Generative AI

COURSE OUTLINE

Module01: Overview of Generative AI

Module02: Introduction to GANs

Module03: Introduction to VAEs

Module04: Introduction to Diffusion Models

Module05: Introduction to Transformers

Module06: Reinforcement Learning for Generative models

Module07: Project Planning & Dataset Preparation

Module 08: Project Proposal

Module 09: Basics of Generative Models

Module 10: Variants of GANs

Module 11: Advanced VAE Topics

Module 12: Implementing Diffusion Models

Module 13: Advanced Transformer Models

Module 14: Ethics and Bias in Generative Ai

Module 15: Model Building and Training

Module 16: Practical Implementation

Module 17: Future Directions and Research

Module 18: Deployment & Production

Module 19: Evaluation and Presentation

Module01

Overview of Generative Ai

Definition and scope of generative AI

Historical context and key milestones

Applications in various fields (art, text, audio, video)

Module02

Introduction to GANs

Basic architecture of GANs (Generator and Discriminator)

Training process and loss functions

Challenges and common pitfalls (mode collapse, training instability)

Module03

Introduction to VAEs

Understanding autoencoders and their limitations

VAE architecture and reparameterization trick

Loss functions: reconstruction loss and KL divergence

Module04

Introduction to Diffusion Models

Understanding the diffusion process

The role of noise in generative models

Comparison with GANs and VAEs

Module05

Introduction to Transformers

Transformer architecture (self-attention, encoder-d ecoder)

Overview of BERT, GPT, and their generative capabilities

Applications in text generation and NLP

Module06

Reinforcement Learning for Generative Models

Introduction to reinforcement learning (RL)

Combining RL with generative models

Applications in game playing and strategy generation

Module07

Project Planning and Dataset Preparation

Choosing a project topic and gathering data

Data preprocessing and augmentation

Module08

Project Proposal

Define a problem statement and objectives

Outline the approach and methodology

Module09

Basics of Generative Models

Understanding generative vs. discriminative models

Key concepts: likelihood, sampling, and latent variable s

Overview of probabilistic modeling

Module10

Variants of GANs

Conditional GANs (cGANs)

DCGAN (Deep Convolutional GAN)

StyleGAN and BigGAN

Module11

Advanced VAE Topics

Conditional VAEs (CVAE)

Beta-VAE and disentangled representations

Applications in image and text generation

Module12

Implementing Diffusion Models

Building basic diffusion models

Training and sampling processes

Applications in various generative tasks

Module13

Advanced Transformer Models

GPT-3 and beyond

Transformers for image generation (Vision Transformers)

Multimodal transformers (DALL-E)

Module14

Ethics and Bias in Generative AI

Ethical considerations in generative AI

Addressing bias and fairness

Ensuring responsible AI use

Module15

Model Building and Training

Building and tuning models for different applicatio ns

Performance evaluation and metrics

Module16

Practical Implementation

Data collection and preprocessing

Model development and training

Hands-on with GANs using TensorFlow/PyTorch

Building and training a basic GAN

Experimenting with advanced GAN variants

Building and training VAEs using TensorFlow/PyTorch

Experimenting with CVAEs and Beta-VAEs

Hands-on projects: Image and text generation with V AEs

Hands-on with diffusion models using Python libraries

Building and training a diffusion model

Projects on image generation and denoising

Fine-tuning transformers for text generation

Building generative models with Vision Transformers

Projects on text and image generation with transformers

Module17

Future Directions and Research

Emerging trends in generative AI

Research challenges and open problems

Potential future applications

Module18

Deployment and Production

Deploying models using cloud services

Monitoring and maintaining models in production

Module19

Evaluation and Presentation

Evaluate model performance

Prepare a presentation and report of the findings

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