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This course is part of the [TensorFlow: Advanced Techniques Specialization](#)

# Custom and Distributed Training with TensorFlow

4.8 • 88 ratings • 15 reviews



Laurence Moroney +1 more instructor

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## About this Course

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In this course, you will:

- Learn about Tensor objects, the fundamental building blocks of TensorFlow, understand the difference between the eager and graph modes in TensorFlow, and learn how to use a TensorFlow tool to calculate gradients.
- Build your own custom training loops using GradientTape and TensorFlow Datasets to gain more flexibility and visibility with your model training.
- Learn about the benefits of generating code that runs in graph mode, take a peek at what graph code looks like, and practice generating this more efficient code automatically with TensorFlow's tools.
- Harness the power of distributed training to process more data and train larger models, faster, get an overview of various distributed training strategies, and practice working with a strategy that trains on multiple GPU cores, and another that trains on multiple TPU cores.

The DeepLearning.AI TensorFlow: Advanced Techniques Specialization introduces the features of TensorFlow that provide learners with more control over their model architecture and tools that help them create and train advanced ML models.

This Specialization is for early and mid-career software and machine learning engineers with a foundational understanding of TensorFlow who are looking to expand their knowledge and skill set by learning advanced TensorFlow features to build powerful models.

### SKILLS YOU WILL GAIN

- Distribution Strategies
- Custom Training Loops
- Basic Tensor Functionality
- GradientTape for Optimization



### Shareable Certificate

Earn a Certificate upon completion



### 100% online

Start instantly and learn at your own schedule.



### Course 2 of 4 in the

[TensorFlow: Advanced Techniques Specialization](#)

### Flexible deadlines

Reset deadlines in accordance to your schedule.



### Intermediate Level

- Basic calculus, linear algebra, stats
- Knowledge of AI, deep learning
- Experience with Python, TF/Keras/PyTorch framework, decorator, context manager



### Approx. 24 hours to complete



### English

Subtitles: English

## Instructors

Instructor rating 5/5 (18 Ratings) [\(i\)](#)**Laurence Moroney**

Instructor

Lead AI Advocate, Google

288,084 Learners

14 Courses

**Eddy Shyu**

Senior Curriculum Developer

Product Lead, DeepLearning.AI

113,105 Learners

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### DeepLearning.AI

DeepLearning.AI is an education technology company that develops a global community of AI talent.

DeepLearning.AI's expert-led educational experiences provide AI practitioners and non-technical professionals with the necessary tools to go all the way from foundational basics to advanced application, empowering them to build an AI-powered future.

A horizontal testimonial slider showing two reviews. On the left, a testimonial from Sonal T. on a grey background: "My life since I discovered AI knowledge helped me become confident." — Sonal T. On the right, a testimonial from Chaitanya A. on a white background: "Learning isn't just about being better at your job; it's so much more than that. Coursera allows me to learn without limits." — Chaitanya A. Navigation arrows < and > are on the sides, and three small circles at the bottom center indicate the slide's position.

## People interested in this course also viewed

A horizontal grid of four course thumbnails. Each thumbnail features a colored background (green, dark green, purple, green) with a white square containing the red DeepLearning.AI logo. To the right of each logo is the course title, provider, and a '1 COURSE' badge. Navigation arrows < and > are on the sides.

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## Syllabus - What you will learn from this course

WEEK



5 hours to complete

1

### Differentiation and Gradients

This week, you will get a detailed look at the fundamental building blocks of TensorFlow - tensor objects. For example, you will be able to describe the difference between eager mode and graph mode in TensorFlow, and explain why eager mode is very user friendly for you as a developer. You will also use TensorFlow tools to calculate gradients so that you don't have to look for your old calculus textbooks next time you need to get a gradient!



12 videos (Total 51 min), 2 readings, 2 quizzes [SEE LESS](#)

▶ 12 videos

A conversation with Andrew Ng: Overview of course 2 4m

What is a tensor? 4m

Creating tensors in code 6m

Math operations with tensors 1m

Basic Tensors code walkthrough 4m

Broadcasting, operator overloading and Numpy compatibility 6m

Evaluating variables and changing data types 4m

Gradient Tape 4m

Gradient Descent using Gradient Tape 4m

Calculate gradients on higher order functions 4m

Persistent=true and higher order gradients 2m

Gradient Tape basics code walkthrough 3m

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### 2 readings

Connect with your mentors and fellow learners on Slack! 10m

Reference: CNN for visual recognition 10m

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### 1 practice exercise

Tensors and Gradient Tape 30m

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WEEK

## 4 hours to complete

# 2

### Custom Training

This week, you will build custom training loops using `GradientTape` and `TensorFlow Datasets`. Being able to write your own training loops will give you more flexibility and visibility with your model training. You will also use a function to calculate the derivatives of functions so that you don't have to look to your old calculus textbooks to calculate gradients.

### 8 videos

8 videos (Total 46 min), 1 reading, 2 quizzes [SEE LESS](#)

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### 8 videos

Custom Training Loop steps 3m

Loss and gradient descent 4m

Define Training Loop and Validate Model 2m

Training Basics code walkthrough 5m

Training steps and data pipeline 4m

Define the training loop 4m

Gradients, metrics, and validation 4m

Fashion MNIST Custom Training Loop code walkthrough 15m

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### 1 reading

Reference: `tf.keras.metrics` 10m

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### 1 practice exercise

Custom Training 30m

WEEK



5 hours to complete

3

## Graph Mode

This week, you'll learn about the benefits of generating code that runs in "graph mode". You'll take a peek at what graph code looks like, and you'll practice generating this more efficient code automatically with TensorFlow's tools, so that you don't have to write the graph code yourself!



6 videos (Total 35 min), 1 reading, 2 quizzes [SEE LESS](#)



6 videos

Benefits of graph mode 3m

Generating graph code 4m

AutoGraph Basics code walkthrough 5m

Control dependencies and flows 4m

Loops and tracing variables 4m

AutoGraph code walkthrough 11m



1 reading

Reference: Fizz Buzz 10m



1 practice exercise

AutoGraph 30m

WEEK



10 hours to complete

4

## Distributed Training

This week, you will harness the power of distributed training to process more data and train larger models, faster. You'll get an overview of various distributed training strategies and then practice working with two strategies, one that trains on multiple GPU cores, and the other that trains on multiple TPU cores. Get your cape ready, because you're going to get some superpowers this week!



9 videos (Total 56 min), 3 readings, 3 quizzes [SEE LESS](#)



9 videos

Intro to distribution strategies 3m

Types of distribution strategies 3m

Converting code to the Mirrored Strategy 4m

Mirrored Strategy code walkthrough 4m

Custom Training for Multiple GPU Mirrored Strategy 5m

Multi GPU Mirrored Strategy code walkthrough 13m

TPU Strategy 6m

TPU Strategy code walkthrough 10m

Other Distributed Strategies 4m



3 readings

References used in Other Distributed Strategies 10m

References 10m

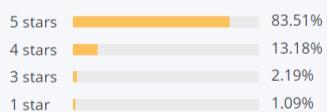
Acknowledgments 10m

 1 practice exercise

Distributed Strategy 30m

## Reviews

**4.8**   
15 reviews



### TOP REVIEWS FROM CUSTOM AND DISTRIBUTED TRAINING WITH TENSORFLOW



by AA Feb 2, 2021

great to learn things about writing custom training loops, and distributed training of deep learning models.



by DG Nov 27, 2020

A very detailed course with lots of nitty gritty. Learned a lot and of course enjoyed it thoroughly.



by NS Feb 28, 2021

This course was fantastic! Laurence and DeepLearning.ai team did great job. Definitely recommended.



by AA Jan 21, 2021

He is a very good instructor and the content is well prepared, also the course covers rare topics.

[View all reviews](#)

## About the TensorFlow: Advanced Techniques Specialization

About TensorFlow

TensorFlow is an end-to-end open-source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries, and community resources that let you build and deploy machine learning models across many platforms.

[SHOW ALL](#)



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**1 COURSE**



**Advanced Computer Vision with TensorFlow**  
DeepLearning.AI  
**1 COURSE**



**Generative Deep Learning with TensorFlow**  
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