Titolo del corso	Advancements in Generative AI Tools
Sottotitolo	A review of theory and applications of recent LLM, Diffusion Models, and GFlownet
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Abstract	This course offers an introduction to three cutting-edge generative AI models: Large Language Models (LLM), Diffusion Models, and GFlownet. LLMs, such as GPT-4, are particularly adept at natural language understanding and generation. Diffusion Models use stochastic processes to generate images and audio. GFlownet combines generative flow models with neural networks for tasks like image translation and style transfer. The course will explore the architectures, training methods, and applications of these generative AI tools, and how they are transforming the field of artificial intelligence.
	In recent years, Generative Artificial Intelligence (AI) tools have seen remarkable progress, transforming various areas such as computer vision, natural language processing, and image production. This course thoroughly examines three leading generative AI models: Large Language Models (LLM), Diffusion Models, and GFlownet. • Large Language Models (LLMs) have become increasingly popular as powerful tools for Natural Language Understanding (NLU) and Generation tasks. LLMs, such as GPT-4, have shown remarkable abilities in producing coherent and contextually appropriate human-like text by utilizing deep neural networks and a large amount of pre-existing textual data. This course briefly introduces NLU and examines LLMs' architecture, training techniques, and applications, focusing on their impact on different NLP tasks. • Diffusion Models, based on the mathematics of stochastic processes, offer a new way of generative modeling. The denoising score matching (DSM) framework is a prime example of these models, which focus on the diffusion process of latent variables to create realistic samples. This course examines the theoretical foundations of Diffusion Models and recent Latent Diffusion Models, their training techniques, and their use in various fields, such as image and audio synthesis. • GFlownet is a state-of-the-art generative model that combines the advantages of generative flow models and neural networks. By explicitly tracking the flow of data, GFlownet has been shown to be more effective in tasks such as image translation and style transfer. During the course, we examine the architecture, training methods, and flexibility of GFlownet, and emphasize its impact on

	the ever-evolving field of generative AI.
	This course aims to give doctoral students a thorough comprehension of the abilities, structures, and uses of LLM, Diffusion Models, and GFlownet in the field of generative artificial intelligence. As these tools continue to develop, their joined effect is likely to form the future of AI.