

Generative AI: Introduction and Applications

This course provides an overview of how Generative AI is transforming industries and enhancing productivity across various domains. It explores foundational concepts, practical tools, and real-world applications of generative AI in areas such as text, image, audio/video, and code generation.

Key Learnings:

- **Generative AI Fundamentals:**
 - Generative AI refers to models capable of creating new content—text, images, audio, video, or code—based on input prompts.
 - It leverages deep learning, especially large language models (LLMs), to understand context and generate human-like outputs.
 - **Text Generation:**
 - Tools like ChatGPT (OpenAI) and Google Gemini can produce coherent text, translate languages, summarize content, and hold conversations.
 - ChatGPT excels at interactive dialogue, while Gemini is better for real-time research and summarization.
 - **Image Generation:**
 - Tools like DALL·E, Stable Diffusion, and StyleGAN generate or modify images based on text or visual prompts.
 - Techniques include style transfer, image-to-image translation, inpainting, and outpainting.
 - Tools such as Adobe Firefly, Microsoft Bing Image Creator, and Freepik expand creative possibilities.
 - **Audio & Video Generation:**
 - Generative AI can synthesize natural-sounding speech, compose music, enhance audio quality, and generate realistic videos.
 - Tools include LOVO, Synthesia, Descript, and Runway, supporting content creation and immersive virtual experiences.
 - **Code Generation:**
 - AI tools like ChatGPT, GitHub Copilot, PolyCoder, and IBM Watson Code Assistant help generate, translate, debug, and explain code.
 - These tools support developers with code suggestions, auto-completions, and documentation support.
 - **Applications Across Industries:**
 - Education: AI tutors, automated grading, and personalized feedback.
 - Finance: Fraud detection, market prediction, and document analysis.
 - Healthcare: Medical imaging, drug discovery, and personalized treatment.
 - Marketing, HR, IT, and entertainment also benefit from AI-enhanced efficiency and creativity.
 - **Ethical Use and Limitations:**
 - While generative AI boosts productivity and innovation, it should be used responsibly, with attention to factual accuracy, data privacy, and model limitations.
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Course Glossary: Generative AI: Introduction and Applications

Term	Definition
Data augmentation	A technique commonly used in machine learning and deep learning to increase the diversity and amount of training data.
Deep learning	A subset of machine learning that focuses on training computers to perform tasks by learning from data. It uses artificial neural networks.
Diffusion model	A type of generative model that is popularly used for generating high-quality samples and performing various tasks, including image synthesis. They are trained by gradually adding noise to an image and then learning to remove the noise. This process is called diffusion.
Discriminative AI	A type of artificial intelligence that distinguishes between different classes of data.
Discriminative AI models	Models that identify and classify based on patterns they observe in training data. In general, they are used in prediction and classification tasks.
Foundation models	AI models with broad capabilities that can be adapted to create more specialized models or tools for specific use cases.
Generative adversarial network (GAN)	A type of generative model that includes two neural networks: generator and discriminator. The generator is trained on vast data sets to create samples like text and images. The discriminator tries to distinguish whether the sample is real or fake.

Generative AI	A type of artificial intelligence that can create new content, such as text, images, audio, and video.
Generative AI models	Models that can understand the context of input content to generate new content. In general, they are used for automated content creation and interactive communication.
Generative pre-trained transformer (GPT)	A series of large language models developed by OpenAI. They are designed to understand language by leveraging a combination of two concepts: training and transformers.
Large language models (LLMs)	A type of deep learning model trained on massive amounts of text data to learn the patterns and structures of language. They can perform language-related tasks, including text generation, translation, summarization, sentiment analysis, and more.
Machine learning	A type of artificial intelligence that focuses on creating algorithms and models that enable computers to learn and make predictions or decisions. It involves designing systems that can learn from training data.
Natural language processing (NLP)	A branch of artificial intelligence that enables computers to understand, manipulate and generate human language (natural language).
Neural networks	Computational models inspired by the structure and functioning of the human brain. They are a fundamental component of deep learning and artificial intelligence.
Prompt	Instructions or questions that are given to a generative AI model to generate new content.

Training data	Data (generally, large datasets that also have examples) used to teach a machine learning model.
Transformers	A deep learning architecture that uses an encoder-decoder mechanism. Transformers can generate coherent and contextually relevant text.
Variational autoencoder (VAE)	A type of generative model that is basically a neural network model designed to learn the efficient representation of input data by encoding it into a smaller space and decoding back to the original space.