About MANNHEIM-FlexKI

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Germany is one of the leading locations for manufacturers of embedded electronic systems, especially for the automotive sector. In this context, the development of applications for autonomous driving and the associated technological disruptions (keyword artificial intelligence - AI) pose new challenges for software and hardware design (SW and HW design).

Autonomous vehicles will be equipped with a multitude of sensors (Video, Lidar, Radar, Sound, Ultrasound) to generate the most accurate possible image of the environment, to interpret it, to predict the behavior of all dynamic objects involved (including motor vehicles, bicycles, pedestrians), to plan maneuvers and driving trajectories, and to control driving dynamics. This leads to exploding demands on the performance, trustworthiness, and energy efficiency of automotive IT systems.

Data streams must be captured, fused and analyzed in real time as early and decentrally as possible in the processing chain. The main pillars for this are embedded AI platforms that run applications based on multiple deep neural networks (DNNs) in a highly efficient manner. Existing AI platforms for the realization of highly complex AI-based driving functions have an electrical power consumption of several kilowatts, so energy efficiency with maximum reliability and trustworthiness plays a crucial role in the design of such systems for "mission critical" application scenarios. This market is currently occupied mostly from classical GPU vendors.

Similar trends are reflected in the roadmaps of leading German automotive OEMs. In the development of applications based on artificial intelligence (AI) for autonomous driving functions, neural networks are first designed and trained by AI experts, subsequently optimized for the embedded target hardware (HW) platform, and finally the software (SW) codes are generated or in many cases still implemented by hand. The use of different HW architectures in this context always requires extensive customization of the AI applications and often binds strongly to vendor-specific development workflows and development tools.

This dependency creates major challenges in the development of AI applications for internationally operating, German automotive companies. The MANNHEIM-FlexKI project (Flexible AI Deployment and AI Platforms for Embedded Automotive Applications) aims to break this HW dependency and explore an open reference approach for the deployment of AI and DSP applications that allows AI applications to be quickly ported to a new HW platform (so-called retargeting). Through this FlexKI retargeting process, there are great economic advantages for German companies to deal with future challenges in the development of AI systems:

Protectionism and blacklisting may make specific AI platforms unusable in a specific target market in the future. HW interchangeability through the HW-agnostic flex AI deployment approach is an enabler here to be present in all markets.

The chip crisis has shown that temporarily certain target platforms may not be available. Future chip crises may force retargeting if there is a need to switch to an alternative AI platform. Being able to act quickly here with the FlexKI approach creates a competitive advantage.

So-called lock-in effects can result in dependencies on a specific AI platform manufacturer, as legacy code from these platforms is required. Avoiding such dependencies generates another competitive advantage for German companies.

FlexKI follows two development paths:

1. The flexible deployment of networked AI applications on high-performance, heterogeneous commercial-off-the-shelf HW platforms.
2. A HW/SW co-design approach for deployment on a new customized, energy-efficient AI HW platform.

Both paths, in addition to avoiding vendor lock-in, enable fast and automatic migration of AI applications to other HW platforms in case certain HW components are not available due to protectionism, blacklisting or supply shortages (chip crisis). Overall, the project strengthens all levels of the automotive value chain in Germany and establishes a path for future standardization in the field of AI deployment.

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