EN2550 Exercise 10 on Introduction to Neural Networks

Ranga Rodrigo

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1. Run gradient descent to find the minimum of $f(x) = x^4 - x^3 - 12x^2 + 15x + 5$. Show with examples that
   (a) Initial solution matters.
   (b) Learning rate is important to tune.
2. Train a linear classifier for CIFAR10[1] ($3 \times 32 \times 32$ images, 10 classes) using SDG. Use mean square loss and a minibatch size of 100.

```
import numpy as np
import tensorflow as tf
from tensorflow import keras
import matplotlib.pyplot as plt
from tensorflow.keras.datasets import cifar10, mnist

(x_train, y_train), (x_test, y_test) = cifar10.load_data()
# (x_train, y_train), (x_test, y_test) = mnist.load_data()
print("x_train -> ", x_train.shape)

Ntr = x_train.shape[0]
Nte = x_test.shape[0]
Din = 3072 # CIFAR10
# Din = 784 # MINIST
x_train = x_train[range(Ntr), :]
x_test = x_test[range(Nte), :]
y_train = y_train[range(Ntr)]
y_test = y_test[range(Nte)]
```

Listing 1: Data Generation Code

[1] https://www.cs.toronto.edu/ kriz/cifar.html