Applied Robotics

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B:RAI 2020

Brunel Robotics & AI Expo

The Business

Established in 1989 by Flemming CHRISTENSEN

- Employee Owned and a *'Life-Style'* company
- 10x people with 300+ years experince
  - 5x with accredited Xilinx FPGA training
- Always designed and built our own products
- BSI - ISO9001-2015 certified, since 2003

Technology Focus

- Acceleration, Vision, Sensor & Robotics

XILINX
ALLIANCE PROGRAM
CERTIFIED

Overview

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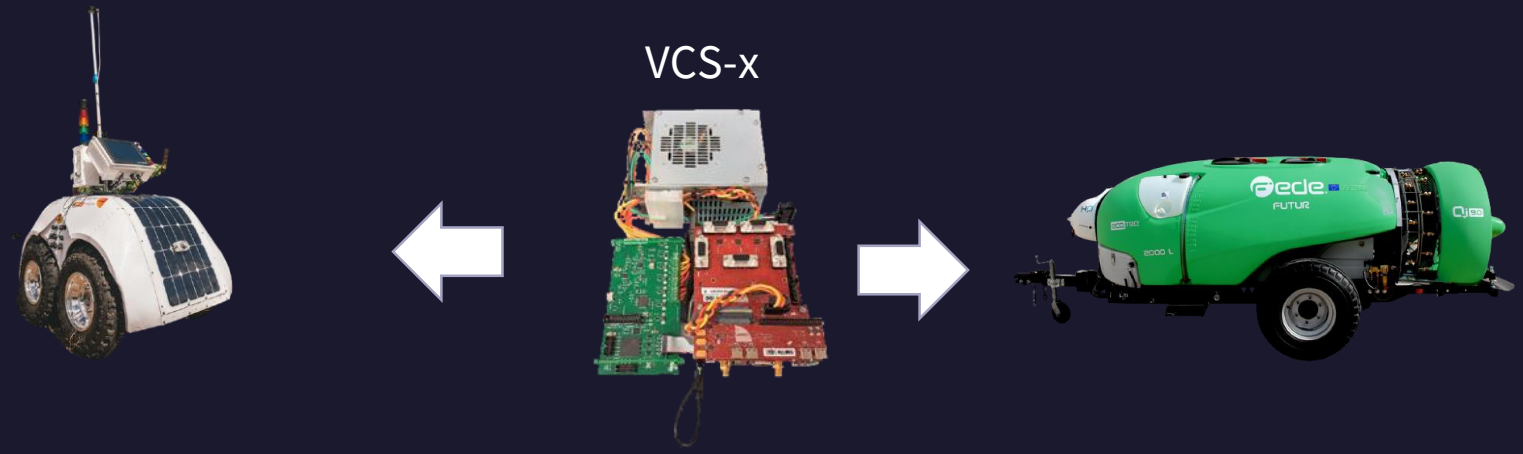
- VCS-x systems
- VCS-Jr system
- ARISE
- Edge-AI on FPGAs
- AWS
- ROS World

VCS-1 JR

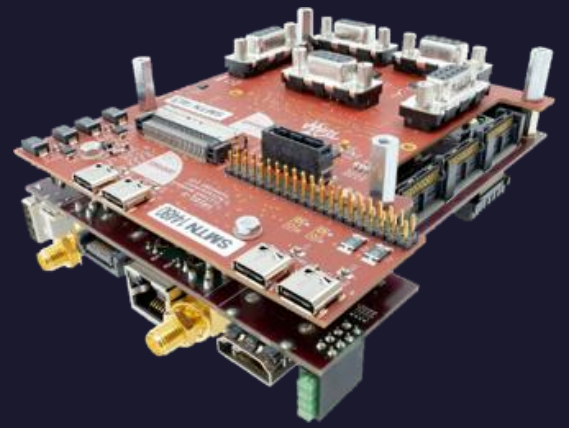
VCS-x

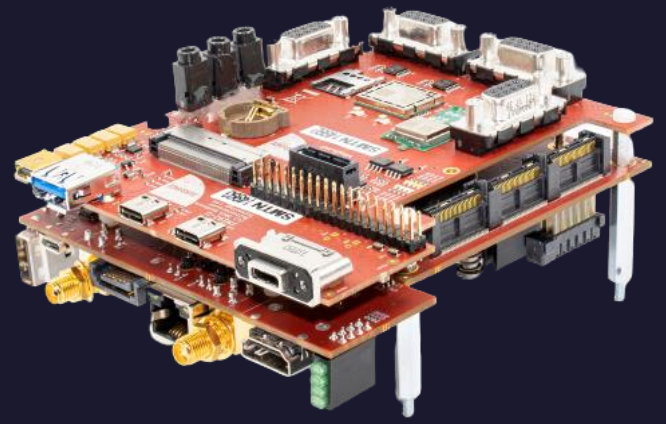


VCS Systems

- The VCS systems have the following characteristics:

1. High performance Xilinx Zynq ARM-CPU/FPGA
2. Low power consumption (typical 15W)
3. Support for a wide range of 3D cameras, sensors and actuators
4. Ideal for computer vision applications, Edge-AI and Deep Learning
5. Fully reconfigurable and expandable using PC/104 form-factor
6. Compatible with the most common Linux distributions
7. Software support for ROS and MQTT
8. Python and C/C++ support





VCS Demo

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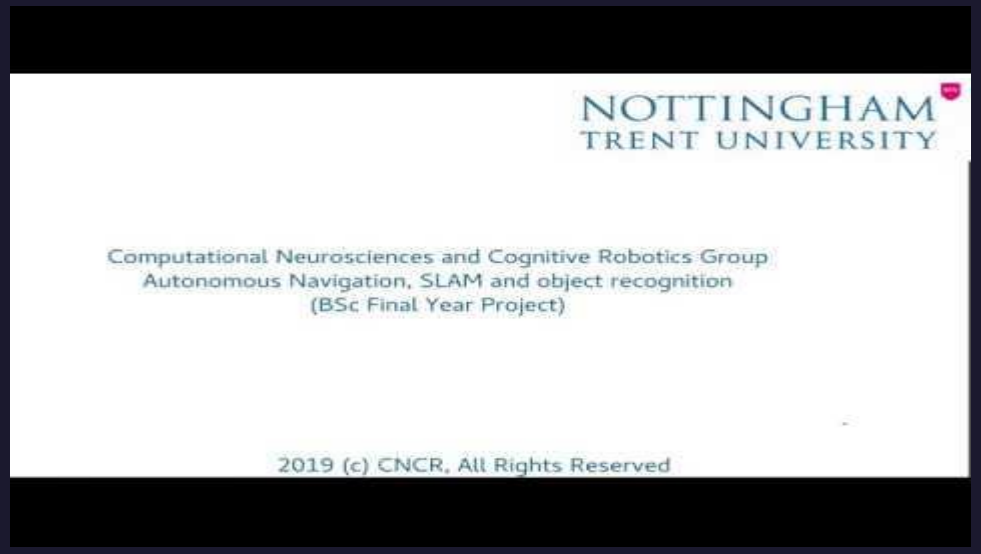
Autonomous Driving



Object Detection

Innovate UK funded - ARISE

ARISE aims to implement autonomous surveys of geotechnical conditions during the normally unproductive period immediately after the blast when workers vacate the mine due to post-blasting fumes and seismic risk.

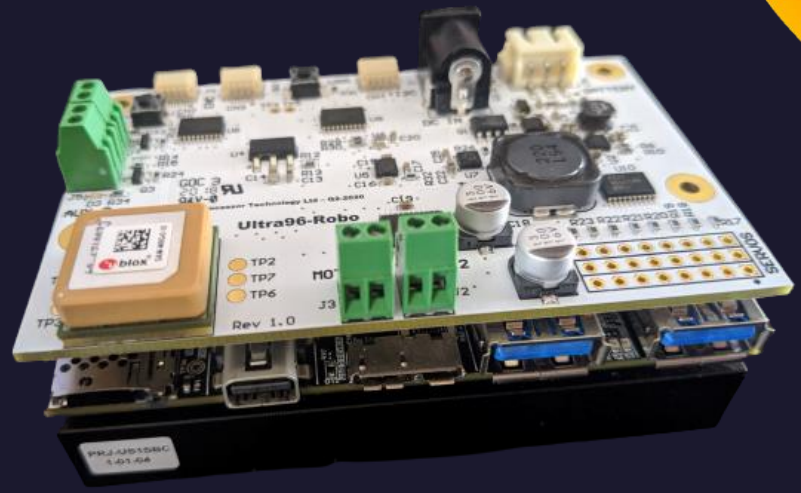
- ARISE project has the following goals:

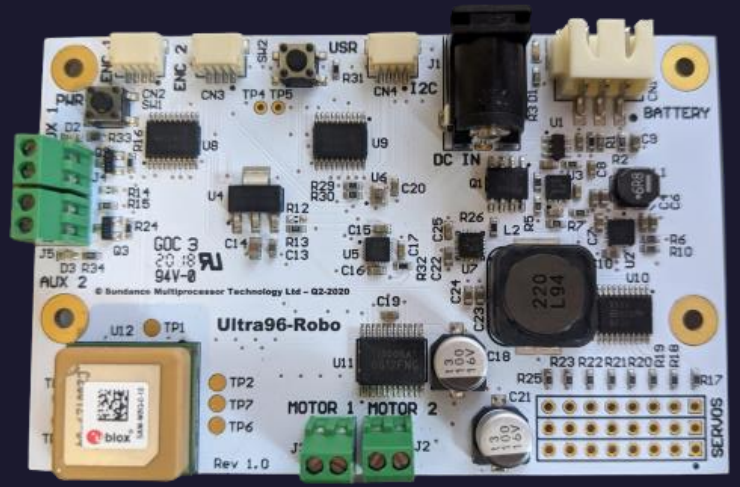
1. Create an intelligent means of surveying deep-mines
2. Increase safety for mine workers
3. Autonomously navigate through a multitude of terrain
4. Create AI algorithms to better facilitate data collection

VCS-Jr

- The Robo96 has the following characteristics:

1. Add-on for Avent's Ultra96v2
2. Utilises Battery power for truly mobile computing
3. Has a wide range on onboard IO : GPS, servo Terminals, Motor drivers
4. Support for Xilinx Vitis toolchain
5. Compatible with the most common Linux distros (I.e. Ubuntu, Debian, RedHat, CentOS, etc.)
6. Software support for ROS and MQTT
7. Python and C/C++ support





VCS-1 Demo

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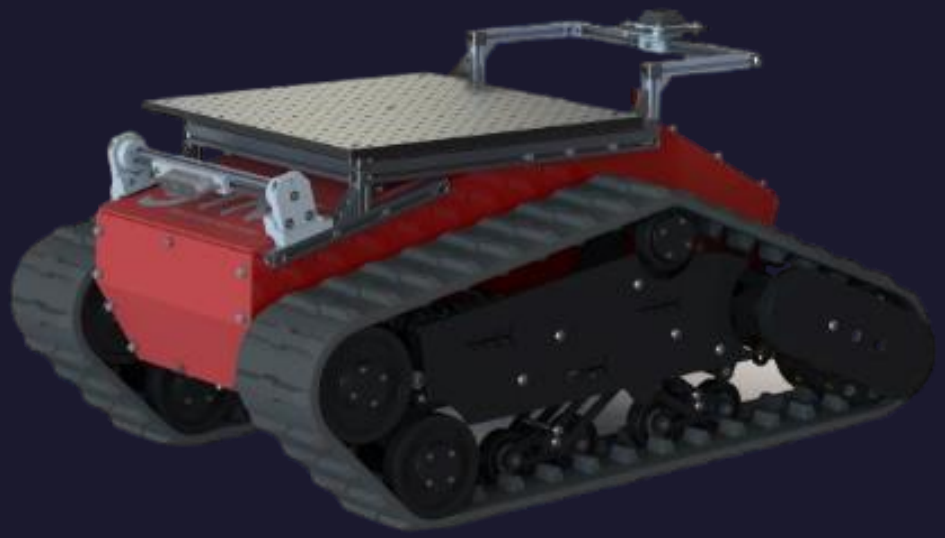
Dennis



VCS-Jr Demo

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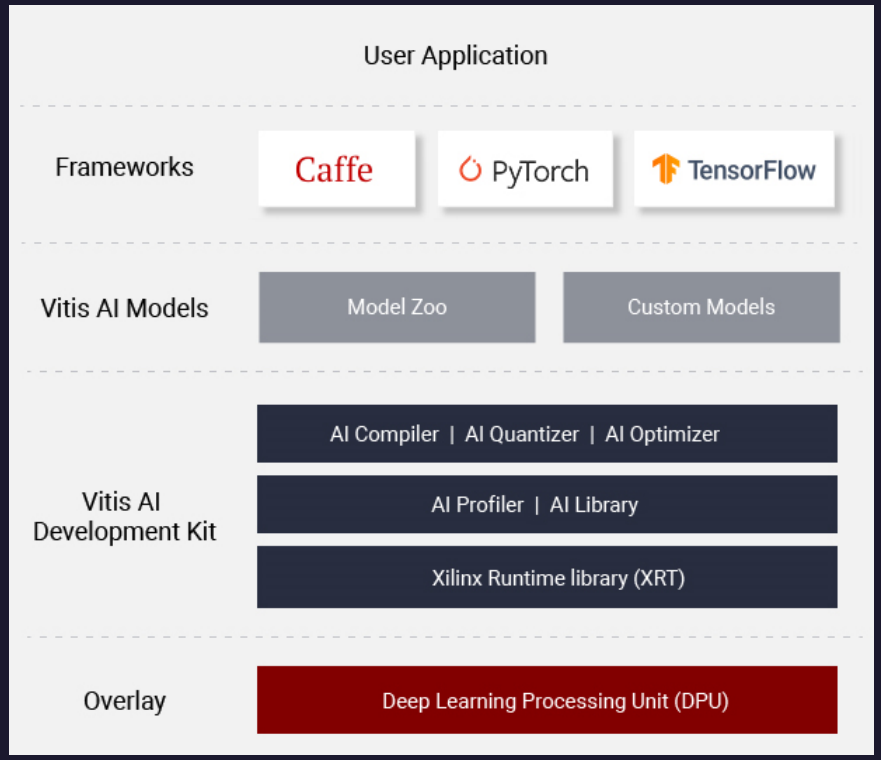
Dennis Jr

Why FPGA?

- FPGA has a much higher level of customization over other with the ability to
- Lower energy consumption over CPUs leading to longer battery life for integrated robots
- With FPGAs running with pure logic this means a lower latency than CPUs
- Bandwidth with the FPGA is high meaning you can attach multiple IO without noticeable low down in performance



Tulipp Book

I will find the front-page somewhere

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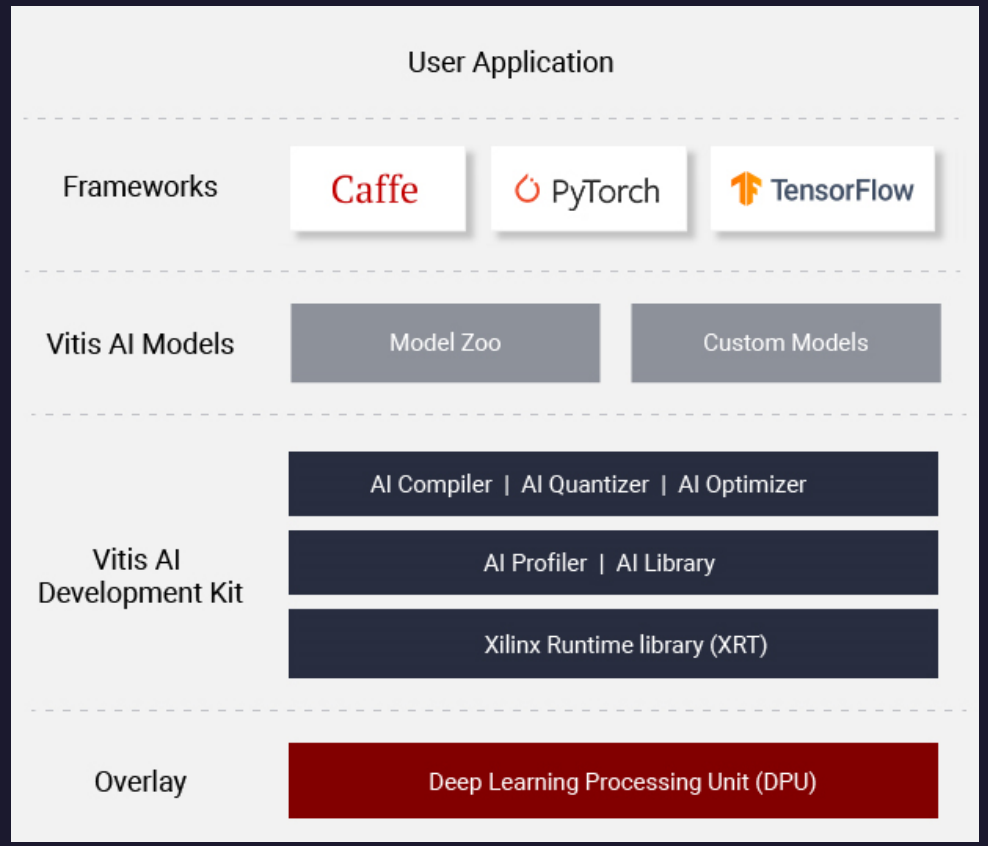

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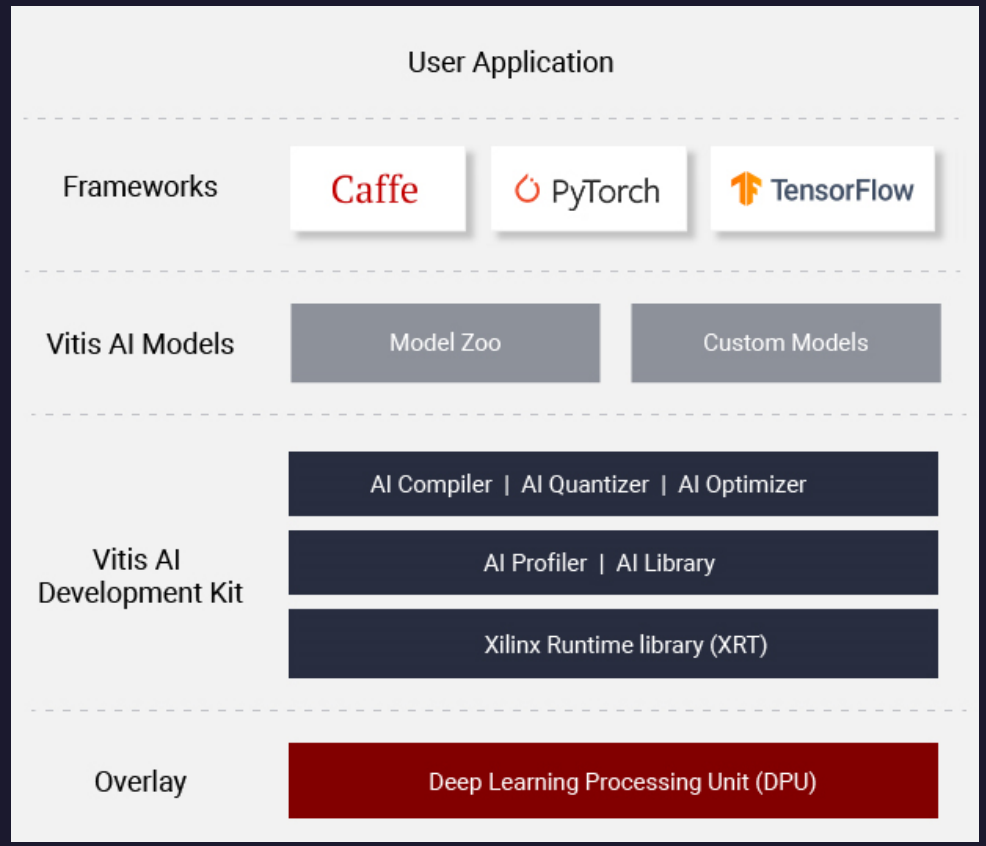
Xilinx Edge AI

Xilinx Edge AI Platform supports a number of industry-standard frameworks

- TensorFlow is an open-source framework developed by Google.
- CAFFE is an open-source framework developed at UC Berkley.
- Darknet is an open-source framework developed by Joseph Redmon.
- Keras is a high-level neural networks API, written in Python and capable of running on top of TensorFlow.



Caffe

- Key Features:

1. Caffe is a deep learning framework made with expression, speed, and modularity in mind.
2. Caffe can process **over 60M images per day.**
3. Caffe already powers academic research projects, start-up prototypes, and even large-scale industrial applications in vision, speech, and multimedia.

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Darknet

- Key Features:
- Darknet is fast with speeds up to 244 FPS with Tiny-YOLO Datasets with single Neural network layer technology.
- There is a large community of academics and developers working on Darknet.
- Well documented and easy to set up.
- Darknet has the ability to run on both CPU and GPU.

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Tensorflow

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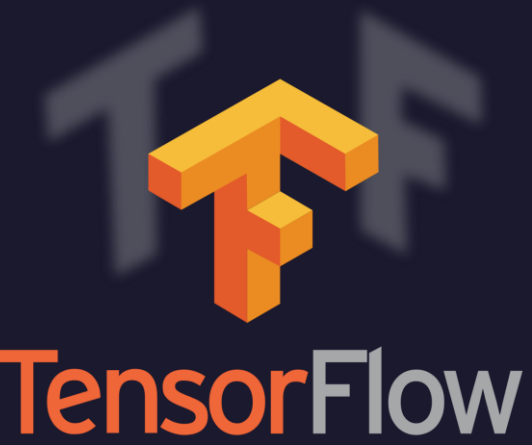
- Key Features:
- Tensorflow is an end-to-end Framework. This is because it is managed by google who have integrated it heavily in a many different platforms.
- Pretrained model libraries make it easy for people to learn how to use Tensorflow along with a large amount of documentation
- Tensorflow can run natively in the cloud thanks to "Google Cloud"



Kera

- Key Features:
- Keras is a deep learning API written in Python, running on top of the machine learning platform TensorFlow.
- It was developed with a focus on enabling fast experimentation. *Being able to go from idea to result as fast as possible is key to doing good research.*
- Scaling computation to many devices (e.g. the Summit supercomputer at Oak Ridge National Lab, which spans 27,000 GPUs) allowing for small to large scale integration

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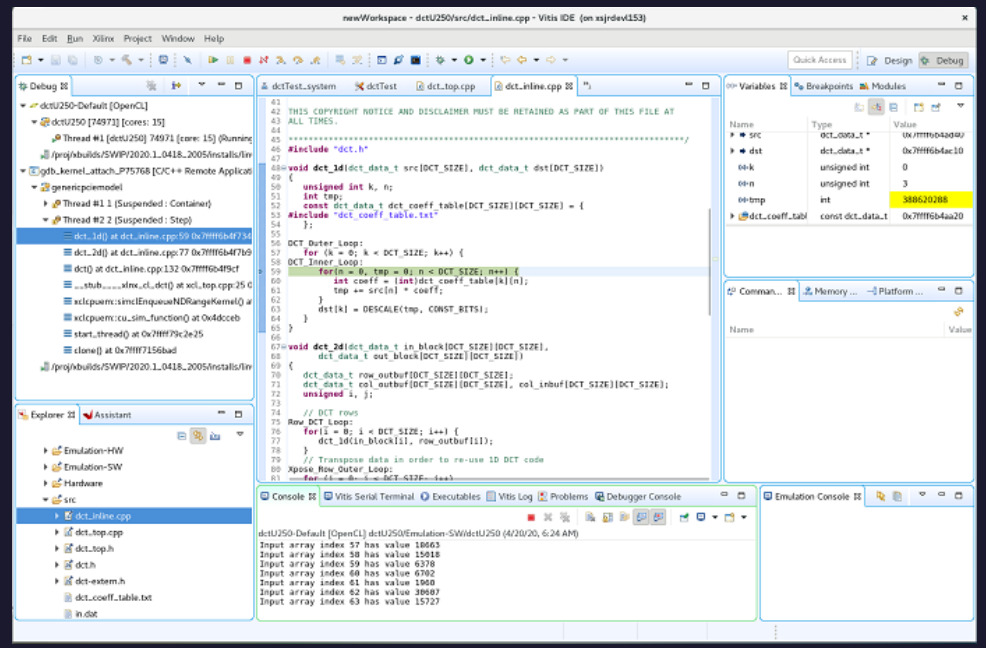
AWS – Xilinx Vitis

- A large array of tools to better integrate work practises into the cloud.
- Increase in data transfer leading to a more efficient workflow
- Little need for expensive onside servers with the wide range of servers available for instant spin up.
- Online workstation templates for easy employee setup on toolchains like : Vitis, Darknet and ROS.
- Increase in simulation performance with Robo-maker allowing us to store and share robotic simulations to customers and colleagues.



VCS & Edge AI in Action

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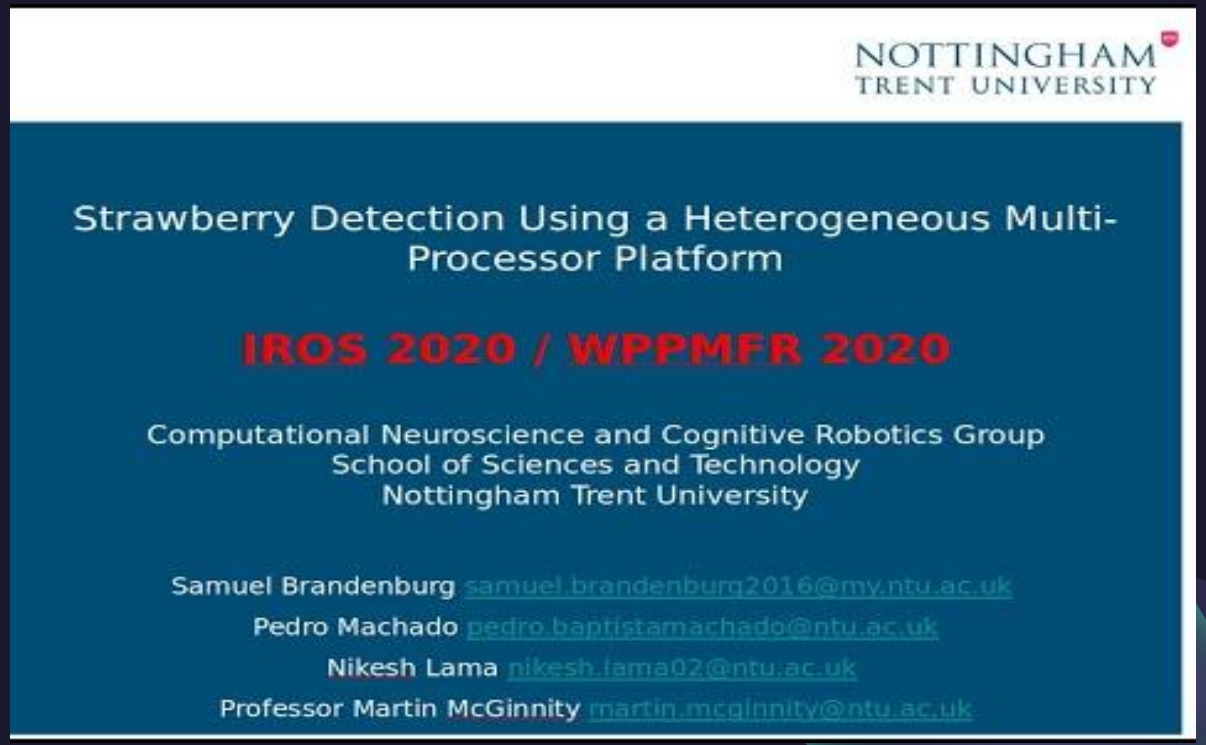
Strawberry Detection using VCS

- The Task of Strawberry Detection:

1. Fruit Classification: Use the CNN algorithm to classify fruits in the image.
2. Pose Estimation: estimate the best pose to pick the object.
3. Path Searching: Search the best path assuming the current position of the objects in the scene.
4. Path Planning: predict moving objects trajectory and estimate the optimal path while avoiding collisions.
5. Grasping: process grasping the target fruit.

Download it as a PDF to read later.



ROS World 2020 – 12th November

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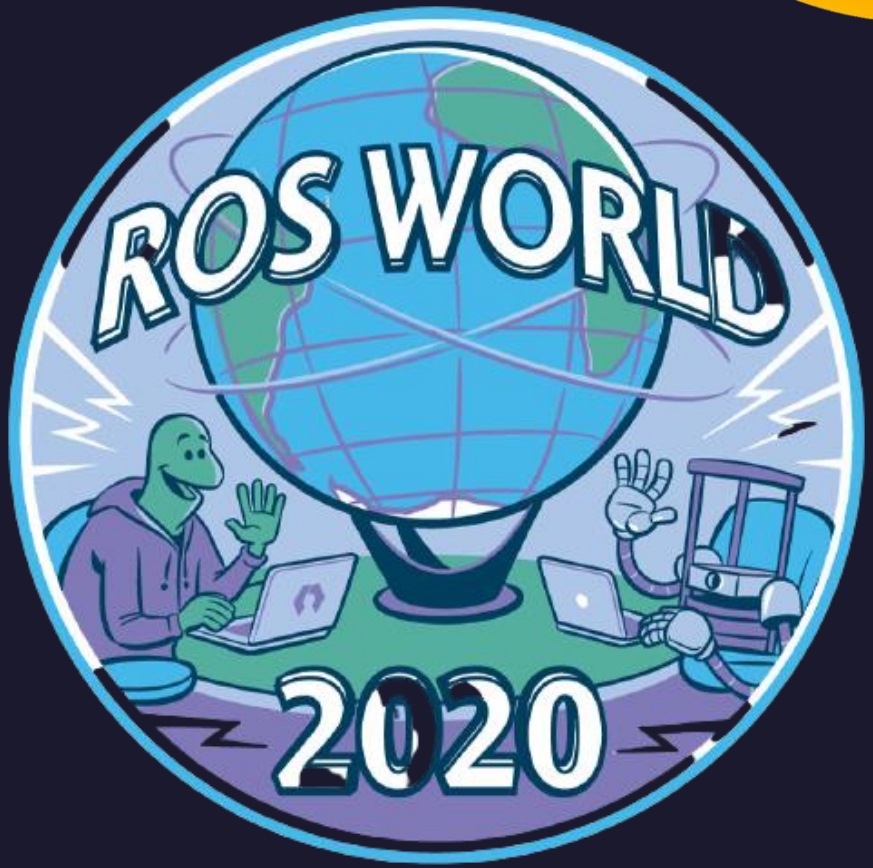
- Sundance was an early adopter of ROS for our range of Xilinx Zynq FPGA solutions for AgriTech, called VCS (Vision, Control, Sensors) and we are currently beta-testing ROS 2.0 on the platform.
- As a strong believer in ROS, Sundance is proud to sponsor ROS World 2020 which will be live tomorrow. It will be a half day event packed with pre-recorded videos and live talks, social events, and panels.
- ROS World is your 2020 opportunity to meet virtually with the rest of the global ROS community. This special single-day online conference will take place November 12th, 2020. There is no fee to register for ROS World 2020.
- See the ROS World website here for more details.
- ROS WORLD Showcase: Click Here



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International Conference on Intelligent Robots and Systems (IROS)

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- The IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) is one of the largest and most impacting robotics research conferences worldwide.
- Established in 1988 and held annually, IROS provides an international forum for the international robotics research community to explore the frontier of science and technology in intelligent robots and smart machines.
- IROS conferences also hold panel discussions, forums, workshops, tutorials, exhibits, and technical tours to enrich the fruitful discussions among conference attendees.

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Thank you for Watching

Any Questions?