Exercises for the course
Deep Learning 2
Summer Semester 2024

Machine Learning Group
Faculty IV – Electrical Engineering and Computer Science
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Exercise Sheet 4

Exercise 1: Types of differential equations (10 P)

For a state $\underline{u} \in \mathbb{R}^2$, come up with an example for each of the following types of differential equations:

(a) linear, time-invariant ODE

(b) linear, time-variant ODE

(c) non-linear, time-invariant ODE

(d) non-linear, time-variant ODE

(e) partial differential equation

Exercise 2: Programming (70 P)

Download the programming files on ISIS and follow the instructions.

Exercise 3: Neural ODE classifier (20 P)

Using the neural ODE from the trajectory optimization problem in programming exercise 2, you now want to train a binary classifier on the "moons" dataset depicted in Figure 1a.

(a) In bullet-points, describe the changes you have to make to the existing code to train a classifier.

(b) In 2 to 3 sentences, explain why the "circles" dataset depicted in Figure 1b is difficult to classify for a Neural ODE and explain how this difficulty can be avoided.
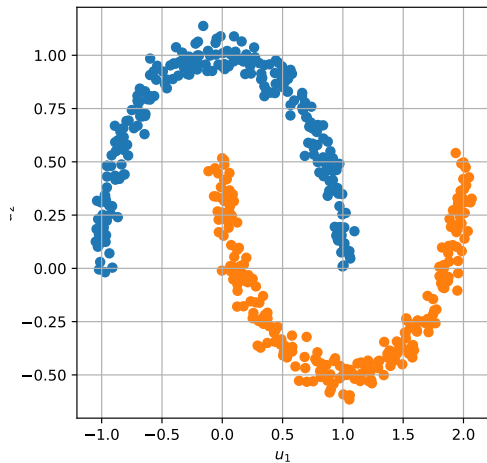
(a) Moons
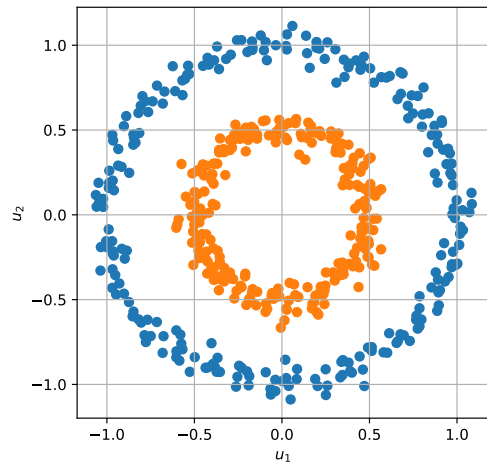
(b) Circles

Figure 1: Datasets for binary classification