Three questions, three Answers

April 29, 2024

India's new leader in AI and software technologies

#Corporate Research

26 4

Amit Kale has been Head of the Bosch Research and Technology Center (RTC) in Bangalore, India, since April. The center – an integral part of the global Bosch Research community – works in close collaboration with Bosch India and Bosch Global Software Technologies (BGSW).

In an interview, Amit told us about the goals he and his team have, their current research areas, and how they want to help shape the future of mobility, connectivity, and sustainability.

As Chief Scientist and now the Head of the Bosch Research and Technology Center in Bangalore, India, what are your key priorities and goals for driving innovation within the organization?

As Chief Scientist for data management for Artificial Intelligence (AI), one of my goals is to help Bosch become an AI-enabled company. As we witness the rapid developments that are taking place in the area of foundation models and GenAI, it is clear that there is one crucial ingredient for these technologies to be adopted successfully – and that's data. Data is not only useful for training AI algorithms – it plays an even more important role in validation. Different BUs at Bosch are at different levels of maturity with regard to data. For those that are less advanced, enabling tools to log data with some ground truth and making historical data usable for AI is one of my key priorities.

For BUs that are more advanced, developing algorithms to build domain-specific foundation models is a key priority. Some of these goals also drive me in my role as Head of Bosch Research and Technology Center India (RTC-IN). More generally for RTC-IN, I see AI and software as the key driver technologies emerging from India. Examples include exploring the impact of GenAI on software development, methods for optimizing algorithms to run in real time on resource-constrained hardware, and researching novel hybrids of physics-based models and AI methods to shorten the time required for parameter optimization in different applications.

Could you share some insights into the current research projects or initiatives that are being undertaken at the Bosch Research and Technology Center in Bangalore?

RTC-IN is home to several activities in different portfolios in CR. Broadly speaking, we are a heavily AI-oriented and software-oriented team. Our activities involve the development of AI methods in the fields of natural language processing, time series, and computer vision. Examples of the activities we undertake include data re-use and generation, data curation and filters, and assisted annotation and label quality checks.

V-Model

The V-Model is a model for the software development process that provides a systematic and structured approach to software development. It is based on the concept of verification and validation (V&V) and places great emphasis on quality assurance throughout the entire development process.

These activities focus on topics ranging from tools for enabling data logging and annotation to the latest approaches based on foundation models and generative AI. In another activity, we are focusing on AI approaches for software supporting different stages of the V-model of development. We are also developing novel hybrid models for approximating physical systems using cutting-edge AI technologies such as Deep Operator Networks for simulation, digital twins, and other solutions in relation to topics such as vibration, corrosion, and other areas of physics.

Another research direction we are pursuing involves addressing the question as to how reliable control applications can be optimally developed and implemented in embedded systems or in upcoming distributed systems. The technologies are based on classical algorithms and embedded AI, including online learning. In this context, we are developing tools to help and support the developer achieve a seamless, more highly automated workflow by getting optimized code for top performance.

What’s more, the team is exploring possible applications in manufacturing, such as process curve analysis (PCA). Process curve time series data is collected from various lines and stations. This data captures the signature of the task or process taking place at that station. It is crucial for production planners to understand their lines and plants through enriched insights derived from this data so they can optimize processes and reduce unplanned downtimes.

With the rapid advancements in technology and the evolving needs of customers, how do you envision the role of Bosch Research India in shaping the future of, for example, mobility, connectivity, and sustainability?

Being co-located with BGSW – Bosch’s largest software development center outside Germany – provides us with unique opportunities to contribute to various domains that Bosch works on. Combining the domain knowledge of the experts in BGSW and the AI expertise of RTC-IN has the potential to impact multiple domains spanning mobility, connectivity, and sustainability and delivering solutions quite fast. One primary impact we envision will be improving efficiency and reducing development time and cost. Examples include improving the efficiency of software development, replacing physical sensors with AI-based approaches, improving the efficiency and turnaround time of optimizations pertaining to designs of components, etc.

Thank you very much, Amit, for these valuable insights into your work. We wish you and your team every continued success!