

# Advanced Topics in Artificial Intelligence & Machine Learning

## Final Exam

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ML Research

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# Content

## ① Exam information

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- ① Exam information
- ② Exam problems

# Exam information

- Exam format: **hand-written on paper**
- Exam duration: **1.5 hrs**
- Materials allowed to be used: **hand-written notes (1 sheet of paper)**
- **No one is allowed to use either the phone, laptop or printed materials**
- Exam parts:
  - ① AI Design: 60%
  - ② Short questions about the course content: 40%

## Exam topics: design

Demonstration the ability to design and apply the discussed during the Course AI techniques. It should consist (but not limited to) of the following sub-steps:

- Justification of a chosen direction (GenAI, NLP, CV, ASR)
- Clear AI task statement: motivation, reasonableness, potential benefits
- Clarification of choosing a trending AI solution over the classical one
- Objective metrics proving the approach selection
- An iterative process of dealing with the new emerging paradigms / change in trends

## Exam topics: concepts

- AI History overview
- Deep Learning and Neural Nets approach
- GenerativeAI concept (and its connection to DL and NN)
- GenAI: GAN-based and Diffusion-based approaches
- Transformer properties and Transformer-based encoders (BERT) and decoders (GPT)
- LLM concept (and its connection to Transformers)
- DL applications: Computer Vision (and Convolution Neural Nets)
- DL applications: Automatic Speech Recognition (and Recurrent Neural Nets)
- Multi-tasking concept (and its connection to optimization)
- Meta-learning (including few-shot learning) framework
- Multi-modality concept (including architectural considerations)
- Neural Net Robustness problem
- Adversarial attacks (including digital and real-world)
- EmbodiedAI main principle
- Autonomous Driving Automation levels
- Autonomous Driving Stack

Thank you *all*!