# NVIDIA Jetson Nano Deep Learning Workshop: From Vision to Video Analytics

Duration: 03 days (24 hours)

\_\_\_\_\_

======

# Module 01: Building a Brain in 10 minutes (Basics of Deep Learning)

## About this Module

This notebook explores the biological and psychological inspirations to the world's first neural networks.

## **Learning Objectives**

The goals of this exercise include:

- Exploring how neural networks use data to learn.
- Understanding the math behind a neuron.

# **Topics Covered**

- Al Data
- Neurons
- TensorFlow 2

# **Module Outline**

- Data
- Building a Neuron
- Initiate Training
- Evaluating the Model

# Module 02: Getting Started with AI on Jetson Nano

#### About this Module

The power of AI is now in the hands of makers, self-taught developers, and embedded technology enthusiasts everywhere with the NVIDIA Jetson developer kits. This easy-to-use, powerful computer lets you run multiple neural networks in parallel for applications like image classification, object detection, segmentation, and speech processing. In this course, you'll use Jupyter iPython notebooks on your own Jetson to build a deep learning classification project with computer vision models.

# Learning Objectives

You'll learn how to:

- Set up your NVIDIA Jetson Nano and camera
- Collect image data for classification models
- Annotate image data for regression models
- Train a neural network on your data to create your own models
- Run inference on the NVIDIA Jetson Nano with the models you create

Upon completion, you'll be able to create your own deep learning classification and regression models with the Jetson Nano.

#### **Topics Covered**

Tools and frameworks used in this course include PyTorch and NVIDIA Jetson Nano.

#### Module Outline

#### 1. Setting up your Jetson Nano

Step-by-step guide to set up your hardware and software for the course projects

• Introduction and Setup

Video walk-through and instructions for setting up JetPack and what items you need to get started

Cameras

Details on how to connect your camera to the Jetson Nano Developer Kit

• Headless Device Mode

Video walk-through and instructions for running the Docker container for the course using headless device mode (remotely from your computer).

Hello Camera

How to test your camera with an interactive Jupyter notebook on the Jetson Nano Developer Kit

• JupyterLab

A brief introduction to the JupyterLab interface and notebooks

#### 2. Image Classification

Background information and instructions to create projects that classify images using Deep Learning

• Al and Deep Learning

A brief overview of Deep Learning and how it relates to Artificial Intelligence (AI)

• Convolutional Neural Networks (CNNs)

An introduction to the dominant class of artificial neural networks for computer vision tasks

• ResNet-18

Specifics on the ResNet-18 network architecture used in the class projects

• Thumbs Project

Video walk-through and instructions to work with the interactive image classification notebook to create your first project

• Emotions Project

## 3. Image Regression

Instructions to create projects that can localize and track image features in a live camera image

• Classification vs. Regression

With a few changes, the Classification model can be converted to a Regression model

• Face XY Project

# Module 03: Building Video Al Applications at the Edge on Jetson Nano

#### About this Module

Al-based video understanding can unlock insights, whether it's recognizing a cat in your backyard or optimizing customers' shopping experiences. The <u>NVIDIA Jetson</u> <u>Nano Developer Kit</u> is an easy-to-use, powerful computer that lets you run multiple neural networks in parallel. This makes it a great platform for an introduction to intelligent video analytics (IVA) applications using the <u>NVIDIA DeepStream SDK</u>. In this course, you'll use JupyterLab notebooks and Python application samples on your Jetson Nano to build new projects that extract meaningful insights from video streams through deep learning video analytics. The techniques you learn from this

course can then be applied to your own projects in the future on the Nano or other Jetson platforms at the Edge.

Note: This course supports the <u>NVIDIA Jetson Nano Developer Kit</u> but does **not** support the <u>NVIDIA Jetson Orin Nano Developer Kit</u>

## Learning Objectives

You'll learn how to:

- Set up your Jetson Nano
- Build end-to-end DeepStream pipelines to convert raw video input into insightful annotated video output
- Build alternate input and output sources into your pipeline
- Configure multiple video streams simultaneously
- Configure alternate inference engines such as YOLO

Upon completion, you'll be able to build DeepStream applications that annotate video streams from various and multiple sources to identify and classify objects, count objects in a crowded scene, and output the result as a live stream or file.

#### **Topics Covered**

Tools, libraries, frameworks used in this course include DeepStream, TensorRT, Jetson Nano, and Python

#### **Module Outline**

#### 1. Setting up your Jetson Nano

Step-by-step guide to set up your hardware and software for the course projects

Note: This course supports the <u>NVIDIA Jetson Nano Developer Kit</u> but does **not** support the <u>NVIDIA Jetson **Orin** Nano Developer Kit</u>

• Introduction and Setup

Video walk-through and instructions for setting up JetPack and what items you need to get started

Camera Setup

How to connect your camera to the Jetson Nano Developer Kit

• Headless Device Mode

Video walk-through and instructions for running the Docker container for the course using headless device mode (remotely from your computer).

• JupyterLab

A brief introduction to the JupyterLab interface and notebooks

• Media Player

How to set up video streaming on your computer

## 2. Introduction to DeepStream SDK

Overview of key DeepStream SDK features and important reference links for deeper exploration

• What is the DeepStream SDK?

An overview of DeepStream applications and the DeepStream SDK

• GStreamer Plugins

Introduction to the GStreamer framework and plugins

• TensorRT

Introduction to TensorRT

• Video to Analytics With the DeepStream SDK

Outline of the DeepStream metadata structure

#### 3. Exploring DeepStream SDK

Course notebook and environment details for your Jetson Nano hands-on learning experience

• Build DeepStream Applications

<u>https://www.nvidia.com/en-in/training/online/</u> → Deep Learning