

# Homework 2

## Generative adversarial network

Deadline: April 7th at 11:59 pm

### Assignment Objectives

- Develop and train an image generation model using the CIFAR-10 dataset based on the GAN architecture.
- Experiment to improve the model's performance and identify the best methods for enhancement.
- Evaluate the model's performance using the Frechet Inception Distance (FID). The goal is to achieve an FID score of 130 or below (The lower, the better).

### Dataset

- CIFAR-10 dataset: Easily loaded using the torchvision library in PyTorch.
- Classes include: airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck

### Model Evaluation

- Use the Frechet Inception Distance (FID) score to assess the similarity between generated images and real images. Lower FID scores indicate higher similarity.
- Randomly select images in batch sizes (128) from both real and generated sets for FID calculation.

### Submission Requirements

- Source Code: Complete source code used for model design, training, and evaluation.
- Trained Model File: The file containing the weights of the final trained model.
- Loss Graphs: Graphs showing the loss of the discriminator and generator over time.
- FID Score Graph: Graph demonstrating the changes in FID score during training.
- Generated Image Set: An image file containing 64 generated images (arranged in an 8x8 grid).

### Additional Guidelines

- Reference Code: Provide reference code for the basic GAN model and the method for calculating FID scores to guide students.

### Learning Objectives

- Understand GAN architecture.
- Use PyTorch and torchvision for model design, implementation, and training.
- Grasp the training process of GANs, including the interaction between discriminator and generator.
- Learn how to evaluate performance using FID scores.
- Explore ways to improve model performance.

- Enhance problem-solving skills to achieve the given objective (FID below 60).

### Evaluation Rubric (Out of 100 points)

- Model Implementation (30 points)
  - Accurate implementation of the GAN architecture: 15 points
  - Efficiency in data handling and model training using PyTorch and torchvision: 15 points
- Model Training and Results (30 points)
  - Stable convergence of loss functions for both discriminator and generator: 10 points
  - Quality and diversity of generated images (including the evaluation of the 8x8 image set): 20 points
- Performance Evaluation (20 points)
  - Calculation and achievement of the FID score goal (below 60): 20 points
- Report and Documentation (20 points)
  - Clarity and annotation of source code: 10 points
  - Accurate submission and interpretation of loss graphs and FID score graphs: 10 points

### Example of FID

