

**Comprehensive Deep Learning with Python**

**Course Number:** PYTH-158
**Duration:** 4 days

**Overview**

This hands-on, live Deep Learning with Python training course builds on our [Comprehensive Data Science with Python](file:////training/comprehensive-data-science-with-python) class and teaches attendees the fundamentals of Deep Learning, and to implement artificial neural network (ANN) applications, using Keras and TensorFlow.

**Prerequisites**

All attendees should have completed the [Comprehensive Data Science with Python](file:////training/comprehensive-data-science-with-python)class or have equivalent experience.

**Materials**

All Deep Learning training students receive comprehensive courseware.

**Software Needed on Each Student PC**

* Windows, Mac, or Linux with at least 8 GB RAM
* A current version of Anaconda for Python 3.x
* Related lab files that Accelebrate will provide

**Objectives**

* Learn the fundamental theory behind neural networks
* Model an arbitrary function using an artificial neural network (ANN)
* Practice interpreting loss metrics and convergence conditions
* Apply a neural net to a regression problem
* Understand regularization within the context of ANNs
* Implement dropout and LASSO as network regularization strategies
* Apply Deep Learning to a classification problem
* Implement image processing methods in Python and Keras
* Extend feed-forward network architectures to convolutional layers
* Construct 2D convolutional image classification architectures
* Perform a multi class classification
* Apply Deep Learning to sequential data using recurrent architectures (RNNS, LSTMs and GRUs)
* Apply Deep Learning to time series forecasting applications
* Automate ANN architecture selection using Autokeras
* Understand the concept of Latent Semantic Representations and word embeddings

**Outline**

* Introduction to Artificial Neural Networks (ANNs) and Deep Learning
	+ Why artificial neural networks? Advantages of ANNs
	+ Understanding the essential concepts
	+ Activation functions, optimizers, back-propagation
	+ Components and architectures of artificial neural networks
	+ Evaluate the performance of neural networks on a known function
	+ Define and monitor convergence of a neural network
	+ Model selection
	+ Scoring new datasets with a model
* Constructing Deep Learning Models
	+ Preprocessing structured datasets for Deep Learning workflows
	+ Model validation strategies
	+ Architectural modifications to manage generalization error
	+ Regularization strategies
	+ Deep Learning: regression models
	+ Deep Learning: classification models
* Introduction to Image Processing with Python and Keras
	+ Management and preparation of image data for Deep Learning models
	+ The dimensionality of image data
	+ Handling image metadata
	+ Conversion of images to NumPy arrays
	+ Python Image Library (PIL) and skimage
	+ Keras' load\_img() function
	+ Image standardization and resampling
	+ Augmentation strategies for image data
* Deep Learning for Image Classification with Convolutional Architectures
	+ Image data is multidimensional
	+ Overview of convolutional architectures
	+ Convolution layers act as filters
	+ Pooling layers reduce computation
	+ Data augmentation through image transformation for smaller datasets
	+ Image transformation using the pillow library
	+ Applying a model to a multi class labeled dataset
	+ Evaluating a confusion matrix for multiple classes
* Time Series Forecasting with Deep Recurrent Architectures
	+ Identify limitations of feed-forward ANN architectures for sequential data
	+ Modify model architecture to include recurrent (RNN) components
	+ Preprocessing time series data for ingestion into RNN models
	+ Examine improvements to RNNs: The LSTM and GRU networks
	+ Time series forecasting with recurrent architectures
	+ Time series forecasting with 1D convolutional architectures
* Deep Learning and Natural Language Processing (NLP)
	+ Text manipulation with TensorFlow
	+ Categorical representations and word embeddings
	+ Text embeddings as layers in an ANN
	+ Word2vec
	+ Exploiting pre-trained word embedding models
	+ Visualizing semantic relationships between words using t-SNE
* Transfer Learning
	+ Exploiting pre-trained models (VGG16) for image classification
	+ Selecting layers to unlock for specific applications
	+ Transfer learning and fine tuning
* Variational Autoencoders
	+ What is an autoencoder?
	+ Building a simple autoencoder from a fully connected layer
	+ Sparse autoencoders
	+ Deep convolutional autoencoders
	+ Applications of autoencoders to image denoising
	+ Sequential autoencoders
	+ Variational autoencoders
* Generative Adversarial Networks (GANs)
	+ Adversarial examples
	+ Generational and discriminative networks
	+ Building a simple generative adversarial network
	+ Generating images with a GAN
* Transformer Architectures
	+ The problems with recurrent architectures for sequential data
	+ Attention-based architectures
	+ Positional encoding
	+ The Transformer: attention is all you need
	+ Time series classification using transformers
	+ GPT-3 and the future of natural language generation
	+ Open AI Codex and the future of programmatic code generation
* Conclusion