



END-TO-END AI APPLICATIONS
ON AUTONOMOUS SYSTEMS

INTRODUCTION TO DEEP LEARNING AND NVIDIA JETSON PLATFORM

Create a strong foundation with this introductory workshop on deep learning that is a commonly used technique for state-of-the-art AI algorithms. Learn the mathematical background of CNNs which is the most preferred method for vision based real-world problems and of algorithms like Backpropagation which makes deep learning algorithms much more robust and accurate from our expert team. Set your first Jetson up with the most popular AI far.

Content

- **Deep Learning Demystified**
 - Introduction to Deep Learning and its application fields.
- **OpenZeka Introduction to Deep Learning for Computer Vision**
 - How to use deep learning methods for computer vision tasks.
 - Mathematical Background of Convolutional Neural Networks
 - Mathematical Background of the Backpropagation Algorithm
- **Introduction to NVIDIA Jetson Platform and First Setup**
 - Introduction to Jetson Platform, capabilities and its application fields.
 - Setting up Jetson device with NVIDIA JetPack
 - Setting up NumPy, Sci-Kit, Pandas, Matplotlib libraries on Jetson
 - Building OpenCV with GPU support on Jetson.
 - Setting up TensorFlow on Jetson
 - Setting up the JupyterLab environment on Jetson.
- **Introduction to Deep Learning Libraries for NVIDIA Jetson**
 - Introduction to Keras/TensorFlow.
 - Running your first CNN on NVIDIA Jetson
- **Using TensorRT Library to Accelerate Deep Learning Pipelines on NVIDIA Jetson**

INTRODUCTION TO COMPUTER VISION WITH OPENCV

Learn how to use OpenCV on your Jetson projects involving computer vision with hands-on experience by creating projects written in Python.

Content

- Discover the foundations of OpenCV computer vision library for edge applications and usage scenarios.
- Learn how to build OpenCV from scratch with GPU support for the Jetson platform.
- Color spaces, filters and color/shape recognition algorithms and mathematical backgrounds with OpenCV.
- Deploy OpenCV development environments on edge devices distributed using Cordatus.
- Transfer streams processed with OpenCV from edge devices to another endpoint globally with HW accelerated streaming functions of the Cordatus AI.
- NVIDIA Vision Programming Interface (VPI)
 - Accelerate common computer vision tasks on different backends, such as CPU, GPU, PVA and VIC on NVIDIA Jetson
 - Sample VPI applications for accelerated computer vision pipelines on the Jetson

NVIDIA DLI: FUNDAMENTALS OF DEEP LEARNING

In this workshop, you'll learn how deep learning works through hands-on exercises in computer vision and natural language processing. You'll train deep learning models from scratch, learning tools and tricks to achieve highly accurate results. You'll also learn to leverage freely available, state-of-the-art pre-trained models to save time and get your deep learning application up and running quickly.

Content

- Learn the fundamental techniques and tools required to train a deep learning model
- Gain experience with common deep learning data types and model architectures
- Leverage transfer learning between models to achieve efficient results with less data and computation.
- Build confidence to take on your own project with a modern deep learning framework
- Enhance datasets through data augmentation to improve model accuracy

TRAINING CLASSIFICATION AND OBJECT DETECTION MODELS WITH TRANSFER LEARNING

Discover how to improve model accuracy further using advanced methods by training your own classification and object detection models from scratch. Optimize and deploy trained models on the Jetson platform with hardware specific NN acceleration methods.

Content

- **Augmentation and Model Fine Tuning | Classification (TensorFlow-Keras)**
 - Discover advanced techniques to improve model accuracy on VGG-16
 - Analyze the dataset
 - Create a subset
 - Apply augmentation on the subset
 - Train a custom NN with Keras Sequential
 - Re-train VGG16 with ImageNet weights
 - Apply fine-tuning on the VGG16
 - Apply further advanced techniques to increase accuracy
- **Training an end-to-end model with NVIDIA TAO Toolkit | Classification**
 - Learn how to train six different classification models and deploy one of them based on performance/accuracy trade-off
 - Prune NN for runtime performance acceleration
 - Re-train and adapt pruned NN to improve accuracy
 - Evaluate trained models in terms of accuracy and performance
 - Optimize the model for specific hardware and deploy at the edge
- **Training an end-to-end model with NVIDIA TAO Toolkit | Object Detection**
 - Train an Object Detection model from scratch using custom OpenZeka Multi Class Traffic Sign Dataset
 - Analyze the dataset
 - Annotate images manually in different labeling formats
 - Prune NN for runtime performance acceleration.
 - Re-train and adapt pruned NN to improve accuracy.
 - Evaluate trained models in terms of accuracy and performance
 - Optimize the model for specific hardware and deploy on the NVIDIA Jetson with real-time camera input.

SEMANTIC/INSTANCE SEGMENTATION AND NVIDIA DEEPCSTREAM SDK

Learn how to train and deploy semantic/instance segmentation models with both TensorFlow-Keras and NVIDIA TAO Toolkit to solve real world problems across different industries. Discover NVIDIA DeepStream SDK for Intelligent Video Analytics and how to use it on NVIDIA Jetson to deliver accelerated AI pipelines at the edge.

Content

- **Fully Convolutional Networks | Semantic Segmentation (TensorFlow-Keras)**
 - Introduction to Fully Convolutional NNs for semantic segmentation tasks
 - Differences between Semantic Segmentation and Instance Segmentation
 - Introduction to existing state of the art datasets and NN architectures for semantic segmentation
 - Mathematical background of FCNs
 - Train UNet model on CityScapes dataset using TensorFlow Keras
 - Analyze Cityscapes dataset
 - Data annotation for semantic segmentation
 - Train UNet model with TensorFlow Keras
 - Deploy resulting model on the Jetson
 - Accelerating UNet models with TensorRT on the Jetson platform.
- **Training an end-to-end model with NVIDIA TAO Toolkit | Instance Segmentation**
 - Prepare COCO dataset for instance segmentation
 - Create model training configuration (with AMP*)
 - Train Mask R-CNN model for instance segmentation
 - Evaluate and verify resulting model
 - Export models in different precisions (FP16/INT8)
 - Deploy resulting models with DeepStream
- **DeepStream SDK**
 - Deploy NVIDIA DeepStream SDK on Jetson
 - Step-by-step data collection, decoding, pre-processing, inference, tracking, encoding, composing and visualizing workflows.
 - Different types of sources and sinks
 - Selecting source and sinks for different task

*Automatic Mixed Precision