

# 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

- Compare the training performance of 4 different training functions in three aspects, epochs, training time and correlation and fill in the table below. State the features of four training algorithms according to the table.
- Plot the contours of the NN with four different training algorithms.

training function	epochs	total time(sec)	Correlation
trainbfg	...	...	...
traingdm	...	...	...
traingd	...	...	...
trainlm	...	...	...

### 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.

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