

SuperTest – helping Ambarella deliver AI-powered vision systems for next-generation vehicle autonomy

California-based Ambarella Inc., an AI vision silicon company, implements deep neural network Artificial Intelligence (AI) in its autonomous driving and automotive vision system chips. To provide its customers with comprehensive hardware/software solutions that incorporate the latest AI algorithms, the company partners with some of the world's leading AI software developers. It has recently partnered with Swedish company Smart Eye, a leader in AI-powered eye, mouth, and head tracking technology for driver monitoring, and German company HELLA Aglaia, a leader in intelligent visual perception software for advanced driver-assistance systems. Optimizing the efficiency of hardware/software integration means delivering fully validated compilers for the on-chip processors in its vision chips, while the safety-critical nature of the automotive market requires conformance to industry standards such as ISO 26262 – the two main reasons why the company chose to include SuperTest in its compiler development tool chain.

“With our AI-based vision chips we are targeting all five levels of autonomous driving – from basic driver assistance right through to fully automated autonomous driving,” says Malhar Palkar, Ambarella’s Director of Software Engineering. “This means implementing functionalities like terrain modeling, traffic light detection, 3D free space detection, lane detection, and high-speed classification of objects such as vehicles, pedestrians, bicycles, and motorcycles.”

To implement AI-powered functions including object classification, Ambarella’s chips employ convolutional neural networks, with a RISC core and ARM® Cortex® core layered on top of them so that application development can be accomplished via AI frameworks such as TensorFlow and Caffe2 using the C/C++ language. Ambarella’s first task for SuperTest was validating the GCC-based compiler for its chips’ ARM core as part of the company’s toolchain maintenance program.

“New releases of the Ubuntu operating system on which our GCC-based compiler runs are issued on a yearly basis, so we need to be confident that the code generated when the compiler runs under future releases matches the code that we are generating and testing today,” says Malhar. “We will also run SuperTest whenever we receive an

updated ARM compiler, comparing the code generated by the new version of the compiler with that produced by the current one.”

Having successfully validated the ARM compiler, Malhar and his team set about validating the compiler for Ambarella’s proprietary RISC-based embedded processor, which supervises and configures the chip’s neural networks.

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“The compiler for our RISC CPU is 95% based on GCC with a few additions to the instruction set that are used in a very specific way, mostly to control the hardware system. We run our modified GCC through SuperTest to verify results. This RISC compiler runs our lower-level microcode on the safety core. Hence the code needs to be safe.”

In performing these compiler validations, Malhar cites SuperTest’s test coverage and the number of individual tests it can generate as two of its main strengths. However, another important reason he chose SuperTest is that it is written with the C standard in the background and that is why it is the only suite that can meet ISO 26262 requirements.

“When you are negotiating with customers in the automotive business, one thing always comes up, and that is: does your solution meet the test requirements of safety-critical systems? Our customers already know about SuperTest and its reputation for meeting ISO 26262 requirements, so when we say that our tools are verified by SuperTest that definitely gives us an advantage.”



Ambarella's products are used in a wide variety of human and computer vision applications, including video security, advanced driver assistance systems (ADAS), electronic mirror, drive recorder, driver/cabin monitoring, autonomous driving, and robotic applications. Ambarella's low-power system on chips (SoCs) offer high-resolution video compression, advanced image processing, and powerful deep neural network processing to enable intelligent cameras to extract valuable data from high-resolution video streams. For more information, please visit www.ambarella.com



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