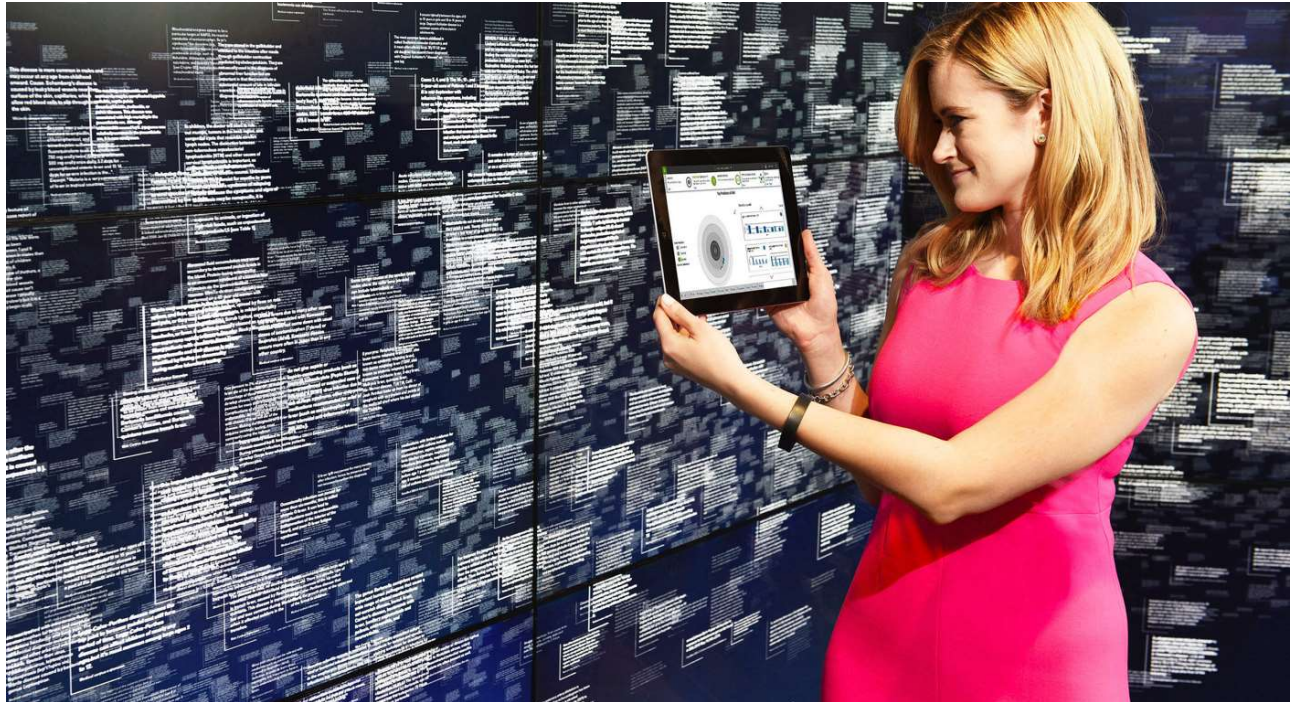


# Artificial Intelligence Nanodegree and Specializations



**Nanodegree key:** nd889

**Version:** 1.0.0

**Locale:** en-us

Become an expert in the core concepts of artificial intelligence and learn how to apply them to real-life problems.

## Content

### Part 01 : Introduction to Artificial Intelligence

In this Term, you'll learn the foundations of AI with Sebastian Thrun, Peter Norvig, and Thad Starner. We'll cover Game-Playing, Search, Optimization, Probabilistic AIs, and Hidden Markov Models.

- **Module 01:** Introduction to the Nanodegree

- ▾ [Lesson 01: Welcome to Artificial Intelligence](#)

Welcome to **Term 1** of the Artificial Intelligence Nanodegree program!

- [Concept 01: Welcome to the Artificial Intelligence Nanodegree Program](#)
- [Concept 02: Meet Your Instructors](#)
- [Concept 03: Projects You Will Build](#)
- [Concept 04: Deadline Policy](#)
- [Concept 05: Udacity Support](#)
- [Concept 06: Community Guidelines](#)
- [Concept 07: Weekly Lesson Plans](#)
- [Concept 08: References & Resources](#)
- [Concept 09: Get Started](#)
- [Concept 10: Lesson Plan: Week 1](#)

- ▶ [Lesson 02: Introduction to AI](#)

An introduction to basic AI concepts with real world examples.

- ▶ [Lesson 03: Applying AI to Sudoku](#)

In this lesson, you'll get taste of the power of Artificial Intelligence by developing an algorithm to solve every Sudoku puzzle. Enjoy the fun of building your first AI agent and get coding!

- ▶ [Lesson 04: Setting up with Anaconda](#)

Get your environment set up using Anaconda, an extremely popular way to manage your environments and packages in python.
- ▶ [Lesson 05: Solving Sudoku with AI](#)  
[Project Description - Solve a Sudoku with AI](#)  
[Project Rubric - Solve a Sudoku with AI](#)
- **Module 02: Search and Optimization**
  - ▶ [Lesson 01: Introduction to Game Playing](#)

In this lesson, you'll learn about how to build a Game Playing AI Agent. You'll focus on an agent that wins in the board game Isolation! You'll learn some of the seminal techniques in AI Game Playing including Adversarial Search and Minimax Trees.
  - ▶ [Lesson 02: Advanced Game Playing](#)

In this lesson, you'll build a Game-Playing agent that defeats opponents in Isolation. Along the way, you'll learn about advanced Game-Playing techniques such as Iterative Deepening, Alpha-Beta Pruning, and Expectimax.
  - ▶ [Lesson 03: Build an Adversarial Search Agent](#)  
[Project Description - Build a Game-Playing Agent](#)  
[Project Rubric - Build a Game-Playing Agent](#)
  - ▶ [Lesson 04: Search](#)

In this lesson, you'll learn how to implement some of the seminal search algorithms that are a cornerstone of AI including Breadth-First Search, Depth-First Search, and finally A Star Search. You'll then put your skills to the test by teaching Pac-Man to navigate his world and complete complex tasks such as finding the fastest path through the map while maximizing points scored.
  - ▶ [Lesson 05: Simulated Annealing](#)

In this lesson, you'll learn how to explore spaces and avoid local optima by using Simulated Annealing. In the process, you'll solve the famous n-Queens problem using this advanced AI technique!
  - ▶ [Lesson 06: Constraint Satisfaction](#)

In this lesson we'll return to one of the main techniques we used to solve Sudoku - constraint propagation. We'll see how to use known constraints to solve a wide variety of problems including Map Coloring problems, and simple puzzles.
- **Module 03: Logic, Reasoning, and Planning**
  - ▶ [Lesson 01: Logic and Reasoning](#)

In this lesson you'll learn to build intelligent systems that can reason using logic! This is in many ways one of the foundational pieces of intelligence - the ability to arrive at new conclusions from a given set of facts.
  - ▶ [Lesson 02: Planning](#)

Explore how we can use logic and search to plan out complex itineraries. Many of these planning approaches are the same ones used to power Self-Driving Cars!
  - ▶ [Lesson 03: Create a Domain-Independent Planner](#)  
[Project Description - Implement a Planning Search](#)  
[Project Rubric - Implement a Planning Search](#)
- **Module 04: Probabilistic Models**
  - ▶ [Lesson 01: Probability](#)

Learn to model uncertainty in the real world using probability theory.
  - ▶ [Lesson 02: Bayes Nets](#)

Learn to encode probability distributions using compact graphical models that enable efficient analysis.
  - ▶ [Lesson 03: Inference in Bayes Nets](#)

In this lesson, you will learn about probabilistic inference using Bayes Nets, i.e. how to answer questions that you are interested in, given certain inputs.

- ► [Lesson 04: Hidden Markov Models](#)

Learn to process sequences and time-series data using Hidden Markov Models.

- ► [Lesson 05: Use HMMs to Recognize ASL](#)  
[Project Description - Build a Sign Language Recognizer](#)

[Project Rubric - Build a Sign Language Recognizer](#)

- ► [Lesson 06: Wrapping Up Term 1](#)

Links to lesson plans for weeks 13 & 14 of term 1.

## Part 02 : Deep Learning and Applications

In this term, you'll learn the cutting edge advancements of AI and Deep Learning. You'll get the chance to apply Deep Learning on a variety of different topics including Computer Vision, Speech, and Natural Language Processing. We'll cover Convolutional Neural Networks, Recurrent Neural Networks, and other advanced models.

- **Module 01:** Introduction to the Nanodegree

- ► [Lesson 01: Welcome to Artificial Intelligence](#)

Welcome to **Term 2** of the Artificial Intelligence Nanodegree program!

- ► [Lesson 02: Review Anaconda Setup](#)

Review the instructions for installing & configuring Anaconda on your system.

- ► [Lesson 03: Cloud Computing Setup Instructions](#)

Instructions for configuring cloud services with GPU access

- ► [Lesson 04: GPU Workspaces Demo](#)

Introduce & demonstrate the functionality of GPU workspaces in the Udacity classroom

- **Module 02:** Introduction to Deep Learning

- ► [Lesson 01: Deep Neural Networks](#)

Luis will give you solid foundations on Deep Learning, and teach you how to apply Neural Networks to analyze real data!

- **Module 03:** Convolutional Neural Networks

- ► [Lesson 01: Convolutional Neural Networks](#)

Alexis explains the theory behind Convolutional Neural Networks and how they help us dramatically improve performance in image classification.

- ► [Lesson 02: CNN Project: Dog Breed Classifier](#)

In this project, you will learn how to build a pipeline to process real-world, user-supplied images. Given an image of a dog, your algorithm will identify an estimate of the canine's breed.

[Project Description - Dog Breed Classifier](#)

[Project Rubric - Dog Breed Classifier](#)

- **Module 04:** TensorFlow

- ► [Lesson 01: Intro to TensorFlow](#)

In this section you'll get a hands-on introduction to deep learning and Tensorflow, Google's deep learning framework, and you'll be able to apply it on an image dataset.

- **Module 05:** Autoencoders

- ► [Lesson 01: Autoencoders](#)

Autoencoders are neural networks used for data compression, image denoising, and dimensionality reduction. In this lesson, Mat will teach how to build autoencoders using TensorFlow.

- **Module 06:** Recurrent Neural Networks

- ▶ [Lesson 01: Recurrent Neural Networks](#)

Jeremy explains Recurrent Neural Networks, and their cutting edge applications to text-based sequence generation

- ▶ [Lesson 02: Long Short-Term Memory Networks \(LSTM\)](#)

Luis explains Long Short-Term Memory Networks (LSTM), and similar architectures which have the benefits of preserving long term memory.

- ▶ [Lesson 03: Implementing RNNs and LSTMs](#)

In this lesson, Mat will review the concepts of RNNs and LSTMs, and then you'll see how a character-wise recurrent network is implemented in TensorFlow.

- ▶ [Lesson 04: Hyperparameters](#)

In this section, Jay will teach you about some important hyperparameters used for our deep learning work, including those used for Recurrent Neural Networks.

- ▶ [Lesson 05: Sentiment Prediction with RNN](#)

In this lesson you'll implement a sentiment prediction RNN

- ▶ [Lesson 06: RNN Project: Time Series Prediction and Text Generation](#)

In this project you'll build RNNs that can generate sequences based on input data.

[Project Description - Time Series Prediction and Text Generation](#)

[Project Rubric - Time Series Prediction and Text Generation](#)

- **Module 07: Generative Adversarial Networks**

- ▶ [Lesson 01: Generative Adversarial Networks](#)

Ian Goodfellow, the inventor of GANs, introduces you to these exciting models. You'll also implement your own GAN on the MNIST dataset.

- ▶ [Lesson 02: Deep Convolutional GANs](#)

In this lesson you'll implement a Deep Convolution GAN to generate complex color images of house numbers.

- ▶ [Lesson 03: Semisupervised Learning](#)

Ian Goodfellow leads you through a semi-supervised GAN model, a classifier that can learn from mostly unlabeled data.

- **Module 08: Concentrations**

- ▶ [Lesson 01: Concentration Previews](#)

In this final section of the nanodegree, you'll choose a concentration in either Voice User Interfaces, Natural Language Processing, or Computer Vision.

- ▶ [Lesson 02: Intro to Computer Vision](#)

Learn what computer vision is all about, its applications in the field of artificial and emotional intelligence.

- ▶ [Lesson 03: Intro to Natural Language Processing](#)

Find out how Natural Language Processing is being used in the industry, why it is challenging, and learn to design an NLP solution using IBM Watson's cloud-based services.

- ▶ [Lesson 04: Intro to Voice User Interfaces](#)

Voice User Interfaces make interacting with machines more natural and less tedious. Learn how you can design and deploy your own VUI using Amazon's Alexa Skills Kit!

- ▶ [Lesson 05: Choose Your Concentration](#)

## Part 03 : Computer Vision

In this module, you will learn how to build intelligent systems that can see and understand the world using Computer Vision. You'll learn fundamental techniques for tasks like Object Recognition, Face Detection, Video Analysis, etc., and integrate classic methods with more modern Convolutional Neural Networks.

- **Module 01:** Introduction to Computer Vision

- ▶ [Lesson 01: Lesson Plans](#)
- ▶ [Lesson 02: Intro to Computer Vision](#)

Learn what computer vision is all about, its applications in the field of artificial and emotional intelligence.

- ▶ [Lesson 03: Mimic Me!](#)

Learn to track faces in a video and identify facial expressions using Affectiva's Emotion-as-a-Service API!

- **Module 02:** Computer Vision Fundamentals

- ▶ [Lesson 01: Image Representation and Analysis](#)

In this section, you'll learn the fundamentals of computer vision: from how an image is formed to how to process, filter, and transform images!

- ▶ [Lesson 02: Image Segmentation](#)

In this section, you'll learn how to break an image up into segments and areas of interest using a variety of different algorithms!

- ▶ [Lesson 03: Features and Object Recognition](#)

Here, we discuss the end goal of many computer vision applications: feature extraction and object recognition. We'll cover why these are important applications and how to code them!

- ▶ [Lesson 04: CV Capstone: Facial Keypoint Detection](#)

You'll apply what you've learned about the computer vision pipeline and build an end-to-end **facial keypoint recognition system!**

[Project Description - CV Capstone Project](#)

[Project Rubric - CV Capstone Project](#)

- **Module 03:** Completing the Program

- ▶ [Lesson 01: Completing the Program](#)

Congratulations! You've reached the end of the Artificial Intelligence Nanodegree program! Read on to learn how to officially complete the program and graduate.

## Part 04 : Natural Language Processing

In this module, you will build end-to-end Natural Language Processing pipelines, starting from text processing, to feature extraction and modeling for different tasks such as Sentiment Analysis, Spam Detection and Machine Translation. You'll also learn how to design Recurrent Neural Networks for challenging NLP applications.

- **Module 01:** Introduction to Natural Language Processing

- ▶ [Lesson 01: Lesson Plans](#)
- ▶ [Lesson 02: Intro to Natural Language Processing](#)

Find out how Natural Language Processing is being used in the industry, why it is challenging, and learn to design an NLP solution using IBM Watson's cloud-based services.

- ▶ [Lesson 03: Bookworm](#)

Learn how to build a simple question-answering agent using IBM Watson.

- **Module 02:** NLP Fundamentals

- ▶ [Lesson 01: Natural Language Processing](#)

An overview of how to build an end-to-end Natural Language Processing pipeline.

- ▶ [Lesson 02: Text Processing](#)

Learn to prepare text obtained from different sources for further processing, by cleaning, normalizing and splitting it into individual words or tokens.

- ▶ [Lesson 03: Feature Extraction](#)



Transform text using methods like Bag-of-Words, TF-IDF, Word2Vec and GloVe to extract features that you can use in machine learning models.

- ► [Lesson 04: Modeling](#)

A selection of different NLP tasks and how to build models that accomplish them.

- ► [Lesson 05: Machine Translation](#)

Apply the skills you've learnt in Natural Language Processing to the challenging and extremely rewarding task of Machine Translation. *Bonne chance!*

[Project Description - Machine Translation](#)

[Project Rubric - Machine Translation](#)

- **Module 03:** NLP: Supplementary

- ► [Lesson 01: Embeddings and Word2Vec](#)

In this lesson, you'll learn about embeddings in neural networks by implementing the word2vec model.

- ► [Lesson 02: Sequence to Sequence](#)

Here you'll learn about a specific architecture of RNNs for generating one sequence from another sequence. These RNNs are useful for chatbots, machine translation, and more!

- **Module 04:** Completing the Program

- ► [Lesson 01: Completing the Program](#)

Congratulations! You've reached the end of the Artificial Intelligence Nanodegree program! Read on to learn how to officially complete the program and graduate.

## Part 05 : Voice User Interfaces

This module will help you get started in the exciting and fast-growing area of designing Voice User Interfaces! You'll learn how to build Conversational Agents for products and services more natural to interact with. You will also dive deeper into the core challenge of Speech Recognition, applying Recurrent Neural Networks to solve it.

- **Module 01:** Introduction to Voice User Interfaces

- ► [Lesson 01: Lesson Plans](#)
- ► [Lesson 02: Intro to Voice User Interfaces](#)
- ► [Lesson 03: Alexa History Skill](#)

Create your own Alexa History Skill!

- **Module 02:** Speech Recognition

- ► [Lesson 01: Introduction to Speech Recognition](#)

Dive deeper into the exciting field of Speech Recognition, including cutting edge deep learning technologies for Automatic Speech Recognition (ASR).

- ► [Lesson 02: DNN Speech Recognizer](#)

Build an Automatic Speech Recognizer using Deep Learning RNN's

[Project Description - DNN Speech Recognizer](#)

[Project Rubric - DNN Speech Recognizer](#)

- **Module 03:** Completing the Program

- ► [Lesson 01: Completing the Program](#)

Congratulations! You've reached the end of the Artificial Intelligence Nanodegree program! Read on to learn how to officially complete the program and graduate.

## Part 06 (Career): Career: Job Search Strategies

Opportunity can come when you least expect it, so when your dream job comes along, you want to be ready. In the following lessons, you will learn strategies for conducting a successful job search, including developing a targeted resume and cover letter for that job.

- **Module 01:** Conduct a Job Search

- ▶ [Lesson 01: Conduct a Job Search](#)

Learn how to search for jobs effectively through industry research, and targeting your application to a specific role.

- **Module 02:** Refine Your Resume

- ▶ [Lesson 01: Refine Your Entry-Level Resume](#)

Receive a personalized review of your resume. This resume review is best suited for applicants who have 0-3 years of work experience in any industry.

[Project Description - Resume Review Project \(Entry-level\)](#)

[Project Rubric - Resume Review Project \(Entry-level\)](#)

- ▶ [Lesson 02: Refine Your Career Change Resume](#)

Receive a personalized review of your resume. This resume review is best suited for applicants who have 3+ years of work experience in an unrelated field.

[Project Description - Resume Review Project \(Career Change\)](#)

[Project Rubric - Resume Review Project \(Career Change\)](#)

- ▶ [Lesson 03: Refine Your Prior Industry Experience Resume](#)

Receive a personalized review of your resume. This resume review is best suited for applicants who have 3+ years of work experience in a related field.

[Project Description - Resume Review Project \(Prior Industry Experience\)](#)

[Project Rubric - Resume Review Project \(Prior Industry Experience\)](#)

- **Module 03:** Write an Effective Cover Letter

- ▶ [Lesson 01: Craft Your Cover Letter](#)

Get a personalized review of your cover letter. A successful cover letter will convey your enthusiasm, specific technical qualifications, and communication skills applicable to the position.

[Project Description - Craft Your Cover Letter](#)

[Project Rubric - Craft Your Cover Letter](#)

## Part 07 (Career): Career: Networking

Networking is a very important component to a successful job search. In the following lesson, you will learn how to tell your unique story to recruiters in a succinct and professional but relatable way.

- **Module 01:** Develop Your Personal Brand

- ▶ [Lesson 01: Develop Your Personal Brand](#)

In this lesson, learn how to tell your unique story in a succinct and professional way. Communicate to employers that you know how to solve problems, overcome challenges, and achieve results.

- ▶ [Lesson 02: LinkedIn Review](#)

Optimize your LinkedIn profile to show up in recruiter searches, build your network, and attract employers. Learn to read your LinkedIn profile through the lens of a recruiter or hiring manager.

[Project Description - LinkedIn Profile Review Project](#)

[Project Rubric - LinkedIn Profile Review Project](#)

- ▶ [Lesson 03: Udacity Professional Profile](#)

Update and personalize your Udacity Professional Profile as you complete your Nanodegree program, and make your Profile visible to Udacity hiring partners when you're ready to start your job search.

[Project Description - Udacity Professional Profile Review](#)

[Project Rubric - Udacity Professional Profile Review](#)

- **Module 02:** GitHub Profile Review

- ▶ [Lesson 01: GitHub Review](#)

Review how your GitHub profile, projects, and code represent you as a potential job candidate. Learn to assess your GitHub profile through the eyes of a recruiter or hiring manager.

[Project Description - Optimize Your GitHub Profile](#)

[Project Rubric - Optimize Your GitHub Profile](#)

## Part 08 (*Elective*): CVND

- **Module 01:** Intro to CVND

- ▶ [Lesson 01: Image Representation & Classification](#)

Learn how images are represented numerically and implement image processing techniques, such as color masking and binary classification.

- ▶ [Lesson 02: Convolutional Filters and Edge Detection](#)

Learn about frequency in images and implement your own image filters for detecting edges and shapes in an image. Use a computer vision library to perform face detection.

- ▶ [Lesson 03: Types of Features & Image Segmentation](#)

Program a corner detector and learn techniques, like k-means clustering, for segmenting an image into unique parts.

- ▶ [Lesson 04: Feature Vectors](#)

Learn how to describe objects and images using feature vectors.

- ▶ [Lesson 05: CNN Layers and Feature Visualization](#)

Define and train your own convolution neural network for clothing recognition. Use feature visualization techniques to see what a network has learned.

- **Module 02:** Advanced CV & Deep Learning

- ▶ [Lesson 01: Advanced CNN Architectures](#)

Learn about advances in CNN architectures and see how region-based CNN's, like Faster R-CNN, have allowed for fast, localized object recognition in images.

- ▶ [Lesson 02: YOLO](#)

Learn about the YOLO (You Only Look Once) multi-object detection model and work with a YOLO implementation.

- ▶ [Lesson 03: RNN's](#)

Explore how memory can be incorporated into a deep learning model using recurrent neural networks (RNNs). Learn how RNNs can learn from and generate ordered sequences of data.

- ▶ [Lesson 04: Long Short-Term Memory Networks \(LSTMs\)](#)

Luis explains Long Short-Term Memory Networks (LSTM), and similar architectures which have the benefits of preserving long term memory.

- ▶ [Lesson 05: Hyperparameters](#)

Learn about a number of different hyperparameters that are used in defining and training deep learning models. We'll discuss starting values and intuitions for tuning each hyperparameter.

- ▶ [Lesson 06: Optional: Attention Mechanisms](#)

Attention is one of the most important recent innovations in deep learning. In this section, you'll learn how attention models work and go over a basic code implementation.

- ▶ [Lesson 07: Image Captioning](#)

Learn how to combine CNNs and RNNs to build a complex, automatic image captioning model.

- ▶ [Lesson 08: Optional: Cloud Computing with AWS](#)



Take advantage of Amazon's GPUs to train your neural network faster. In this lesson, you'll learn how to setup an instance on AWS and train a neural network on a GPU.

- **Module 03:** Object Tracking & Localization

- ▶ [Lesson 01: Introduction to Motion](#)

This lesson introduces a way to represent motion mathematically, outlines what you'll learn in this section, and introduces optical flow.

- ▶ [Lesson 02: Robot Localization](#)

Learn to implement a Bayesian filter to locate a robot in space and represent uncertainty in robot motion.

- ▶ [Lesson 03: Mini-project: 2D Histogram Filter](#)

Write sense and move functions (and debug) a 2D histogram filter!

- ▶ [Lesson 04: Introduction to Kalman Filters](#)

Learn the intuition behind the Kalman Filter, a vehicle tracking algorithm, and implement a one-dimensional tracker of your own.

- ▶ [Lesson 05: Representing State and Motion](#)

Learn about representing the state of a car in a vector that can be modified using linear algebra.

- ▶ [Lesson 06: Matrices and Transformation of State](#)

Linear Algebra is a rich branch of math and a useful tool. In this lesson you'll learn about the matrix operations that underly multidimensional Kalman Filters.

- ▶ [Lesson 07: Simultaneous Localization and Mapping](#)

Learn how to implement SLAM: simultaneously localize an autonomous vehicle and create a map of landmarks in an environment.

- ▶ [Lesson 08: Optional: Vehicle Motion and Calculus](#)

Review the basics of calculus and see how to derive the x and y components of a self-driving car's motion from sensor measurements and other data.

- **Module 04:** Applications of Computer Vision & Deep Learning

- ▶ [Lesson 01: Applying Deep Learning Models](#)

Try out a few really cool applications of computer vision and deep learning, such as style transfer, using pre-trained models that others have generously provided on Github.

- **Module 05:** Review: Training a Neural Network

- ▶ [Lesson 01: Feedforward and Backpropagation](#)

Short introduction to neural networks: how they train by doing a feedforward pass then performing backpropagation.

- ▶ [Lesson 02: Training Neural Networks](#)

Now that you know what neural networks are, in this lesson you will learn several techniques to improve their training.

- ▶ [Lesson 03: Deep Learning with PyTorch](#)

Learn how to use PyTorch for building deep learning models

- **Module 06:** Skin Cancer Detection

- ▶ [Lesson 01: Deep Learning for Cancer Detection with Sebastian Thrun](#)

Sebastian Thrun teaches us about his groundbreaking work detecting skin cancer with convolutional neural networks.

- **Module 07:** Review: Text Sentiment Analysis

- ▶ [Lesson 01: Sentiment Analysis](#)

In this lesson, Andrew Trask, the author of Grokking Deep Learning, will walk you through using neural networks for sentiment analysis.

- **Module 08:** More Deep Learning Models

- ▶ [Lesson 01: Fully-Convolutional Neural Networks & Semantic Segmentation](#)

Get a high-level overview of how fully-convolutional neural networks work, and see how they can be used to classify every pixel in an image.

- ▶ [Lesson 02: 3D CNN's](#)

Learn about the 3D CNN Architecture, which allows us to add time dimension to our usual x-y image inputs. 3D CNN's are currently being used to analyze and classify video clips.

- **Module 09: C++ Programming**

- ▶ [Lesson 01: C++ Getting Started](#)

The differences between C++ and Python and how to write C++ code.

- ▶ [Lesson 02: C++ Vectors](#)

To program matrix algebra operations and translate your Python code, you will need to use C++ Vectors. These vectors are similar to Python lists, but the syntax can be somewhat tricky.

- ▶ [Lesson 03: Practical C++](#)

Learn how to write C++ code on your own computer and compile it into a executable program without running into too many compilation errors.

- ▶ [Lesson 04: C++ Object Oriented Programming](#)

Learn the syntax of C++ object oriented programming as well as some of the additional OOP features provided by the language.

- ▶ [Lesson 05: Python and C++ Speed](#)

In this lesson, we'll compare the execution times of C++ and Python programs.

- ▶ [Lesson 06: C++ Intro to Optimization](#)

Optimizing C++ involves understanding how a computer actually runs your programs. You'll learn how C++ uses the CPU and RAM to execute your code and get a sense for what can slow things down.

- ▶ [Lesson 07: C++ Optimization Practice](#)

Now you understand how C++ programs execute. It's time to learn specific optimization techniques and put them into practice. This lesson will prepare you for the lesson's code optimization project.

## Part 09 (Elective): NLPND

- **Module 01: Introduction to Natural Language Processing**

- ▶ [Lesson 01: Welcome to Natural Language Processing](#)

Welcome to the Natural Language Processing Nanodegree program!

- ▶ [Lesson 02: Intro to NLP](#)

Arpan will give you an overview of how to build a Natural Language Processing pipeline.

- ▶ [Lesson 03: Text Processing](#)

Learn to prepare text obtained from different sources for further processing, by cleaning, normalizing and splitting it into individual words or tokens.

- ▶ [Lesson 04: Spam Classifier with Naive Bayes](#)

In this section, you'll learn how to build a spam e-mail classifier using the naive Bayes algorithm.

- ▶ [Lesson 05: Part of Speech Tagging with HMMs](#)

Luis will give you an overview of several part-of-speech tagging, including a deeper dive on hidden Markov models.

- ▶ [Lesson 06: \(Optional\) IBM Watson Bookworm Lab](#)

Learn how to build a simple question-answering agent using IBM Watson.

- **Module 02: Computing with Natural Language**

- ▶ [Lesson 01: Feature extraction and embeddings](#)

Transform text using methods like Bag-of-Words, TF-IDF, Word2Vec and GloVe to extract features that you can use in machine learning models.
- ▶ [Lesson 02: Topic Modeling](#)

In this section, you'll learn to split a collection of documents into topics using Latent Dirichlet Analysis (LDA). In the lab, you'll be able to apply this model to a dataset of news articles.
- ▶ [Lesson 03: Sentiment Analysis](#)

Learn about using several machine learning classifiers, including Recurrent Neural Networks, to predict the sentiment in text. Apply this to a dataset of movie reviews.
- ▶ [Lesson 04: Sequence to Sequence](#)

Here you'll learn about a specific architecture of RNNs for generating one sequence from another sequence. These RNNs are useful for chatbots, machine translation, and more!
- ▶ [Lesson 05: Deep Learning Attention](#)

Attention is one of the most important recent innovations in deep learning. In this section, you'll learn attention, and you'll go over a basic implementation of it in the lab.
- ▶ [Lesson 06: RNN Keras Lab](#)

This section will prepare you for the Machine Translation project. Here you will get hands-on practice with RNNs in Keras.
- ▶ [Lesson 07: Cloud Computing Setup Instructions](#)

Overview of the steps to configure remote environment for GPU-accelerated training (Note: NLPND does not include AWS credits)
- **Module 03: Communicating with Natural Language**
  - ▶ [Lesson 01: Intro to Voice User Interfaces](#)

Get acquainted with the principles and applications of VUI, and get introduced to Alexa skills.
  - ▶ [Lesson 02: \(Optional\) Alexa History Skill](#)

Build your own Alexa skill and deploy it!
  - ▶ [Lesson 03: Speech Recognition](#)

Learn how an ASR pipeline works.
- **Module 04: Review: Recurrent Neural Networks**
  - ▶ [Lesson 01: Recurrent Neural Networks](#)

Ortal will introduce Recurrent Neural Networks (RNNs), which are machine learning models that are able to recognize and act on sequences of inputs.
  - ▶ [Lesson 02: Long Short-Term Memory Networks \(LSTM\)](#)

Luis explains Long Short-Term Memory Networks (LSTM), and similar architectures which have the benefits of preserving long term memory.
- **Module 05: Review: Keras**
  - ▶ [Lesson 01: Keras](#)

In this section you'll get a hands-on introduction to Keras. You'll learn to apply it to analyze movie reviews.
- **Module 06: Sentiment Analysis Extras**
  - ▶ [Lesson 01: Sentiment Analysis with Andrew Trask](#)
  - ▶ [Lesson 02: Sentiment Prediction RNN](#)

Implement a sentiment prediction RNN
- **Module 07: Review: TensorFlow**
  - ▶ [Lesson 01: TensorFlow](#)

In this section you'll get a hands-on introduction to TensorFlow, Google's deep learning framework, and you'll be able to apply it on an image dataset.

- **Module 08:** Embeddings & Word2Vec
  - ► [Lesson 01: Embeddings and Word2Vec](#)

In this lesson, you'll learn about embeddings in neural networks by implementing the word2vec model.

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