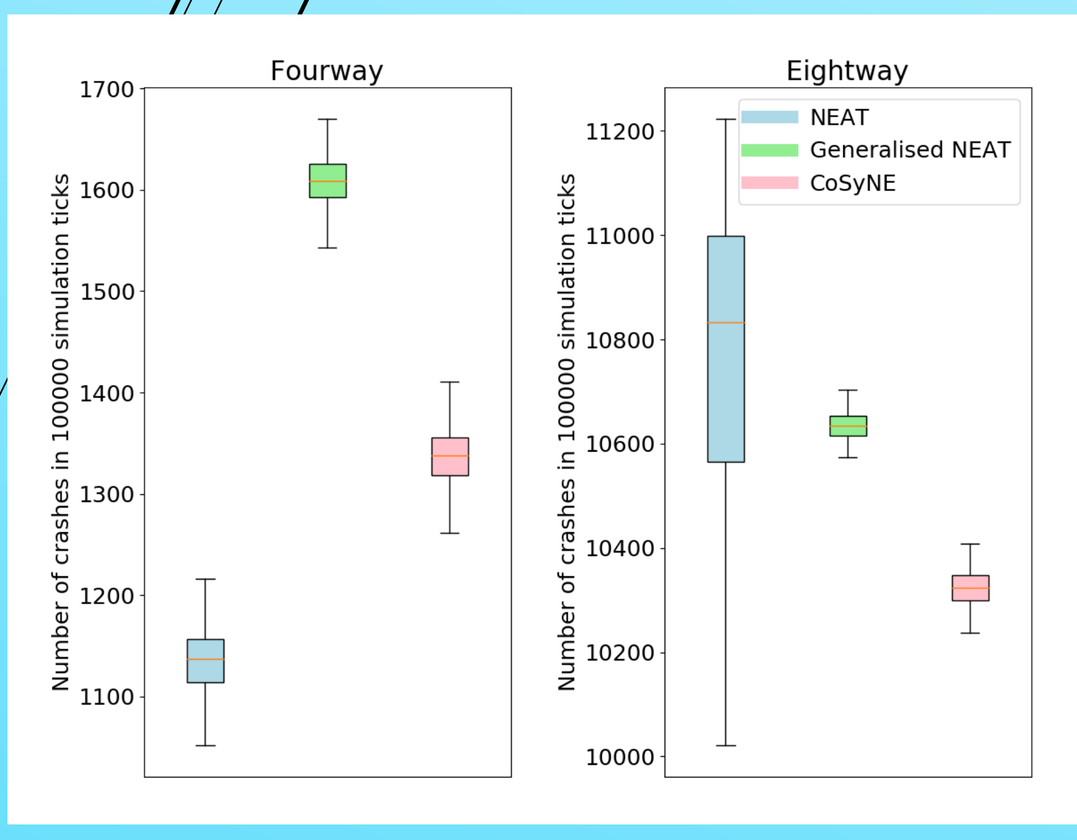
The results (right) show that no one technique has clearly superior performance, however, the hybrid technique shows the most consistent performance and displays significantly lower variance.



Coevolution of Intersection and Controller Design

In the coevolutionary approach, intersections are evolved in tandem with the vehicle controllers. This leads to intersections and controllers which are specifically suited to each other. CoSyNE and NEAT are the coevolutionary techniques used, while Generalized NEAT is referring to a controller which is evolved without a changing intersection.

The results (right) indicate that the coevolved techniques outperform generalized systems. In the simplest case of the four-way intersection, this difference is quite extreme, but in the more complex example of the eight-way the difference is much smaller.



University of Cape Town
Computer Science Dept.

Website: www.cs.uct.ac.za
Email: dept@cs.uct.ac.za
Tel: 021 650 2663

Team Members

Rhett Flanagan
Harry Heathcock
Kaedon Williams

Supervisor

Dr. Geoff Nitschke