# 1. Project

- Some questions about the project implementation choices
- In the code, where can you find a specific function that's coming from theory? What is the mapping between theory statements about a certain function and the code implementing that function?
- Difference between RNN and LSTM (due to their presence in a project)

# 2. Theory

## 2.1 Shallow and Deep Neural Networks

- Analytic form of a Shallow Neural Network

## 2.2 Fitting and Backpropagation

- Update rule of Stochastic Gradient Descent (SGD)
- Given an MLP, find the number the parameters and the gradient w.r.t a certain weight

## 2.3 Measuring Performance and Regularization

- Explain what is overfitting
- What is LeakyReLU function and why is it used?

## 2.4 CNNs and ResNets

- What is a Convolution?
- CNNs uses and properties
- What's the role of Layer Normalization? Do you know any other type of Layer Normalization?

## 2.5 Self-Supervised Learning

- Self-Supervised Learning (SSL): How is the Dataset composed?
- Siamese Neural Networks
- What is Contrastive Learning? Apart from Self-Supervision, where is it used?
- Explain the Contrastive Loss and write the formula

## 2.6 Transformers

- Optimization algorithm in RNNs
  - Answer: Backpropagation through time (+ explanation)
- Is Backpropagation through time (BPTT) expensive?
- What is one of the risks of BPTT?
  - Answer: Vanishing and exploding gradients (+ explanation)
- Seq2Seq can be done using CNNs? How do you deal with variable length?
- What are the Self-Attention variables?
  - Answer: Query, Key, Value
- How Q, K, V are used in a Transformer model? Why are they called like that?

## 2.7 Generative AI Foundations

- GAN: Architecture, Training, Losses and Nash Equilibrium
- VAE: Architecture

- What's the problem with GANs and how to solve it

## 2.8 Graph Neural Networks

- Update rule of Graph Neural Networks (GNN)
- How does Attention work in GCN?
- What's the disadvantage of using a GCN Spectrum based?
- What is a Graph Convolutional Network (GCN)?
- Message passing in GNN

## 2.9 Model Compression

- General overview of Model Compression
- What is the Lottery Ticket Hypothesis?

## 2.10 Meta-Learning

- What is Meta-Learning? Explain an algorithm (for example Update rule of Optimization-Based)

## 2.11 Seminars

- What did you understand from the "Lecture on Learning in the Presence of Noisy Labels" part and if you know any modality of identifying corrupted labels
- What is Retrieval Augmented Generation (RAG)?