Artificial Intelligence Solutions for Time Latency Cancellation for Driving Simulator and Remote Co-Simulations

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Introduction

Modern automotive simulators are complex systems with multiple applications. These virtual environments can connect with other **neighbouring systems** enabling **real-time X-In-The-Loop solutions.**

Systems latencies must be kept below a certain threshold. In particular:

- in remote applications, **network communication latencies** prevent remote real-time co-simulation, resulting in system instability.
- in complex systems, the various subsystem **execution time latencies** may cause a local phase oddness between human input and simulator response.

Here, it is introduced **®Sybille**. The motivations for ®Sybille development are supported on one hand to enhance the simulators human feeling and their performance and on the other to integrate very distant X-ware systems without the need for relocation.

Product Solution

®Sybille is an Artificial Intelligence-Based software for **latency cancellation**, giving a signal forecast over a few tens of milliseconds, patented by Addfor.

There may be two main possible applications:

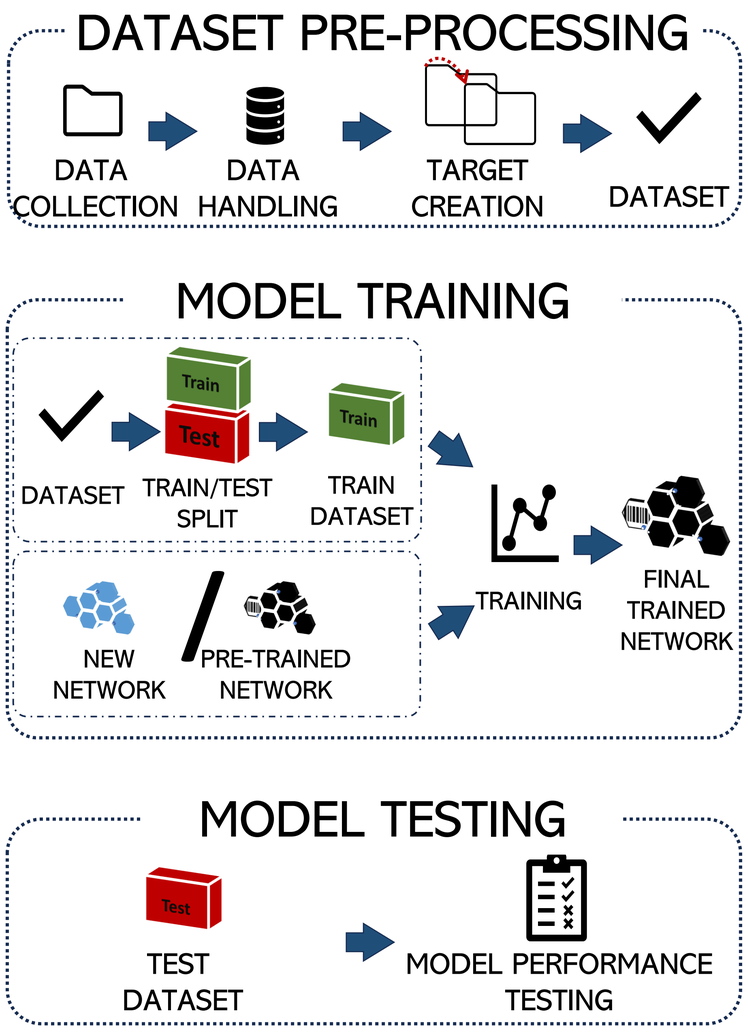
- latency cancellation in **local processes** to improve response and enhance the synchronization;
- **internet communication** latencies cancellation for co-simulation X-in-the-loop experiments.

The software chooses the best solution between a set of pre-trained models and adapts itself to different situations by checking the real-time prediction accuracy. ®Sybille is potentially able to perform additional learning.

Methodology

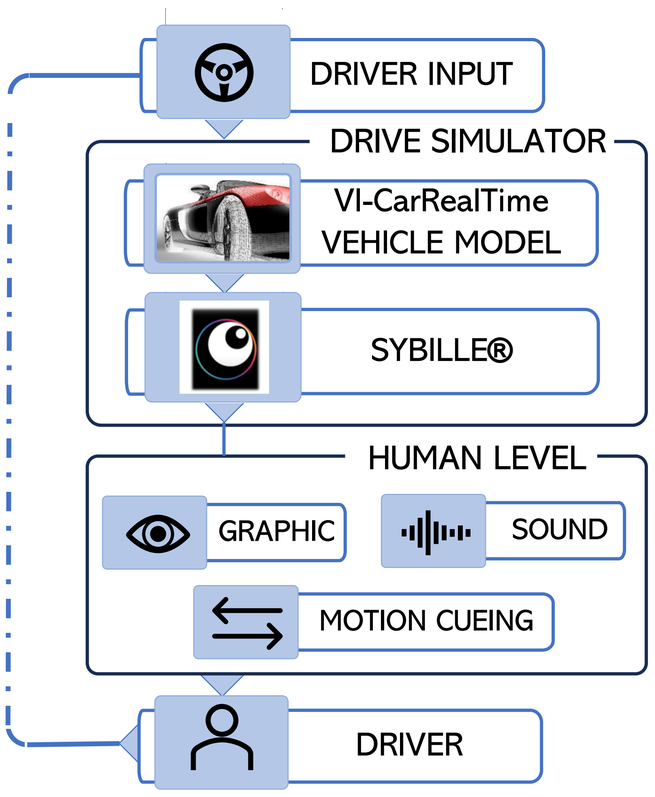
A **generic model training process** has been represented. With an available processed dataset:

- a new predictor model can be trained ex-novo;
- an already trained model can be refined with new training sessions.

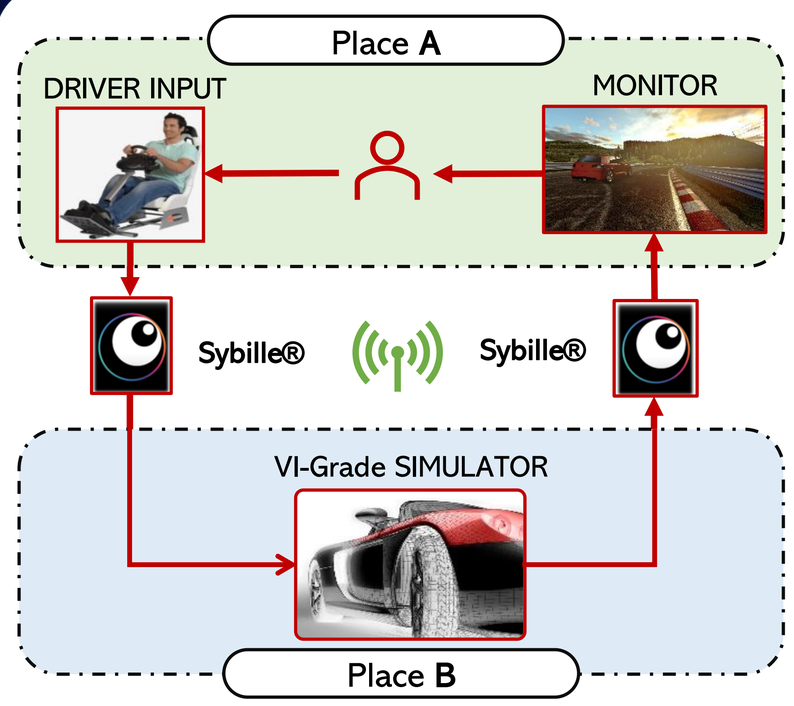


Following, some examples of ®Sybille applications are presented.

- The first experiment shows the ®Sybille application in VI-Grade simulators to the **graphic**, **platform motion cueing** and **sound generation** signals, allowing to cancel the subsystems delay and obtaining a better response and synchronization while driving the simulator.

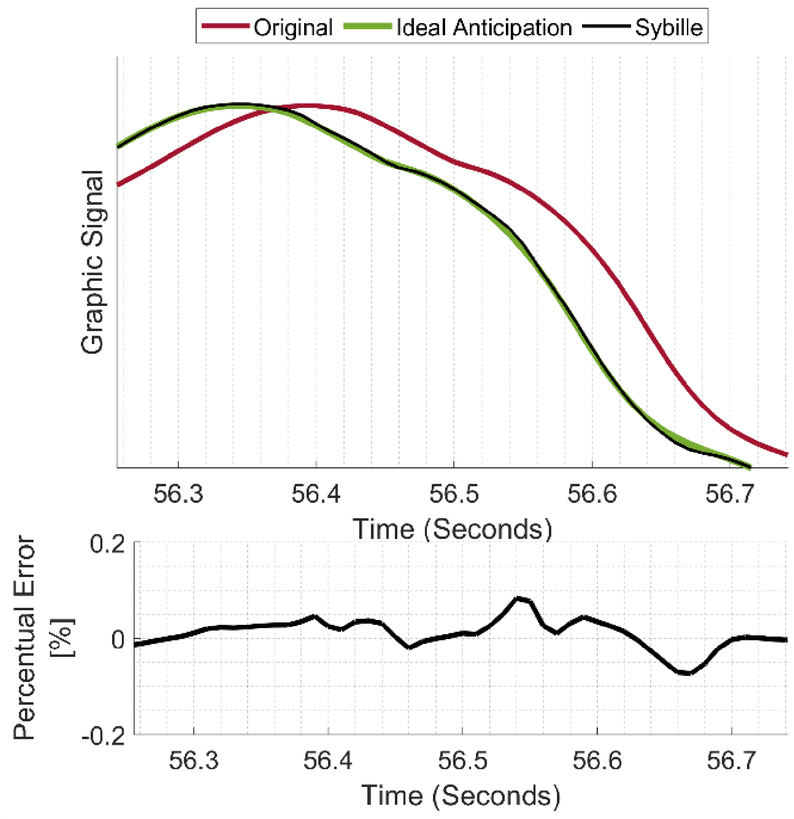


- In the second experiment, a VI-Grade static simulator in place B was **remotely driven** through a steering wheel from place A, about 500 km far away. The driver successfully controlled the vehicle doing obstacle avoidance maneuvers and handling laps, so the experiment has shown the possibility to have a **real-time remote Driver-in-The-Loop co-simulation via internet**.



Results

As a results, an **outcome signal of ®Sybille** in its applications can be shown, along with the error respect to the theoretically anticipated target. By analyzing the displacement between the original signal and the predicted signal it can be proved that they are shifted by the requested value (50 ms in this example).



Conclusion

This poster shows an Artificial Intelligence based method for the **real-time anticipation of signals** within a specified time horizon. This allows **latency cancellation** both in local systems improving response and enhancing synchronization, and in communications processes enabling remote co-simulations without need for hardware devices relocation (a strongly desired scenario for the automotive industry). It is quite effective in **improving signal stability** through latency cancellation using zero delay real time filters.