Toyota Gazoo Racing picks **Muttii** to deliver artificial intelligence and machine learning

Muttii enhancing aerodynamic processes at TGR to understand ways to improve performance

BACKGROUND

Toyota Gazoo Racing (TGR) is the motorsport brand of the Japanese automaker, Toyota. It encompasses many divisions in various racing disciplines, and in Cologne, Germany, Toyota Gazoo Racing Europe GmbH is responsible for the design and development of race cars for the World Endurance Championship, including the Le Mans 24 Hours.

With technology becoming pervasive in all facets of the racing industry both on and off the track, TGR wanted to understand how cutting edge artificial intelligence and machine learning could support car development. Namely, could TGR reach conclusions better and faster when it came to their cars' performance and efficiency?

THE CHALLENGE

TGR tests its car models in wind tunnels and using computational fluid dynamics, both of which generate massive amounts of data. TGR-E has developed several tools to treat and extract conclusions from a very large set of results data, from either CFD or wind tunnel testing, but this was still a time-consuming process which risked that interesting trends could be overlooked. Enter artificial intelligence and machine learning (AI/ML), which has the capacity to look at trends within all the data collected by TGR. The key challenge is to train the AI to know what to look for.

The first challenge was to prove that the concept works and TGR put the Muttii AI/ML technology to the test with a specific task. TGR engineers tasked the AI/ML software to search for trends connected to an area of bodywork on TGR's new GR010 Hybrid race car, with the aim of finding improvements. With

KEY CHALLENGES

- Large quantities of data being collected in CFD and wind tunnel testing
- Interesting trends could be missed
- Faster performance optimization desired

KEY REQUIREMENTS

- Analyze all performance data for trends
- Make actionable recommendations about performance improvements

KEY BENEFITS

- Proved the AI/ML concept can deliver
- Free up engineering resources
- Efficiency gains in development

240GB of data generated in every single CFD test, and even more coming from wind tunnel analyses, TGR and Muttii saw significant potential for collaboration.

THE SOLUTION — MUTTII ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Starting in early 2020, TGR engaged Muttii to implement AI/ML within its aerodynamic department. Muttii setup and trained its AI/ML software to look at TGR's CFD and wind tunnel data and analyze it in detail. According to Rene Hilhorst, Manager of the Aerodynamics Department at Toyota Gazoo Racing Europe, with the initial use case, Muttii was able to demonstrate its ability to help TGR to understand aerodynamic performance and isolate areas for improvement.

Hilhorst continues, "This use case showed TGR the potential for AI as a tool for development." The initial success led to Muttii further training its AI/ML software to handle the terabytes of data coming out of TGR's CFD tests. Additional targets were given related to the aero targets by the rules and the AI/ML began looking at how changes to the car's design would affect these targets. Now, notes Hilhorst, "The solution is being integrated into our wind tunnel and CFD processes to help TGR understand ways to improve aerodynamic performance."

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>
> **Rene Hilhorst, Manager of Aerodynamics Department**

THE BENEFITS – A MUCH MORE EFFICIENT DEVELOPMENT SYSTEM

As a result of implementing AI/ML with Muttii, TGR is enhancing operation efficiencies by reducing the significant amount of engineering hours spent looking at data. According to Hilhorst, "Any time we free up engineering resources, we create an opportunity to look for other improvements, searching for performance increases elsewhere which increases our efficiency."

As the Muttii AI continues to train on data, it is learning to rapidly identify how windflow changes in one way or another have a positive (or negative) effect on performance. Hilhorst adds, "This will allow the TGR team to dive further into these potential areas of improvement, optimizing the car based on the AI's analysis of the data."

Hilhorst continues, "With Muttii, we are creating a much more efficient development system. Our goal is to reach the optimum design and setup as fast as possible." Looking forward, Hilhorst comments, "We are looking forward to seeing the results of our collaboration with Muttii; we are sure this will make us more competitive on and off track."

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