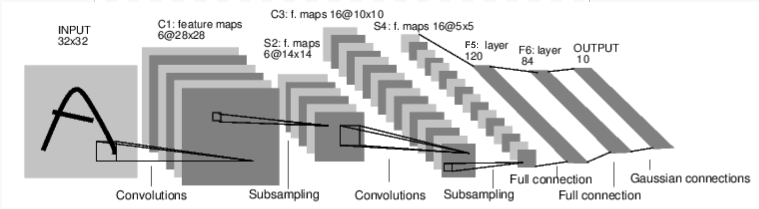
This lab is based on the CNN



3.1

C1

C3

3.2

3.3

Appendix:

3.3.1

When C1=6 and C3=16

plane horse frog plane

[1, 2000] loss: 2.174

[1, 4000] loss: 1.816

[1, 6000] loss: 1.677

[1, 8000] loss: 1.578

[1, 10000] loss: 1.519

[1, 12000] loss: 1.437

[2, 2000] loss: 1.382

[2, 4000] loss: 1.370

[2, 6000] loss: 1.355

[2, 8000] loss: 1.325

[2, 10000] loss: 1.319

[2, 12000] loss: 1.285

Finished Training

GroundTruth: cat ship ship plane

Predicted: bird ship ship ship

Accuracy of the network on the 10000 test images: 51 %

Accuracy of plane : 40 %

Accuracy of car : 85 %

Accuracy of bird : 55 %

Accuracy of cat : 53 %

Accuracy of deer : 26 %

Accuracy of dog : 25 %

Accuracy of frog : 47 %

Accuracy of horse : 60 %

Accuracy of ship : 79 %

Accuracy of truck : 40 %

cuda:0

When C1=8 and C3=16

car cat ship frog

[1, 2000] loss: 2.170

[1, 4000] loss: 1.812

[1, 6000] loss: 1.643

[1, 8000] loss: 1.547

[1, 10000] loss: 1.490

[1, 12000] loss: 1.440

[2, 2000] loss: 1.383

[2, 4000] loss: 1.337

[2, 6000] loss: 1.319

[2, 8000] loss: 1.306

[2, 10000] loss: 1.288

[2, 12000] loss: 1.264

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat car car plane

Accuracy of the network on the 10000 test images: 56 %

Accuracy of plane : 46 %

Accuracy of car : 75 %

Accuracy of bird : 48 %

Accuracy of cat : 29 %

Accuracy of deer : 49 %

Accuracy of dog : 49 %

Accuracy of frog : 78 %

Accuracy of horse : 56 %

Accuracy of ship : 61 %

Accuracy of truck : 66 %

cuda:0

When C1=10 and C3=16

Files already downloaded and verified

Files already downloaded and verified

truck frog plane horse

[1, 2000] loss: 2.218

[1, 4000] loss: 1.923

[1, 6000] loss: 1.707

[1, 8000] loss: 1.597

[1, 10000] loss: 1.510

[1, 12000] loss: 1.448

[2, 2000] loss: 1.392

[2, 4000] loss: 1.345

[2, 6000] loss: 1.324

[2, 8000] loss: 1.300

[2, 10000] loss: 1.293

[2, 12000] loss: 1.268

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat ship ship ship

Accuracy of the network on the 10000 test images: 54 %

Accuracy of plane : 53 %

Accuracy of car : 73 %

Accuracy of bird : 33 %

Accuracy of cat : 54 %

Accuracy of deer : 42 %

Accuracy of dog : 19 %

Accuracy of frog : 70 %

Accuracy of horse : 65 %

Accuracy of ship : 83 %

Accuracy of truck : 49 %

cuda:0

When C1=12 and C3=16

Files already downloaded and verified

Files already downloaded and verified

car cat bird ship

[1, 2000] loss: 2.196

[1, 4000] loss: 1.796

[1, 6000] loss: 1.660

[1, 8000] loss: 1.558

[1, 10000] loss: 1.478

[1, 12000] loss: 1.432

[2, 2000] loss: 1.341

[2, 4000] loss: 1.306

[2, 6000] loss: 1.274

[2, 8000] loss: 1.290

[2, 10000] loss: 1.227

[2, 12000] loss: 1.242

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat plane ship plane

Accuracy of the network on the 10000 test images: 59 %

Accuracy of plane : 72 %

Accuracy of car : 71 %

Accuracy of bird : 39 %

Accuracy of cat : 29 %

Accuracy of deer : 45 %

Accuracy of dog : 51 %

Accuracy of frog : 78 %

Accuracy of horse : 69 %

Accuracy of ship : 76 %

Accuracy of truck : 57 %

cuda:0

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

When C3=16 and C1=6

Files already downloaded and verified

Files already downloaded and verified

cat deer truck plane

[1, 2000] loss: 2.213

[1, 4000] loss: 1.916

[1, 6000] loss: 1.709

[1, 8000] loss: 1.585

[1, 10000] loss: 1.513

[1, 12000] loss: 1.452

[2, 2000] loss: 1.369

[2, 4000] loss: 1.357

[2, 6000] loss: 1.334

[2, 8000] loss: 1.329

[2, 10000] loss: 1.305

[2, 12000] loss: 1.283

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat ship ship plane

Accuracy of the network on the 10000 test images: 55 %

Accuracy of plane : 54 %

Accuracy of car : 78 %

Accuracy of bird : 53 %

Accuracy of cat : 30 %

Accuracy of deer : 42 %

Accuracy of dog : 47 %

Accuracy of frog : 57 %

Accuracy of horse : 61 %

Accuracy of ship : 68 %

Accuracy of truck : 64 %

cuda:0

When C3=20 and C1=6

Files already downloaded and verified

Files already downloaded and verified

plane horse bird dog

[1, 2000] loss: 2.159

[1, 4000] loss: 1.833

[1, 6000] loss: 1.658

[1, 8000] loss: 1.577

[1, 10000] loss: 1.503

[1, 12000] loss: 1.460

[2, 2000] loss: 1.405

[2, 4000] loss: 1.360

[2, 6000] loss: 1.355

[2, 8000] loss: 1.305

[2, 10000] loss: 1.280

[2, 12000] loss: 1.272

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat car car ship

Accuracy of the network on the 10000 test images: 56 %

Accuracy of plane : 54 %

Accuracy of car : 70 %

Accuracy of bird : 40 %

Accuracy of cat : 41 %

Accuracy of deer : 49 %

Accuracy of dog : 45 %

Accuracy of frog : 58 %

Accuracy of horse : 58 %

Accuracy of ship : 84 %

Accuracy of truck : 61 %

cuda:0

When C3=24 and C1=6

Files already downloaded and verified

Files already downloaded and verified

frog bird truck dog

[1, 2000] loss: 2.165

[1, 4000] loss: 1.797

[1, 6000] loss: 1.625

[1, 8000] loss: 1.533

[1, 10000] loss: 1.452

[1, 12000] loss: 1.394

[2, 2000] loss: 1.332

[2, 4000] loss: 1.281

[2, 6000] loss: 1.279

[2, 8000] loss: 1.239

[2, 10000] loss: 1.209

[2, 12000] loss: 1.205

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat ship ship plane

Accuracy of the network on the 10000 test images: 58 %

Accuracy of plane : 71 %

Accuracy of car : 70 %

Accuracy of bird : 37 %

Accuracy of cat : 29 %

Accuracy of deer : 61 %

Accuracy of dog : 54 %

Accuracy of frog : 62 %

Accuracy of horse : 63 %

Accuracy of ship : 68 %

Accuracy of truck : 67 %

cuda:0

When C3=28 and C1=6

Files already downloaded and verified

Files already downloaded and verified

cat plane cat deer

[1, 2000] loss: 2.176

[1, 4000] loss: 1.801

[1, 6000] loss: 1.643

[1, 8000] loss: 1.526

[1, 10000] loss: 1.461

[1, 12000] loss: 1.394

[2, 2000] loss: 1.315

[2, 4000] loss: 1.295

[2, 6000] loss: 1.262

[2, 8000] loss: 1.234

[2, 10000] loss: 1.217

[2, 12000] loss: 1.195

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat car plane plane

Accuracy of the network on the 10000 test images: 58 %

Accuracy of plane : 63 %

Accuracy of car : 78 %

Accuracy of bird : 56 %

Accuracy of cat : 36 %

Accuracy of deer : 52 %

Accuracy of dog : 45 %

Accuracy of frog : 69 %

Accuracy of horse : 71 %

Accuracy of ship : 55 %

Accuracy of truck : 60 %

cuda:0

3.3.2

7-layer

Files already downloaded and verified

Files already downloaded and verified

horse horse frog dog

[1, 2000] loss: 2.216

[1, 4000] loss: 1.896

[1, 6000] loss: 1.713

[1, 8000] loss: 1.609

[1, 10000] loss: 1.521

[1, 12000] loss: 1.491

[2, 2000] loss: 1.421

[2, 4000] loss: 1.384

[2, 6000] loss: 1.350

[2, 8000] loss: 1.327

[2, 10000] loss: 1.294

[2, 12000] loss: 1.308

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat car ship ship

Accuracy of the network on the 10000 test images: 50 %

Accuracy of plane : 36 %

Accuracy of car : 72 %

Accuracy of bird : 47 %

Accuracy of cat : 35 %

Accuracy of deer : 47 %

Accuracy of dog : 34 %

Accuracy of frog : 48 %

Accuracy of horse : 61 %

Accuracy of ship : 77 %

Accuracy of truck : 45 %

cuda:0

9-layer

Files already downloaded and verified

Files already downloaded and verified

horse deer dog dog

[1, 2000] loss: 2.219

[1, 4000] loss: 1.844

[1, 6000] loss: 1.679

[1, 8000] loss: 1.571

[1, 10000] loss: 1.540

[1, 12000] loss: 1.489

[2, 2000] loss: 1.396

[2, 4000] loss: 1.355

[2, 6000] loss: 1.338

[2, 8000] loss: 1.342

[2, 10000] loss: 1.280

[2, 12000] loss: 1.261

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat ship ship ship

Accuracy of the network on the 10000 test images: 53 %

Accuracy of plane : 41 %

Accuracy of car : 67 %

Accuracy of bird : 48 %

Accuracy of cat : 23 %

Accuracy of deer : 67 %

Accuracy of dog : 33 %

Accuracy of frog : 57 %

Accuracy of horse : 56 %

Accuracy of ship : 83 %

Accuracy of truck : 55 %

cuda:0

11-layer

Files already downloaded and verified

Files already downloaded and verified

horse dog cat truck

[1, 2000] loss: 2.176

[1, 4000] loss: 1.833

[1, 6000] loss: 1.672

[1, 8000] loss: 1.567

[1, 10000] loss: 1.501

[1, 12000] loss: 1.455

[2, 2000] loss: 1.396

[2, 4000] loss: 1.365

[2, 6000] loss: 1.340

[2, 8000] loss: 1.287

[2, 10000] loss: 1.269

[2, 12000] loss: 1.268

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat ship ship ship

Accuracy of the network on the 10000 test images: 55 %

Accuracy of plane : 68 %

Accuracy of car : 68 %

Accuracy of bird : 28 %

Accuracy of cat : 27 %

Accuracy of deer : 29 %

Accuracy of dog : 64 %

Accuracy of frog : 81 %

Accuracy of horse : 52 %

Accuracy of ship : 73 %

Accuracy of truck : 62 %

cuda:0

13-layer

Files already downloaded and verified

Files already downloaded and verified

truck deer car car

[1, 2000] loss: 2.195

[1, 4000] loss: 1.843

[1, 6000] loss: 1.663

[1, 8000] loss: 1.580

[1, 10000] loss: 1.482

[1, 12000] loss: 1.445

[2, 2000] loss: 1.388

[2, 4000] loss: 1.366

[2, 6000] loss: 1.336

[2, 8000] loss: 1.299

[2, 10000] loss: 1.297

[2, 12000] loss: 1.286

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat car ship plane

Accuracy of the network on the 10000 test images: 55 %

Accuracy of plane : 58 %

Accuracy of car : 80 %

Accuracy of bird : 27 %

Accuracy of cat : 52 %

Accuracy of deer : 43 %

Accuracy of dog : 38 %

Accuracy of frog : 73 %

Accuracy of horse : 59 %

Accuracy of ship : 61 %

Accuracy of truck : 63 %

cuda:0

3.3.3

(C1=6 C3=16 Original)

Relu:

Files already downloaded and verified

Files already downloaded and verified

horse plane horse frog

[1, 2000] loss: 2.171

[1, 4000] loss: 1.842

[1, 6000] loss: 1.669

[1, 8000] loss: 1.573

[1, 10000] loss: 1.490

[1, 12000] loss: 1.454

[2, 2000] loss: 1.386

[2, 4000] loss: 1.345

[2, 6000] loss: 1.313

[2, 8000] loss: 1.311

[2, 10000] loss: 1.276

[2, 12000] loss: 1.275

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat car car plane

Accuracy of the network on the 10000 test images: 56 %

Accuracy of plane : 55 %

Accuracy of car : 59 %

Accuracy of bird : 43 %

Accuracy of cat : 37 %

Accuracy of deer : 36 %

Accuracy of dog : 58 %

Accuracy of frog : 73 %

Accuracy of horse : 64 %

Accuracy of ship : 59 %

Accuracy of truck : 72 %

cuda:0

torch.sigmoid:

Files already downloaded and verified

Files already downloaded and verified

deer bird car car

[1, 2000] loss: 2.315

[1, 4000] loss: 2.313

[1, 6000] loss: 2.312

[1, 8000] loss: 2.312

[1, 10000] loss: 2.312

[1, 12000] loss: 2.310

[2, 2000] loss: 2.311

[2, 4000] loss: 2.309

[2, 6000] loss: 2.309

[2, 8000] loss: 2.308

[2, 10000] loss: 2.307

[2, 12000] loss: 2.308

Finished Training

GroundTruth: cat ship ship plane

Predicted: plane plane plane plane

Accuracy of the network on the 10000 test images: 10 %

Accuracy of plane : 100 %

Accuracy of car : 0 %

Accuracy of bird : 0 %

Accuracy of cat : 0 %

Accuracy of deer : 0 %

Accuracy of dog : 0 %

Accuracy of frog : 0 %

Accuracy of horse : 0 %

Accuracy of ship : 0 %

Accuracy of truck : 0 %

cuda:0

sigmoid:

Files already downloaded and verified

Files already downloaded and verified

truck horse plane bird

[1, 2000] loss: 2.316

[1, 4000] loss: 2.315

[1, 6000] loss: 2.315

[1, 8000] loss: 2.312

[1, 10000] loss: 2.313

[1, 12000] loss: 2.311

[2, 2000] loss: 2.310

[2, 4000] loss: 2.309

[2, 6000] loss: 2.309

[2, 8000] loss: 2.309

[2, 10000] loss: 2.308

[2, 12000] loss: 2.307

Finished Training

GroundTruth: cat ship ship plane

Predicted: dog dog dog dog

Accuracy of the network on the 10000 test images: 10 %

Accuracy of plane : 0 %

Accuracy of car : 0 %

Accuracy of bird : 0 %

Accuracy of cat : 0 %

Accuracy of deer : 0 %

Accuracy of dog : 100 %

Accuracy of frog : 0 %

Accuracy of horse : 0 %

Accuracy of ship : 0 %

Accuracy of truck : 0 %

cuda:0

sigmoid introduces only one object’s accuracy

torch.tanh:

Files already downloaded and verified

Files already downloaded and verified

truck bird bird deer

[1, 2000] loss: 2.032

[1, 4000] loss: 1.742

[1, 6000] loss: 1.595

[1, 8000] loss: 1.557

[1, 10000] loss: 1.485

[1, 12000] loss: 1.434

[2, 2000] loss: 1.377

[2, 4000] loss: 1.358

[2, 6000] loss: 1.305

[2, 8000] loss: 1.321

[2, 10000] loss: 1.296

[2, 12000] loss: 1.280

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat car plane plane

Accuracy of the network on the 10000 test images: 54 %

Accuracy of plane : 65 %

Accuracy of car : 77 %

Accuracy of bird : 43 %

Accuracy of cat : 24 %

Accuracy of deer : 26 %

Accuracy of dog : 49 %

Accuracy of frog : 69 %

Accuracy of horse : 66 %

Accuracy of ship : 62 %

Accuracy of truck : 61 %

cuda:0

tanh:

Files already downloaded and verified

Files already downloaded and verified

horse horse car horse

D:\Anaconda\lib\site-packages\torch\nn\functional.py:1628: UserWarning: nn.functional.tanh is deprecated. Use torch.tanh instead.

warnings.warn("nn.functional.tanh is deprecated. Use torch.tanh instead.")

[1, 2000] loss: 2.047

[1, 4000] loss: 1.745

[1, 6000] loss: 1.617

[1, 8000] loss: 1.537

[1, 10000] loss: 1.470

[1, 12000] loss: 1.440

[2, 2000] loss: 1.363

[2, 4000] loss: 1.346

[2, 6000] loss: 1.314

[2, 8000] loss: 1.290

[2, 10000] loss: 1.262

[2, 12000] loss: 1.261

Finished Training

GroundTruth: cat ship ship plane

Predicted: cat ship ship ship

Accuracy of the network on the 10000 test images: 54 %

Accuracy of plane : 46 %

Accuracy of car : 68 %

Accuracy of bird : 39 %

Accuracy of cat : 20 %

Accuracy of deer : 36 %

Accuracy of dog : 61 %

Accuracy of frog : 74 %

Accuracy of horse : 56 %

Accuracy of ship : 73 %

Accuracy of truck : 66 %

cuda:0