

# AI Short Courses for Self-Paced Learning

Kee Siong Ng

Nov 2025

## Contents

|          |                                                   |           |
|----------|---------------------------------------------------|-----------|
| <b>1</b> | <b>AI for Everyone</b>                            | <b>2</b>  |
| 1.1      | Learning Objectives . . . . .                     | 2         |
| 1.2      | Course Format . . . . .                           | 2         |
| 1.3      | Supplementary Material (Optional) . . . . .       | 2         |
| <b>2</b> | <b>Generative AI for Everyone</b>                 | <b>3</b>  |
| 2.1      | Learning Objectives . . . . .                     | 3         |
| 2.2      | Course Format . . . . .                           | 3         |
| 2.3      | Supplementary Material (Optional) . . . . .       | 3         |
| <b>3</b> | <b>Foundations of AI</b>                          | <b>4</b>  |
| 3.1      | Learning Objectives . . . . .                     | 4         |
| 3.2      | Course Contents . . . . .                         | 4         |
| 3.3      | Course Format . . . . .                           | 5         |
| 3.4      | Supplementary Material (Optional) . . . . .       | 5         |
| <b>4</b> | <b>Deep Learning – Option 1</b>                   | <b>6</b>  |
| 4.1      | Learning Objectives . . . . .                     | 6         |
| 4.2      | Course Contents . . . . .                         | 6         |
| 4.3      | Course Format . . . . .                           | 7         |
| 4.4      | Supplementary Material (Optional) . . . . .       | 7         |
| <b>5</b> | <b>Deep Learning – Option 2</b>                   | <b>8</b>  |
| 5.1      | Learning Objectives . . . . .                     | 8         |
| 5.2      | Course Contents . . . . .                         | 8         |
| 5.3      | Course Format . . . . .                           | 9         |
| 5.4      | Supplementary Material (Optional) . . . . .       | 9         |
| <b>6</b> | <b>Algorithmic Foundations for Responsible AI</b> | <b>10</b> |
| 6.1      | Learning Objectives . . . . .                     | 10        |
| 6.2      | Course Contents . . . . .                         | 10        |
| 6.3      | Course Format . . . . .                           | 11        |

# 1 AI for Everyone

There are many AI for public interest courses available. A recommended course is the AI for Everyone course offered by Andrew Ng, a renowned AI researcher and educator from Stanford University and co-founder of Google Brain. The lectures are freely available online at

[AI for Everyone \(Coursera\) on Youtube](#)

A paid version of the course, with assignments and certification, is available for USD\$49 at [Deeplearning.ai](#).

## 1.1 Learning Objectives

In this course, you will learn:

- The meaning behind common AI terminology, including neural networks, machine learning, deep learning, and data science
- What AI realistically can – and cannot – do
- How to spot opportunities to apply AI to problems in your organization
- What it feels like to build machine learning and data science projects
- How to work with an AI team and build an AI strategy in your company
- How to navigate ethical and societal discussions surrounding AI

Though this course is largely non-technical, engineers can also take this course to learn the business aspects of AI.

## 1.2 Course Format

In total, 6 hours of video lectures broken into 35 videos of 7-10 minutes each, delivered over 4 weeks. The paid version has weekly assignments. Self-paced learners can likely go through the video lectures in a lot less than 4 weeks.

## 1.3 Supplementary Material (Optional)

1. [AI Snake Oil: What Artificial Intelligence Can Do, What It Can't, and How to Tell the Difference](#) by Arvind Narayanan and Sayash Kapoor
2. [Understanding AI substack](#) – Requires subscription for full access
3. [Me Myself and AI](#) Podcast by MIT Sloan Management Review and BCG
4. [Against the Gods: The Remarkable Story of Risk](#) by Peter L. Bernstein
5. [Superforecasting: The Art and Science of Prediction](#) by Philip Tetlock and Dan Gardner
6. [The Wisdom of Crowds](#) by James Surowiecki
7. [The Book of Why](#) by Judea Pearl and Dana Mackenzie
8. [The Signal and the Noise: The Art and Science of Prediction](#) and other books by Nate Silver

## 2 Generative AI for Everyone

The world of AI has changed rapidly since the release of ChatGPT in Nov 2022. Large language models (LLMs) and other generative AI applications have taken the world by storm and continue to evolve rapidly. This is another recommended course by Andrew Ng, a renowned AI researcher and educator from Stanford University and co-founder of Google Brain, on Generative AI for Everyone. The lectures are freely available online at

[Generative AI for Everyone \(Coursera\) on Youtube](#)

A paid version of the course, with assignments and certification, is available at [DeepLearning.ai](#).

### 2.1 Learning Objectives

In this course, you will:

- learn the technology of generative AI, how it works, and what it can and cannot do;
- learn to debunk misinformation about generative AI and think through how to use this technology best in your life and at work.
- get an overview of generative AI tools, and learn from real-world examples of generative AI in use today;
- understand the impacts of generative AI on business and society to develop effective AI strategies and approaches.

### 2.2 Course Format

About 30 video lectures of 5-10 minutes each, delivered over 3 weeks. The paid version has weekly assignments. Self-paced learners can likely go through the video lectures in a lot less than 3 weeks.

### 2.3 Supplementary Material (Optional)

1. [What is ChatGPT Doing .. and Why Does It Work?](#) by Stephen Wolfram
2. [Transformers from Scratch](#) by Peter Bloem
3. [Transformers from Scratch](#) by Brandon Rohrer
4. [The Illustrated Transformer](#) and many [other visualisations of Gen AI concepts](#) by Jay Alammar
5. [Understanding AI substack](#) – Requires subscription for full access
6. [Google DeepMind: The Podcast](#)

## 3 Foundations of AI

This is a recommended technical first course on the foundations of AI. It is offered by top AI researchers Peter Norvig and Sebastian Thrun and covers essential techniques like search algorithms, symbolic logic, planning systems and probabilistic modelling and inference. The course will take 2 months to complete. It costs USD\$700 and is available at

[Artificial Intelligence Nanodegree at Udacity](#).

### 3.1 Learning Objectives

In this course, you will learn:

- the basics of how to build intelligent agents that can strategise, optimise, and make decisions independently;
- algorithms for problem-solving and automated planning used in robotics and complex logistical systems.

### 3.2 Course Contents

The course is broken into 6 modules:

**Introduction to AI** In this module, you'll learn about the foundations of AI. You'll configure your programming environment to work on AI problems with Python. At the end of the course you'll build a Sudoku solver and solve constraint satisfaction problems.

**Classical Search** In this module, you'll learn classical graph search algorithms, including uninformed search techniques like breadth-first and depth-first search and informed search with heuristics including A\*. These algorithms are at the heart of many classical AI techniques, and have been used for planning, optimization, problem solving, and more.

**Automated Planning** In this module, you'll learn how to represent general problem domains with symbolic logic and use search to find optimal plans for achieving your agent's goals. Planning and scheduling systems power modern automation and logistics operations, and aerospace applications like the Hubble telescope and NASA Mars rovers.

**Optimisation Problems** In this module, you'll learn about iterative improvement optimization problems and classical algorithms (with emphasis on gradient-free) methods for solving them. These techniques can often be used on intractable problems to find solutions that are "good enough" for practical purposes, and have been used extensively in fields like Operations Research and logistics.

**Adversarial Search** In this module, you'll learn how to search in multi-agent environments (including decision making in competitive environments) using the minimax theorem from game theory.

**Probabilistic Graphical Models** In this module, you'll learn how to use Bayesian Networks to represent complex probability distributions, and algorithms for sampling from those distributions, including algorithms used to train, predict, and evaluate Hidden Markov Models for pattern recognition. HMMs have been used for gesture recognition in computer vision, gene sequence identification in bioinformatics, speech generation and part of speech tagging in natural language processing, and more.

### 3.3 Course Format

This specialisation is made up of 6 modules, with each one lasting about 1-3 weeks. The required time commitment is about 5 hours per week, including video lectures and weekly assignments.

### 3.4 Supplementary Material (Optional)

1. [Artificial Intelligence: A Modern Approach, 4th Edition](#) by Stuart Russell and Peter Norvig
2. [An Introduction to Probability and Inductive Logic](#) by Ian Hacking
3. [Probabilistic Machine Learning: An Introduction](#) by Kevin Murphy
4. [Reinforcement Learning: An Introduction](#) by Richard Sutton and Andrew Barto
5. [Multi-Agent Reinforcement Learning: Foundations and Modern Approaches](#) by S. Albrecht, F. Christianos, and L. Schäfer
6. [Mathematics for Machine Learning](#) by M.P. Deisenroth, A.A. Faisal and C.S. Ong
7. [Probability Theory: The Logic of Science](#) by E.T. Jaynes
8. [An Introduction to Statistical Learning with Applications in R and Python](#) by G. James, D. Witten, T. Hastie and R. Tibshirani.

## 4 Deep Learning – Option 1

This intermediate-level Deep Learning Specialisation course is recommended for practitioners with some existing machine learning experience who want to do self-paced learning on the topic of Deep Learning. The total course will take 2-6 months to complete. It costs USD\$300 and is available at

<https://www.deeplearning.ai/courses/deep-learning-specialization>

### 4.1 Learning Objectives

In this course, you will

- learn how deep neural networks work mathematically; and
- how to build them from the ground up via guided coding sessions.

### 4.2 Course Contents

There are five mini courses:

**Neural Networks and Deep Learning** In the first course, you will study the foundational concept of neural networks and deep learning. By the end, you will be familiar with the technological trends driving the rise of deep learning; build, train, and apply fully connected deep neural networks; implement efficient (vectorized) neural networks; identify key parameters in a neural network’s architecture; and apply deep learning to your own applications.

**Hyperparameter Tuning, Regularization, and Optimization** In the second course, you will open the deep learning black box to understand the processes that drive performance. By the end, you will learn the best practices to train and develop test sets and analyze bias/variance for building deep learning applications; be able to use standard neural network techniques such as initialization, L2 and dropout regularization, hyperparameter tuning, batch normalization, and gradient checking; implement and apply various optimization algorithms, such as mini-batch gradient descent, Momentum, RMSprop, and Adam, and check for their convergence; and implement a neural network in TensorFlow.

**Structuring Machine Learning Projects** In the third course, you will learn how to build a successful machine learning project and get to practice decision-making as a machine learning project leader. By the end, you will be able to diagnose errors in a machine learning system; prioritize strategies for reducing errors; and apply end-to-end learning, transfer learning, and multi-task learning.

**Convolutional Neural Networks** In the fourth course, you will understand how computer vision has evolved and become familiar with applications

such as autonomous driving, face recognition, reading radiology images, and more. By the end, you will be able to build a convolutional neural network, including recent variations such as residual networks; apply convolutional networks to visual detection and recognition tasks; and use neural style transfer to generate art and apply these algorithms to a variety of image, video, and other 2D or 3D data.

**Sequence Models** In the fifth course, you will become familiar with sequence models and their applications such as speech recognition, music synthesis, chatbots, machine translation, natural language processing (NLP), and more. By the end, you will be able to build and train Recurrent Neural Networks (RNNs) and commonly-used variants such as GRUs and LSTMs; apply RNNs to Character-level Language Modeling; gain experience with natural language processing and Word Embeddings; and use HuggingFace tokenizers and transformer models to solve different NLP tasks such as NER and Question Answering.

### 4.3 Course Format

This specialisation is made up of 5 mini courses, with each one lasting about 5 weeks. The required time commitment is about 5 hours per week, including video lectures and weekly assignments.

### 4.4 Supplementary Material (Optional)

1. [Deep Learning](#) by Ian Goodfellow, Yoshua Bengio and Aaron Courville
2. [A Recipe for Training Neural Networks](#) by Andrej Karpathy
3. [Beginners Guide to Convolutional Neural Network from Scratch – Kuzushiji-MNIST](#)
4. [Denoising Diffusion Probabilistic Models in Six Simple Steps](#) by R. Turner et al.

## 5 Deep Learning – Option 2

This intermediate-level Practical Deep Learning course is recommended for practitioners with some coding experience who want to do self-paced learning on how to apply deep learning and machine learning to practical problems. It doesn't matter if you don't come from a technical or a mathematical background (though it's okay if you do too!); we wrote The course was designed to make deep learning accessible to as many people as possible. The only prerequisite is at least one year of coding experience, preferably in Python; no university-level mathematics is required. The course is available for free online, and will take about 1-2 months to complete. It is available at

<https://course.fast.ai>

### 5.1 Learning Objectives

In this course, you will learn

- How to train models that achieve state-of-the-art results in:
  - Computer vision, including image classification;
  - Natural language processing (NLP), including document classification and phrase similarity
  - Tabular data with categorical data, continuous data, and mixed data
  - Collaborative filtering
- How to turn your models into web applications, and deploy them
- Why and how deep learning models work, and how to use that knowledge to improve the accuracy, speed, and reliability of your models
- The latest deep learning techniques that really matter in practice
- How to implement stochastic gradient descent and a complete training loop from scratch

### 5.2 Course Contents

Here are some of the techniques covered:

- Random forests and gradient boosting
- Affine functions and nonlinearities
- Parameters and activations
- Transfer learning
- Stochastic gradient descent (SGD)
- Data augmentation
- Weight decay
- Image classification

- Entity and word embeddings

In this course, you will be using [PyTorch](#), [fastai](#), and [Hugging Face Transformers](#). PyTorch is now the world's fastest-growing deep learning library and is already used for most research papers at top conferences. PyTorch works best as a low-level foundation library, providing the basic operations for higher-level functionality. The fastai library is one of the most popular libraries for adding this higher-level functionality on top of PyTorch. Hugging Face Transformers is a popular library focused on natural language processing (NLP) using transformers models.

### 5.3 Course Format

There are 9 lessons, and each lesson is around 90 minutes long. The lessons can be taken at one's own pace.

### 5.4 Supplementary Material (Optional)

1. [Deep Learning](#) by Ian Goodfellow, Yoshua Bengio and Aaron Courville
2. [minGPT: A minimal PyTorch re-implementation of the OpenAI GPT training](#) by Andrej Karpathy. (See also [nanoGPT](#): the simplest, fastest repository for training / finetuning medium-sized GPTs.)
3. [A Recipe for Training Neural Networks](#) by Andrej Karpathy
4. [Beginners Guide to Convolutional Neural Network from Scratch – Kuzushiji-MNIST](#)
5. [Natural Language Processing with Transformers](#) by L. Tunstall, L. von Werra, and T. Wolf
6. [Denoising Diffusion Probabilistic Models in Six Simple Steps](#) by R. Turner et al.

## 6 Algorithmic Foundations for Responsible AI

### 6.1 Learning Objectives

The goal of this short course is to equip practitioners with a working knowledge on how important Responsible AI (RAI) concepts like privacy, explainability, and fairness can be incorporated into data engineering pipelines and the design of AI/ML algorithms and models in a defensible and pragmatic manner.

This short course is targeted at scientists and engineers who build and maintain AI/ML models and supporting software and data infrastructure in application domains with strong RAI requirements. Course attendees are expected to have a basic working knowledge of data engineering, data analytics, and AI/ML model building before starting this short course.

### 6.2 Course Contents

The design of the course is, in part, motivated by this quote by Clifford Truesdell:

There is nothing that can be said by mathematical symbols and relations which cannot also be said by words. The converse, however, is false. Much that can be and is said by words cannot successfully be put into equations, because it is nonsense.

In particular, we will take an inter-disciplinary approach to formalise social and legal concepts in RAI using a variety of mathematical models and present solutions to RAI problems that are *achievable* today.

The course is in three parts:

**Privacy** In this part, we will cover some key technologies in Confidential Computing. We first introduce a formal notion of privacy called Differential Privacy and show how it can be used to manage privacy risks in large-scale statistical data analysis and the subsequent publishing of statistical data. We then introduce two classes of algorithms, Homomorphic Encryption and Secure Multiparty Computaton, that allow multiple parties to jointly perform a computation without any party having to reveal its private information to the others. This part concludes with some real-world Intelligence applications.

**Explainability** In this part, we will be looking at different ways explainability can be sensibly achieved. Causal inference using graphical models that can be used to capture human domain knowledge and perform counterfactual what-if reasoning will be studied. We will also look at different formalisms for representing knowledge, how they can be used in AI/ML models, and the trade-off between model accuracy and model explainability from a Bayesian probability perspective.

**Fairness** In this part, we will investigate how bias can come from flaws in the data-collection process, and how these biases can then be reinforced in

AI/ML models built from such datasets. To partially address these issues, we will look at how notions of fairness can be incorporated into the optimisation criteria that underlie common AI/ML algorithms. We will also study how social choice theory, which cover the design of auctions, election systems, and market places that maximise notions of social welfare, can be used to coordinate and align multi-agent systems where the agents may have conflicting goals.

Each of the topics will be covered with a balanced mix of theory and practice.

### **6.3 Course Format**

A series of 45-minute lectures, supported by lab exercises and background reading material for self-paced learning.