Generative AI for Data Compression and Transmission

Generativ AI för datakompression och transmission
6 credits

Programme course

TSKS18

Valid from:

Determined by	**Main field of study**	
	Electrical Engineering	
Date determined	**Course level**	**Progressive specialisation**
	Second cycle	A1F
Revised by	**Disciplinary domain**	
	Information missing	
Revision date	**Subject group**	
Offered first time	**Offered for the last time**	
Spring semester 2026		
Department	**Replaced by**	
Institutionen för systemteknik		

Course offered for

- Master of Science in Applied Physics and Electrical Engineering
- Master's Programme in Data Science and Information Engineering

Prerequisites

Calculus (e.g., differentiation and integration), linear algebra (e.g., matrix operations), and probability (e.g., random variables, central limit theorem) • A first course in machine learning, e.g., Machine Learning • Python programming skills, e.g., to train a machine learning model

Intended learning outcomes

After completing the course, the student should be able to:

1. explain theoretical foundations of deep generative modeling, including methods for modeling a density function, network structure, loss function, and training routines;
2. implement and train generative AI models to generate new data, and apply these models in a data compression and transmission system;
3. analyze and evaluate the effectiveness of a solution based on generative modeling for data compression and transmission;
4. reflect on implications and ethical considerations of using generative AI tools

Outcomes 1, 3, and 4 are fostered by the lectures and tutorieals, and assessed via the written examination. Outcomes 2 and 3 are fostered by lab sessions, and assessed via the lab reports. Outcome 4 is further fostered by peer assessment

Course content

This course provides an introduction to generative models, their applications to data compression and transmission, and their implications and ethical considerations. This includes: introduction to probabilistic generative modeling; generative models (including variational autoencoders, generative adversarial networks, diffusion models, flow-based models, energy-based models, transformers); frameworks and techniques for generative-AI-based data compression and transmission, including neural compression, rate-distortion-perception tradeoff, latent coding, joint source-channel coding; privacy, security, and ethical considerations of generative AI.

Examination

LAB1	Computer Based Laboratory Assignments	2 credits	U, G
TEN1	Written Exam	4 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5