

# Deep Learning Workshop

Preventing disease, Building smart cities, Revolutionizing analytics. These are just a few things happening today with Artificial Intelligence and, specifically, Deep Learning.

This workshop teaches deep learning techniques using neural network architecture inspired by biology.

There will be three Classes included in this workshop:

**Class I** – Fundamentals of Deep Learning for Computer Vision hands-on training on using GPU-accelerated workstation in the cloud.

**Class II** – Introduction to SPANNER

**Class III** – Introduction to SpiNNaker

## Class I – NVIDIA Deep Learning Institute (DLI) Fundamentals of Deep Learning for Computer Vision

The NVIDIA Deep Learning Institute (DLI) offers hands-on training developers, data scientists, and researchers looking to solve the world's most challenging problems with Deep Learning.

This class teaches deep learning techniques for a range of computer vision tasks through a series of hands-on exercises. You will work with widely-used deep learning tools, frameworks, and workflows to train and deploy neural network models on a fully-configured, GPU-accelerated workstation in the cloud. After a quick introduction to deep learning, you will advance to: building and deploying deep learning applications for image classification and object detection, modifying your neural networks to improve their accuracy and performance, and implementing the workflow you have learned on a final project. At the end of the workshop, you will have access to additional resources to create new deep learning applications on your own.

### Learning Objectives

At the conclusion of the workshop, you will have an understanding of the fundamentals of deep learning and be able to:

- Implement common deep learning workflows, such as image classification and object detection.
- Experiment with data, training parameters, network structure, and other strategies to increase performance and capability of neural networks.
- Integrate and deploy neural networks in your own applications to start solving sophisticated real-world problems.

Class I will be instructor-led in the morning part of Deep Learning workshop. The delegates will be able to complete the Fundamentals of Deep Learning for Computer Vision course from home using online resources and will have the opportunity to earn certification.

Assessment type:	Coding
Certification:	Upon successful completion of the workshop, participants will receive NVIDIA DLI Certification to recognize subject matter competency and support professional career growth.
Prerequisites:	Familiarity with programming fundamentals such as functions and variables

Tools, libraries, and frameworks: Caffe, DIGITS

## **Class II – Introduction to SPANNER**

Use of brain-inspired temporal intelligence is increasingly in demand as novel solutions to neural network-based artificial intelligence for providing brain power. This class would cover multi-layered spiking neural network architecture inspired by biology in delivering fault-resilience in electronic systems. The architecture uses unsupervised machine intelligence in delivering a homeostatic spiking activity, providing a reliable pattern identification response in hardware. The use of field-programmable gate array devices in the architecture accelerates the biological scale of response by providing a real-time responsive behavior for tasks where reliability is of paramount importance. Use of spiking neural networks in developing machine intelligence is a sparsely explored area, and the aim of the workshop is to identify understand its limitations and develop plausible countermeasures encouraging its extensive use in today's artificial intelligence tasks (SPANNER Architecture). The session would also discuss various steps in deducing a compact scalable hardware architecture delivering homeostatic spiking behavior.

Introduction to Bio-inspired computations and Spiking Neural Network (SNN). Understand the limitations of Spiking Neural Networks. Discuss plausible countermeasures to overcome the issues. Understand the need for FPGAs in SNN implementations. Understanding SPANNER architecture providing fault tolerance mediated by Astrocyte.

Navigation task on SPANNER Architecture. Neural network coding using ARM embed (Intermediate- experience in using C required). SPANNER FPGA-raspberry- Pi robot navigation demonstration (Video).

## Class III - Introduction to SpiNNaker

This workshop will introduce participants to simulating Spiking Neural Networks on the SpiNNaker architecture. We will first introduce the architecture to give an overview of how it works when executing neural networks. We will then describe the neural network language PyNN and show how this can be used to describe the SNN to be simulated. Finally, we will have a lab session, where attendees will be able to try building a few simple networks.

Time	Agenda
08:00 AM - 09:00 AM	Registration, Seating & Connect to Wifi
09:00 AM - 10:45 AM	Introduction: Getting started with deep learning Biological inspiration for deep neural networks (DNN)
10:45 AM - 11:00 AM	Coffee/Tea Break
11:0 AM - 1:00 PM	Class I
01:00 PM - 01:45 PM	Lunch
01:45 PM - 03:45 PM	Class II
03:45 PM - 04:00 PM	Coffee/Tea Break
04:00 PM - 06:00 PM	Class III