Assignment 2

This assignment focuses on implementing a Recurrent Neural ODE model for a regression task on time series data. You will work with a synthetic dataset of spirals.

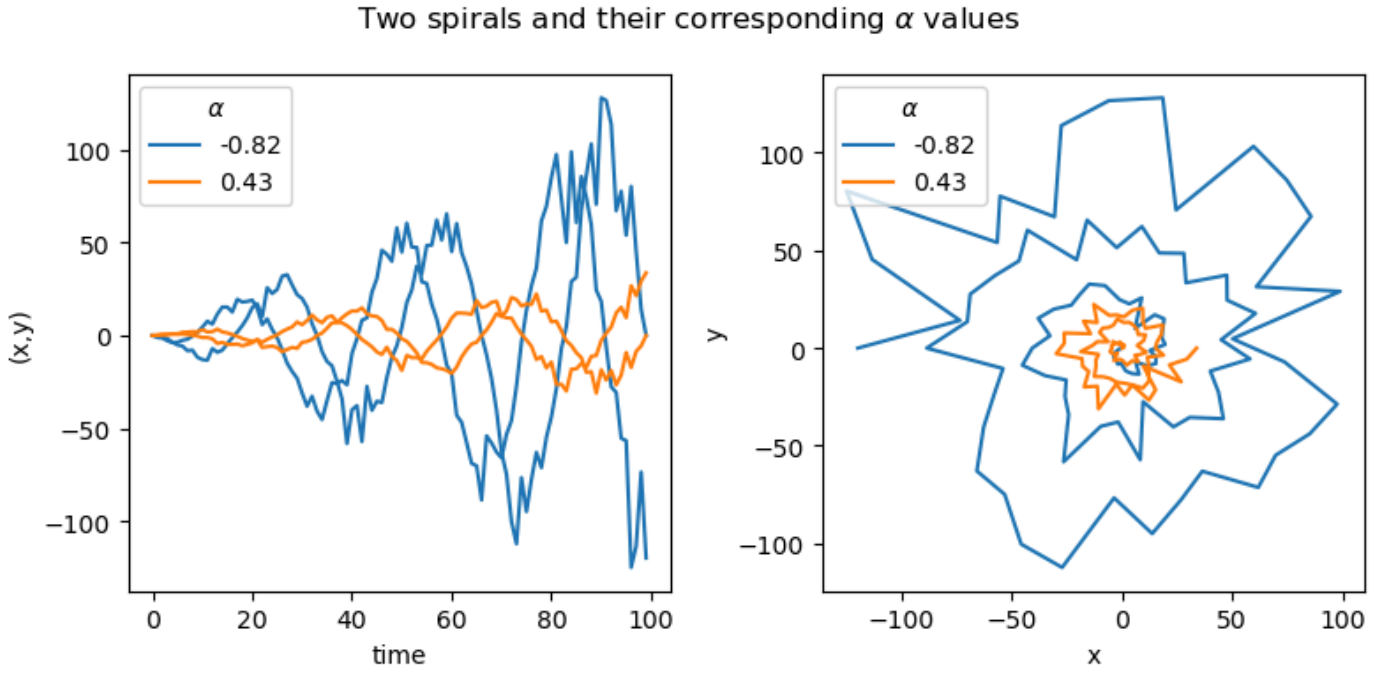
Spirals Dataset

The file `spirals.npz` contains synthetically generated spiral trajectories. This dataset is designed to test your model's ability to infer a latent parameter governing the trajectory's dynamics.

The dataset is structured as a `.npz` archive containing three arrays:

- `xy_train`: Training data of shape `(10000, 100, 2)`. This represents 10,000 spiral trajectories, each with 100 time points and 2 spatial dimensions (x, y).
- `alpha_train`: The ground-truth variable `alpha` for each trajectory in the training set, with shape `(10000, 1)`.
- `xy_test`: Test data of shape `(10000, 100, 2)` for evaluating your model.

Alpha (α) is the spiral constant in the equation given in polar coordinates as $r = \alpha\theta$. A positive α creates a counter-clockwise spiral, and a negative α creates a clockwise one.



Task:

Your goal is to build a latent variable model that can predict the parameter α given a spiral trajectory. Choose and implement one of GRU-ODE, ODE-RNN, ODE-LSTM (see Table 1 of https://arxiv.org/abs/2502.09885 for explicit equations.). The model should use its recurrent nature to process the input sequence `xy` and update its hidden state. Either the entire hidden trajectory or the final hidden state can then be used to predict `alpha`. Train the model to predict `alpha_train` from the `xy_train` data.

Submission:

- Documented code for your model, training loop, and evaluation.
- Predicted `alpha` values for `xy_test` as an array of shape `(10000, 1)`, saved in `.npy` format. These submissions will be used to evaluate and compare model performance.
- Present your code and findings in class on 18.11.2025.