Assignment 1: Neural Networks

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1 Introduction

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2 Task 1: Function Approximation

2.1 Data Preparation

- Plot the parametric surface and contour of the target function

2.2 Network Design

- Plot the contours of the NN with 2, 8 and 50 hidden neurons.
- Which is the best hidden neurons number among them? Why?

2.3 Network Training

- Plot the contours of the NN with four different training algorithms.

2.4 Network Testing

- Plot the graphical output provided by `postreg`.

3 Task 2: System identification

- Generate performance and training state plots for each of the cases.
- Run the control system with each of the 3 cases and generate the reference tracking plots for them (X-Y plot in the default setup).
- Do brief comparisons on the performance of each of the 3 cases based on the generated plots.
- How relevant is the number of training epochs in this context?
- Shortly justify which of the 3 sets of identification data you would pick to use.

$$SE(3) = \left\{ \begin{pmatrix} R & \mathbf{t} \\ \mathbf{0} & 1 \end{pmatrix} : R^\top R = R R^\top = I_3, \mathbf{t} \in \mathbb{R}^3 \right\} \tag{1}$$