UDACITY
Part of Accenture

SCHOOL OF ARTIFICIAL INTELLIGENCE

Generative AI

Syllabus

UDACITY.COM

Overview

Embark on a transformative journey into Generative AI! We'll start by diving into the essentials with an introductory course, progress to mastering text generation with Large Language Models, unravel the complexities of image creation in computer vision and cap it off by bringing AI to life in real-world applications. From foundational theories to building sophisticated chatbots and AI agents, this program will empower you with job-ready skills in the exciting field of Generative AI.

Nanodegree Program | Intermediate | 50 hours | 4.9 (26 Reviews)

Prerequisites

Prior to enrolling, you should have the following knowledge:

Database fundamentals | Intermediate Python

You will also need to be able to communicate fluently and professionally **in written and spoken English**.

Skills You'll Learn

Generative AI Fundamentals

Generative AI Fluency | Image classification | Transfer learning | Training neural networks | Hugging Face | Parameter-Efficient Fine-Tuning | Prompt Engineering | Deep learning | PyTorch | Foundation Models | Ethical AI

Large Language Models (LLMs) & Text Generation

Together AI API | Search implementation in Python | NLP transformers | GPT | Selenium | Large Language Models | Data cleaning | Natural language processing | Bert | OpenAI API | Retrieval-Augmented Generation | Transformer neural networks | Prompt Engineering | Pandas | PyTorch | Tokenization | Cosine | API requests | Recurrent neural networks | Attention mechanisms | Text generation | Beautifulsoup | Data quality assessment | Word embeddings | Data scraping

Computer Vision and Generative AI

Image pre-processing | Transfer learning | Word embeddings | Ethical AI | Diffusion Models | Yolo algorithm | Model evaluation | Text generation | Computer vision fluency | Image classification | Large Language Models | Pandas | Image generation | Training neural networks | Convolutional neural networks | Parameter-Efficient Fine-Tuning | Image segmentation | Computer Vision Transformers | Tokenization | Data quality assessment | Generative adversarial networks

Building Generative AI Solutions

Vectors | Retrieval-Augmented Generation | OpenAI API | LangChain

Courses

01. Welcome to the Nanodegree Program!

45 minutes

Welcome to Udacity! We're excited to share more about your Nanodegree program and start this journey with you!

L1 Welcome!	Welcome to Udacity. Takes 5 minutes to get familiar with Udacity courses and gain some tips to succeed in courses.
L2 Getting Help	You are starting a challenging but rewarding journey! Take 5 minutes to read how to get help with projects and content.

02. Generative AI Fundamentals

14 hours

Dive into generative AI with this course, which explores its fundamental principles and relationship to prior artificial intelligence innovations. We will walk through popular generative models and how they work, how deep learning models are developed using tools like PyTorch and Hugging Face, and finally, how to customize pre-trained open-source models for a specific use case. In the project, you will apply a cutting-edge technique called parameter-efficient fine-tuning (PEFT), which allows for the adaptation of massive foundation models with minimal usage of computational resources.

L1 Introduction to Generative AI Fundamentals	This lesson provides the foundational knowledge needed about generative AI: what it is, how it's applied, and explanations of some popular algorithms and architectures for text and image generation.
L2 Deep Learning Fundamentals	This lesson covers the essentials of deep learning for the generative AI practitioner. From perceptrons to transfer learning including an introduction to the PyTorch and Hugging Face Python libraries.
L3 Foundation Models	This lesson explores foundation models in AI, how they differ from traditional models, how you can apply them to various tasks and evaluate their performance, and the ethical implication of their use.
L4 Adapting Foundation Models	This lesson covers a range of techniques for adapting foundation models, including prompt tuning, in-context learning, full fine-tuning, and parameter-efficient fine-tuning (PEFT).
L5 Project: Apply Lightweight Fine-Tuning to a Foundation Model	Load and customize a Hugging Face foundation model using parameter-efficient fine-tuning. This technique allows you to harness the power of a pre-trained model for your custom task.

03. Large Language Models (LLMs) & Text Generation

12 hours

Dive deeper into how computers understand and create language, and learn how to build a custom chatbot using unsupervised machine learning, prompt engineering, and retrieval augmented generation. We'll start with a high-level overview of the types of LLMs, the differences between them, and how best to account for their strengths and weaknesses. Then we'll get into the internal details, including natural language processing (NLP) techniques like tokenization, as well as modern transformer architectures and attention mechanisms. Finally, we'll build a practical LLM application that combines an LLM with a custom dataset.

L1	Introduction to LLMs	This lesson covers the types of LLMs, an intuitive understanding of their limitations and capabilities, inference and decoding hyperparameters, and strategies for effective prompt engineering.
L2	NLP Fundamentals	This lesson covers the essential Natural Language Processing topics needed to use the latest LLM technology. You will learn the basics of NLP and then dive into text encoding and text generation.
L3	Transformers and Attention Mechanism	In this lesson, you will open up the black box of transformer architectures and learn about the attention mechanisms and other components that make these powerful models possible.
L4	Retrieval Augmented Generation	In this lesson, we will learn how to create a custom Q&A bot powered by OpenAI! Along the way, you'll learn how OpenAI works and how to leverage its powerful language processing capabilities.
L5	Build Custom Datasets for LLMs	In this lesson, you will learn how to construct a relevant, quality dataset for fine-tuning large language models and performing retrieval augmented generation.
L6	Project: Project: Build Your Own Custom Chatbot	For this project, you will use everything you learned in this course to create a custom chatbot using a dataset of your choice.

04. Computer Vision and Generative AI

11 hours

Learn how computers process and understand image data, then harness the power of the latest Generative AI models to create new images.

L1	Introduction to Image Generation	In this lesson, you will define image generation and understand its relevance in AI and machine learning.

L2	Computer Vision Fundamentals	Learn how computers see images and perform key image processing techniques using classic image processing techniques such as image transformation, noise reduction, and more.
L3	Image Generation and GANs	Explore the landscape of Gen AI tools for Computer Vision and learn how they are evaluated. Learn what a generative adversarial network is and how it is utilized to generate images.
L4	Transformer-Based Computer Vision Models	In this lesson, we will be exploring Vision Transformers and the architecture that makes them work. Along the way we will explore Vision Transformers like DALL-E, DINO, and SAM.
L5	Diffusion Models	Learn the fundamentals of transformers. Then, get hands-on with the creation of a diffusion algorithm and work with Huggingface Diffusers to generate and work with images.
L6	Project: Project: AI Photo Editing with Inpainting	In this project, you will utilize Generative AI to take a famous painting and swap out the background with an image generated by Stable Diffusion.

05. Building Generative AI Solutions

14 hours

Gain the skills to build advanced AI systems with real-world impact. Start by teaching AI to interpret human language through semantic search, then manage complex data structures with vector databases. Get hands-on with LangChain to develop adaptive language models, gaining the expertise to bring AI-driven solutions to life. With a focus on practical applications across industries, you'll learn to create user-friendly AI solutions that truly stand out. By the end, you'll be equipped to design innovative systems that redefine what's possible, ready to apply your expertise wherever AI can make a difference.

L1	Introduction to Building Generative Apps	This lesson explores the design and implementation of Generative AI using Large Language Models in features, applications, and solutions.
L2	Building Solutions with Vector Databases	This lesson covers vector databases, crucial for enhancing AI's long-term memory. Topics include core concepts, retrieval methods, and advanced indexing.
L3	Developing Generative AI Solutions with LangChain	In this lesson, you will explore and get hands-on with LangChain, a framework for working with large language models (LLM) and powering the next generation of AI apps.
L4	Project: Project: Personalized Real Estate Agent	In this project, you'll create a "Real Estate Agent" that uses large language models for content generation, and vector databases for semantic search to provide personalized real estate listings.

06. Congratulations!

10 minutes

Congratulations on finishing your program!

L1	Congratulations!	Congratulations on your graduation from this program! Please join us in celebrating your accomplishments.

Meet Your Instructors

Brian Cruz

Head of Core AI at Samba TV

Brian Cruz is the Head of Core AI at Samba TV, where he leads the initiative to use AI to improve the TV viewing experience. He formerly worked at Salesforce as a Machine Learning Engineer, creating models for forecasting sales revenue as part of Einstein Guidance. He has a degree in Pure Mathematics from UC Berkeley.

Emily McMilin

Research Scientist

Emily McMilin is a Senior Research Scientist and Independent Researcher working at the intersection of NLP and Causal Inference. She obtained her Ph.D. in Electrical Engineering from Stanford University and prior to that an M.Sc. from University of Victoria, and a B.Sc. from Stanford in Symbolic Systems.

Victor Geislinger

Machine Learning Engineer

Victor Geislinger is a machine learning engineer and is dedicated to sharing his knowledge with others. Victor recently joined Google as a software engineer focused on AI/ML but has been programming and educating others for over a decade.

Jason Lin

Chief Scientist, Reasonly AI

Jason has developed deep learning algorithms and AI applications at Lyft self-driving, Spotify and Google DeepMind. Formerly a Stanford Online and UN keynote speaker, he's earned a M.S. in Machine Learning from Georgia Tech and coauthored NLP and computer vision papers with MIT.

Erick Galinkin

Principal AI Researcher

Erick Galinkin is a hacker and computer scientist, leading research at the intersection of security and artificial intelligence at Rapid7. He has spoken at numerous industry and academic conferences on topics ranging from malware development to game theory in security.

Giacomo Vianello

Principal Data Scientist

Giacomo Vianello is an end-to-end data scientist with a passion for state-of-the-art but practical technical solutions. He is Principal Data Scientist at Cape Analytics, where he develops AI systems to extract intelligence from geospatial imagery bringing, cutting-edge AI solutions to the insurance and real estate industries.

Chuyi Shang

UC Berkeley ML Researcher

Chuyi Shang is a machine learning researcher at Berkeley and a member of the Machine Learning @ Berkeley organization. He conducts research in video understanding and multimodal learning at Berkeley's AI Research Lab (BAIR), and has also conducted ML research at Berkeley's Haas School of Business.

Annabel Ng

UC Berkeley ML Researcher

Annabel Ng is an EECS undergrad at UC Berkeley, where she's researching brain-inspired vision models to improve image encodings in a Berkeley AI Research lab. She also leads the workshop division at Machine Learning @ Berkeley where she delivers lectures and develops interactive ML content for students.

Derek Xu

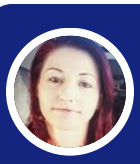
Derek Xu, VP of Education of Machine Learning @ Berkeley

Derek Xu is the Vice President of Education of Machine Learning @ Berkeley. He studies EECS and Business Administration through the M.E.T. Program and teaches a modern computer vision course at UC Berkeley. Derek was previously a machine learning engineering intern at TikTok working on the ML Platforms team, and an undergraduate researcher at UC Berkeley Sky Computing Lab. He also has experience as a software engineering intern at Salesforce and Ramp.

Nathaniel Haynam

ML Researcher at BAIR

Nathaniel Haynam is an ML Researcher at BAIR, where they push the edge of inverse reinforcement learning for multi-agent simulations. They are a ML Engineer and Lecturer in Machine Learning at Berkeley, teaching a modern computer vision course at UC Berkeley. They are a computer science major at UC Berkeley.



Valerie Scarlata

Senior Technical Content Developer at Udacity

Valerie is a Sr. Technical Content Developer at Udacity who has developed and taught a broad range of computing curricula for multiple colleges and universities. She is a former professor and software engineer for over 10 years specializing in web, mobile, voice assistant, and full-stack application development.

Chang She

CEO and Co-founder of LanceDB

Chang has nearly two decades of experience building and teaching data / ML tooling. He was the second major contributor to pandas, an adjunct at Columbia for introduction to data science, and ran engineering at TubiTV focusing on recommender systems. Most recently, Chang co-founded LanceDB to build the next generation database for AI.

Sergei Kozyrenko

Senior Staff Engineer

Sergei Kozyrenko is a technology leader with over 20 years of diverse industry experience - he's built trading engines, banking software, learning management systems, co-founded an AI startup that accurately predicted street parking availability and even automated shooting of high-powered lasers at blocks of chocolate.

Why Udacity

Demonstrate proficiency with practical projects

Projects are based on real-world scenarios and challenges, allowing you to apply the skills you learn to practical situations, while giving you real hands-on experience

- ✓ Gain proven experience
- ✓ Retain knowledge longer
- ✓ Apply new skills immediately

24/7 access to real human support

Reviewers provide timely and constructive feedback on your project submissions, highlighting areas of improvement and offering practical tips to enhance your work

- ✓ Get help from subject matter experts
- ✓ Gain valuable insights and improve your skills
- ✓ Learn industry best practices