Smarter Driving With LLM Assistance

FORUM8 12th CPWC

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What LLMs make possible

1. Provides situational awareness
2. Real-Time Communication
3. Psychological stability
4. Customized driving experience

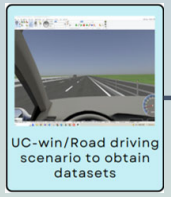
Unfamiliar situation

Uncertainty in Self-Driving

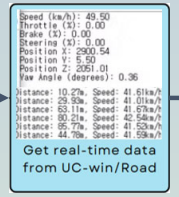
Background

Human error while driving can lead to significant accidents, and autonomous vehicles offer the potential to minimize these risks by making optimal decisions. However, the commercial adoption of self-driving cars requires ensuring their safety and decision-making reliability. Our research focuses on using large language models (LLMs) to analyze the factors considered by autonomous vehicles during navigation, aiming to enhance the transparency and reliability of autonomous driving systems.

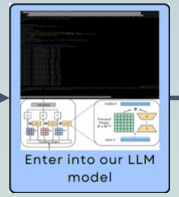
System architecture



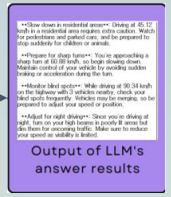
Extract Data



Data pre-processing



Insert data into LLM

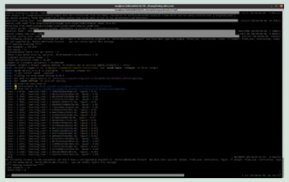


Output Results

Execution process

The log data extracted from UC-win/Road scenarios is labeled and transformed into prompts to create well-structured datasets. The obtained datasets are used to train the LLM, enabling it to generate responses for each specific situation.

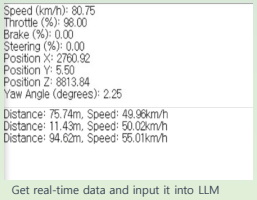
Get our scenario data with prompt



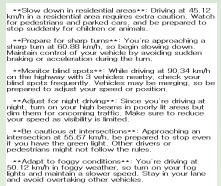
Training datasets on LLM

Execution results

Real-time traffic data is obtained from test scenarios in UC-win/Road, and this data is used as a prompt to input into the LLM. Based on the information input into the LLM, it provides answers on what actions to take depending on the surrounding environment.



Get real-time data and input it into LLM



Get answers from LLM

Program results

The system was tested under different scenarios, such as highways, urban areas, and varying lighting conditions, to ensure that the LLM responses adapted to different road and driving conditions. As shown in the screenshots, the LLM successfully generated real-time driving advice based on vehicle speed, nearby cars, and road conditions.

Program final results

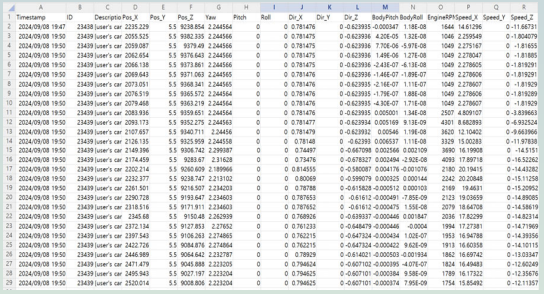
Future Work

Enhancing model performance

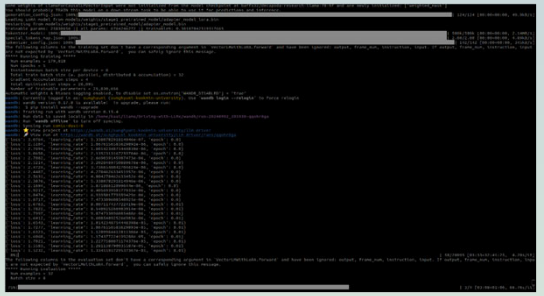
We plan to enhance model performance by building a dataset that includes various driving scenarios. This will train the model to handle a broader range of real-world situations. Ultimately, it will provide more reliable and accurate driving assistance.

Voice-based interaction support

We plan to integrate voice-based interaction into our LLM-assisted driving system to enable natural, hands-free communication. This feature will provide real-time explanations and updates on driving conditions, enhancing safety and focus on the road. It will also answer queries and offer suggestions, improving user experience and driving safety.



More Various Datasets



Fine-Tuning

Our future plan is to integrate voice-based interaction with LLM assistance in the driving system. The UC-win/Road simulation will provide driving scenario inputs, which will be used to fine-tune the LLM with a diverse dataset. The model will then generate outputs such as real-time driving assistance and explanations, which will be delivered to passengers and drivers through voice interaction, enhancing safety and communication.