Verification and Validation of Automated Systems' Safety and Security

Results in Brief

Verification and validation for complex automated systems

With automated systems becoming more interconnected, researchers have streamlined processes and diminished the time and expenses incurred in verifying and validating them.

DIGITAL ECONOMY

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In the realm of highly automated systems, the consequences of failures can be severe, often leading to catastrophic outcomes. As these systems become more intricate and interconnected, the emergence of unforeseen properties necessitates meticulous verification and validation (V&V). However, the complexity involved in this process makes it time-consuming and expensive.

The EU-funded VALU3S project, concluding in July 2023, undertook a pivotal role in evaluating cutting-edge V&V methods and tools for automated systems across various sectors including automotive, agriculture, healthcare, aerospace, railway, industrial automation and robotics.

Elevating safety and security

VALU3S' primary objective was to devise a multi-domain framework that addresses these escalating complexities by implementing, enhancing, and assessing V&V methods and tools – thus qualifying and quantifying safety, security and privacy aspects. By utilising demonstrators with specific safety, cybersecurity, and privacy requirements across these diverse domains, VALU3S aimed to streamline the V&V process and subsequently diminish the time and expenses incurred in verifying and validating automated systems.

Two significant results from the project stand out, according to Behrooz Sangchoolie, project coordinator of VALU3S. Firstly, over 40 distinct V&V tools were implemented, improved and evaluated. These tools played a pivotal role in achieving the core objective of minimising the time and costs associated with verifying and validating automated systems concerning safety and cybersecurity requirements.

Secondly, the creation of the VALU3S web-based repository served as a cornerstone. "The repository hosts pointers to some of the key results generated by the project e.g. the V&V methods and tools enhanced, the evaluation results connected to the project use cases, as well as the V&V workflow models generated using verification and validation modelling language (VVML) developed during the project," adds Sangchoolie.

Demystifying V&V processes

One of the primary challenges revolved around harmonising V&V activities across domains that varied in maturity levels regarding V&V processes. However, this challenge was transformed into a strength, enabling the project to amalgamate insights from different domain-specific V&V processes.

"A significant number of the methods and tools developed in the project were also applied on use-cases introduced by some of the industrial project partners. This way we made sure that the solutions proposed in the project have real-world applications," comments Sangchoolie.

Thirteen use-cases from six distinct domains formed the crux of demonstrators in the project. The application of developed technologies in these use cases led to the unveiling of over 20 demonstrators during the project's final event.

The project's success in structuring the components and elements necessary for V&V processes stemmed from an eight-dimensional V&V framework. This blueprint provided a clear delineation of essential elements required for effective V&V procedures.

State-of-the-art verification

While VALU3S has made substantial strides in advancing V&V methodologies, further avenues for exploration exist. Future endeavours encompass enhancing V&V tools through state-of-the-art machine learning models, targeting eco-friendly practices in V&V activities, transforming the VALU3S repository into a go-to platform for V&V stakeholders and contributing to the training of future engineers and practitioners in the domain. Nevertheless, the project sets the stage for a more efficient, cost-effective and safer landscape for highly automated systems across multiple industries.

Keywords

VALU3S | automated systems | safety and security | multi-domain framework | verification & validation

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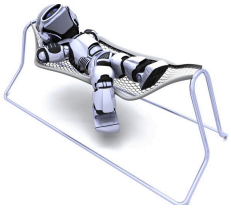

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