

GPU Technology Conference, May 14-17, 2012  
McEnergy Convention Center, San Jose, California  
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## Sessions on **Machine Vision** (subject to change)

**IMPORTANT:** Visit <http://www.gputechconf.com/page/sessions.html> for the most up-to-date schedule.

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### **S0088 - Point Cloud Library (PCL) on CUDA**

**Radu Rusu (Willow Garage, Inc), Michael Dixon (Willow Garage, Inc.)**

**Day:** Tuesday, 05/15 | **Time:** 2:00 pm - 2:50 pm

**Topic Areas:** Computer Vision; Algorithms & Numerical Techniques; Stereoscopic 3D; Machine Vision

**Session Level:** Intermediate

The Point Cloud Library (PCL - <http://pointclouds.org>) is a large scale, open project for 3D point cloud processing. The PCL framework contains numerous state-of-the art algorithms including filtering, feature estimation, surface reconstruction, registration, model fitting and segmentation. Due to the massively parallel nature of many of the above algorithms, GPGPU accelerations holds great potential for achieving real-time performance in numerous applications. In this work we demonstrate some of the recent advances in GPGPU programming for 3D point cloud processing, and outline plans for future development.

### **S0319 - Advanced Driver Assistance System Testing using OptiX**

**Erwin Roth (Technische Universitaet Muenchen), Tugkan Calapoglu (VIRES Simulationstechnologie GmbH)**

**Day:** Tuesday, 05/15 | **Time:** 2:00 pm - 2:50 pm

**Topic Areas:** Ray Tracing; Machine Vision

**Session Level:** Intermediate

Learn in this session how the AUDI AG and its partners make use of OptiX as a unified platform for the simulation of perception sensors utilizing different physical measurement principles, e.g. Video Camera, LIDAR, Ultra Sonic, etc. The aim is to generate synthetic sensor data with realistic measurement errors for testing Advanced Driver Assistance Systems. Get details about the challenges they faced during the implementation of the necessary tools for validating the sensor models and join the discussion when they describe the upcoming challenges related to real-time Ray Tracing and advanced material descriptions, when multiple sensors are simulated simultaneously.

### **S0075 - Oculus Real-Time Modular Cognitive Vision System**

**Jeremie Papon (University of Gottingen), Alexey Abramov (University of Gottingen)**

**Day:** Tuesday, 05/15 | **Time:** 3:00 pm - 3:50 pm

**Topic Areas:** Computer Vision; Audio, Image and Video Processing; Application Design & Porting Techniques; Machine Vision

**Session Level:** Intermediate

This session will explore ways to integrate GPU processing into a real-time computer vision architecture. While there has been a rapid push to move vision algorithms onto GPUs, integration into an efficient vision system architecture remains elusive. We will discuss our development of a modular vision system architecture that enables rapid prototyping of complex pipelines using multiple GPUs. The system incorporates modules for segmentation, disparity mapping, optical flow and particle filter tracking on the GPU. Our talk will explore the

various difficulties associated with developing such a system and will give a hands-on demonstration of Oculus, our vision platform.

#### **S0049 - Using the GPU Direct for Video API**

**Thomas True (NVIDIA), Alina Alt (NVIDIA)**

**Day:** Tuesday, 05/15 | **Time:** 3:00 pm - 3:50 pm

**Topic Areas:** Audio, Image and Video Processing; Development Tools & Libraries; Digital Content Creation & Film; Machine Vision

**Session Level:** Advanced

This tutorial will demonstrate how video I/O devices can take advantage of the GPU Direct for Video API to optimize the data transfer performance for digital video, film and broadcast applications and computer vision applications. The GPU Direct for Video API is a technology that permits the DMA transfer of data buffers between video I/O devices and the GPU through the use of a shared system memory buffer for immediate processing by OpenGL, DirectX, CUDA and OpenCL. This direct transfer can improve synchronization and eliminate latency between video capture, GPU processing and video output.

#### **S0062 - Histograms of Oriented Gradients with CUDA: Performance Analysis and Optimization Tips**

**Anton Obukhov (Consultant)**

**Day:** Tuesday, 05/15 | **Time:** 4:00 pm - 4:25 pm

**Topic Areas:** Computer Vision; Machine Vision; Development Tools & Libraries

**Session Level:** Advanced

Computer Vision is becoming increasingly popular and important nowadays. With the advent of powerful mobile devices and increasing power of desktop PCs, it is important to improve user experience by tackling the hardest problems of real-time interaction with the user. These include body parts tracking, face, and gesture recognition. This talk discusses a well-known Histogram of Oriented Gradients approach to object detection in images and its implementation with CUDA. A detailed performance analysis of different algorithm parts is conducted and optimizations for various usage cases are proposed. The role of OpenCV GPU module is highlighted and implementation details are provided.

#### **S0253 - Sensor Processing with Rugged Next-Generation NVIDIA GPUs (*Presented by GE Intelligent Platforms*)**

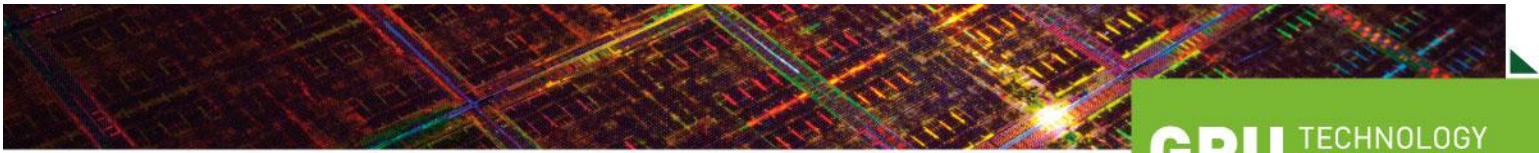
**Dustin Franklin (GE Intelligent Platforms)**

**Day:** Wednesday, 05/16 | **Time:** 9:00 am - 9:50 am

**Topic Areas:** Audio, Image and Video Processing; General Interest; Machine Vision; Computer Vision

**Session Level:** Intermediate

Swimming in sensors and drowning in data? Turn the tide on high-bandwidth sensors with rugged next-generation GPUs from NVIDIA. See how we deploy NVIDIA GPUs into the most extreme of environments, providing GPGPU capabilities onboard platforms where SWaP and GFLOPS/watt is key. Dig into four realtime CUDA sensor processing applications - Hyperspectral Imaging, Wide-Area Surveillance, 360° Situational Awareness, and GSM cellular SIGINT. Discuss the CUDA algorithms, interconnects, and rugged platforms behind each. Learn how we utilize GPUDirect and realtime Linux for improved latency and determinism.



## **S0081 - Parallel Computing in Mobile Robotics for RISE**

**Janusz Bedkowski**

**Day:** Thursday, 05/17 | **Time:** 9:30 am - 9:55 am

**Topic Areas:** Machine Vision

**Session Level:** Beginner

RISE - Risky Intervention and Surveillance Environment is very demanding task. In presentation three areas of research are shown such as 3D data registration, robot navigation and 3D cloud of points processing. The approach based on robust KNN nearest neighborhood search applied for improvement of ICP algorithm is shown. The path planning parallel approach based on wave propagation method is shown. On line segmentation of 3D cloud of points based on normal vector computation is given. The set of proposed algorithms where tested on GPGPU NVIDIA CUDA GF 580, the results are satisfying.