

**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