Making Better Use of Data – AI and ML in Vehicle Engineering

Whether measured in test vehicles or recorded in modern vehicles during operation: In the automotive sector, the availability of data has been increasing for years. This also applies to quantity and quality of environmental data: digital maps, climate, topographical data and even socio-economic information are flowing into the growing data pool. The technologies used to collect and process this data are also constantly being improved, which is why methods of artificial intelligence (AI) and machine learning (ML) can be used very efficiently and effectively today, to extract valuable information from the sheer volume of data.

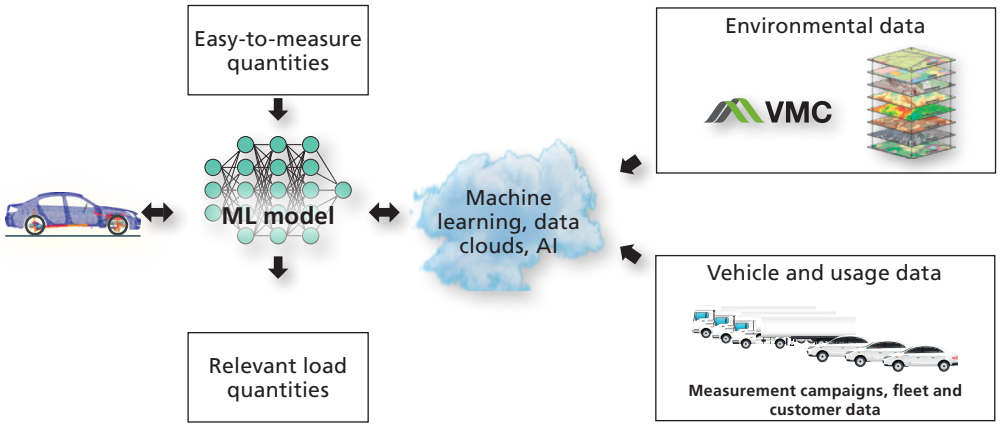
Modern vehicles are bubbling sources of data. AI methods help to use and understand the flood of data.

In our department "Mathematics for Vehicle Engineering – Dynamics, Loads and Environmental Data", such methods are used to incorporate the knowledge gained in the process into the vehicle development process at an early stage. For example, in the form of the Virtual Measure Campaign VMC® software suite: Its aim is to compile and maintain environmental data in a geo-referenced database covering as much of the world as possible and to link it with mathematical analysis tools. With the help of driver, vehicle and environment models, VMC® can predict traffic-dependent speed profiles thanks to efficient simulation technology and – based on this – derive statements about vehicle loads and energy demands.

Another profound benefit for the entire development and safeguarding process arises in the next step through the combination of usage data on the one hand and vehicle and environmental data on the other hand.

From the vehicle directly in the cloud

Modern vehicles reveal a lot about their use because they record numerous condition variables; commercial vehicles are also often equipped with a telematics system that sends the collected data to a cloud at regular intervalsFor commercial vehicles, especially for agricultural and construction machinery, the usage



Environmental data, vehicle data and models support the development process of modern vehicles and their operation.

variability is very high, depending on the customer group and region of use: For example, a truck in the mountainous regions of the Caucasusis exposed to very different loads than a truck that transports its load mainly in mainly in central Europe. Or an excavator in a sand pit compared to an excavator that crushes construction debris and separates it into "metal" and "concrete".

For the development process, it is therefore of particular interest to know as much as possible about the actual use of a vehicle in order to set the right design and testing criteria.

AI recognizes type of use

To draw the right conclusions from the data at hand, AI and ML come into the game. "At this point, we use an ML-based detection algorithm that recognizes the type of use, for example 'digging' in the case of an excavator," explains Dr. Michael Burger, deputy head of the "Dynamics, Loads and Environmental Data" department. "Once an appropriate ML model is trained, we can derive very accurate and very efficiently usage profiles, specific to groups of people and their respective regions of use. However, equipping a large number of commercial vehicles with sensors that are precise and sensitive requires a lof of effort and a robust operation is usually costly and time-consuming. "As an alternative or complementary approach, we also use data-based and hybrid models that predict relevant internal quantities, such as internal component forces. For this purpose, we use easily measurable external quantities such as accelerations at axles or on the frame," says Michael Burger. This makes it possible to avoid numerous sensors and complex measurement technology.

Further information is available on our website at www.itwm.fraunhofer.de/environmental-data

Contakt

Dr. Michael Burger
Deputy Head of Department
"Dynamics, Loads and Environmental Data"
Phone +49 631 31600-4414
michael.burger@itwm.fraunhofer.de