Project Proposal II
Advanced Deep Learning Modes

Sidharth Gupta

27 February 2026

Using cGAN to perform Class-Conditional Image Generation on CIFAR-10

1 Objective

The objective of the project is to train a cGAN on the CIFAR-10 dataset, conditioning the generator on a class label. This is valuable because class imbalance is often seen in real-world datasets and a cGAN can help with this by generating synthetic images of underrepresented classes and hence improving classifier's performance.

2 Dataset

The CIFAR-10 dataset will be used for training.

- Source: https://www.cs.toronto.edu/ kriz/cifar.html
- Total images: 60000; Train: 50000, Test:10000
- Image Size: 32x32 RGB Images
- 10 Classes - [airplane, automobile, cat, deer, bird, dog, frog, horse, ship, truck]
- Annotations – Class labels.

3 Methodology

3.1 Model

A Conditional GAN (cGAN) is used in this project. The generator receives a random noise vector concatenated with a one-hot encoded class label as input, and outputs a synthetic 32x32 RGB image. The discriminator receives an image (real or fake) alongside the one-hot encoded class label, and outputs a real/fake prediction. The architecture is based on DCGAN, using convolutional layers suited for image data.

3.2 Tools and Libraries

- torch, torch.nn
- torchvision, torchvision.datasets
- matplotlib
- PIL
- pytorch-fid
- os, pathlib
- Jupyter Lab

3.3 Steps

- Load dataset; train/test already split.
- Pre-process images – ToTensor(normalize to [-1,1]) and One-Hot encode the labels.
- Define the cGAN architecture (Generator + Discriminator)
- Train the model
- Evaluate based on FID Score
- Visualize

4 Expected Output

4.1 Quantitative

Under an 8-hour constraint, achieving an FID score of under 50 is the target, aiming for better score.

4.2 Qualitative

After the training is complete, one image per class will be generated by the GAN to visualise the work.

5 8-Hour Timeline

Task	**Time**
Dataset loading and pre-processing	1.5h
cGAN implementation	2h
Training & tuning	2h
Evaluation	0.5h
Visualization & Results	0.5h
Report Writing	1.5h

Table 1: Project Timeline (Total: 8 hours)