



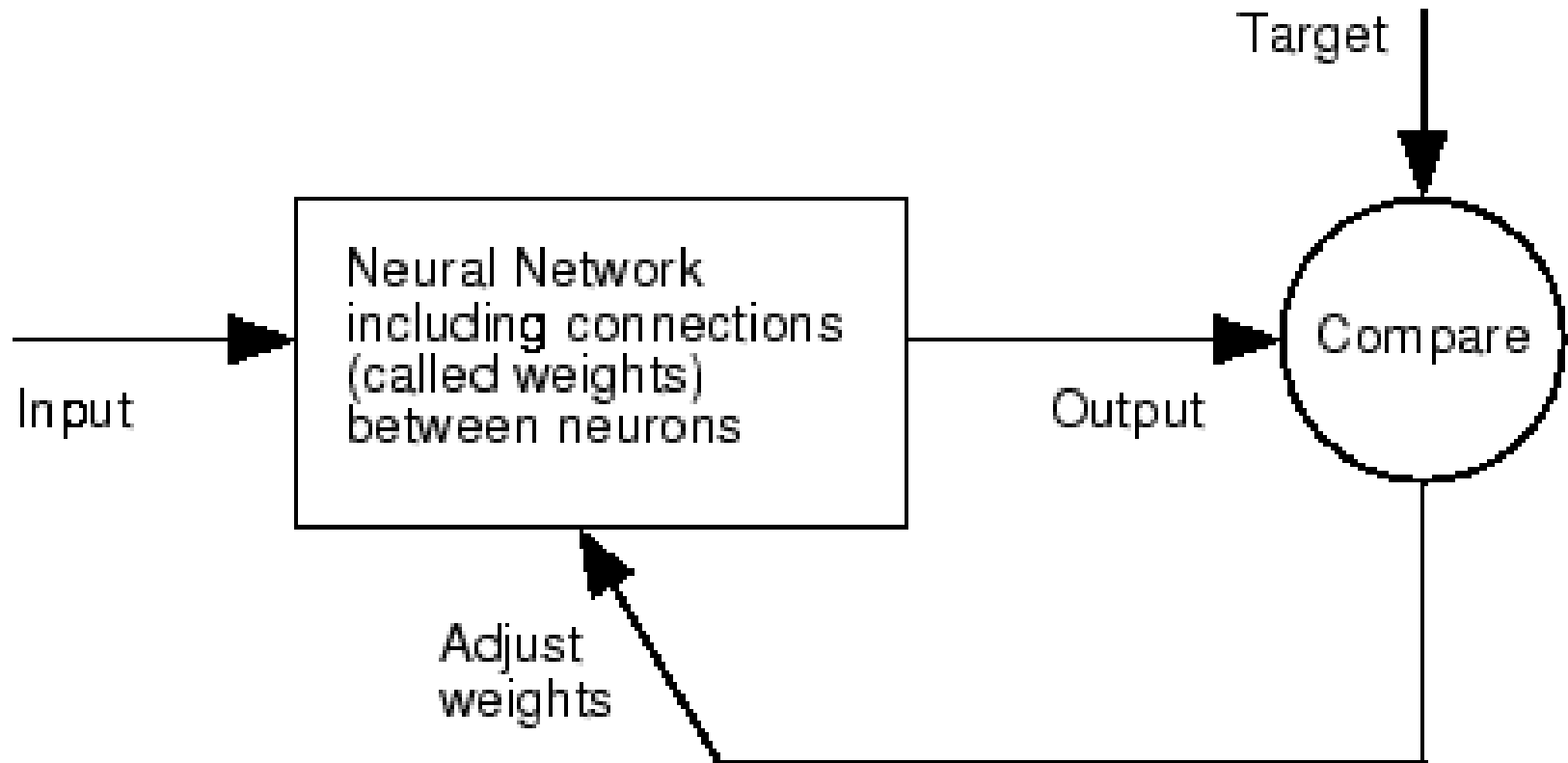
UNIVERSITÀ DEGLI STUDI DI MILANO

Introduction to Neural Networks

Ruggero Donida Labati

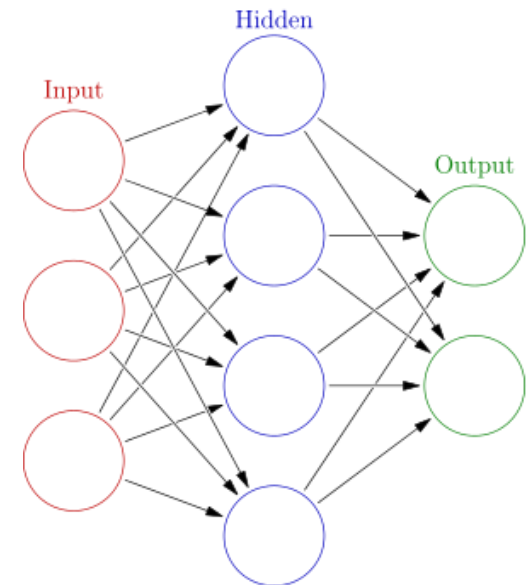
Dipartimento di Tecnologie dell'Informazione
via Bramante 65, 26013 Crema (CR), Italy
ruggero.donida@unimi.it

Applications based on Neural Networks



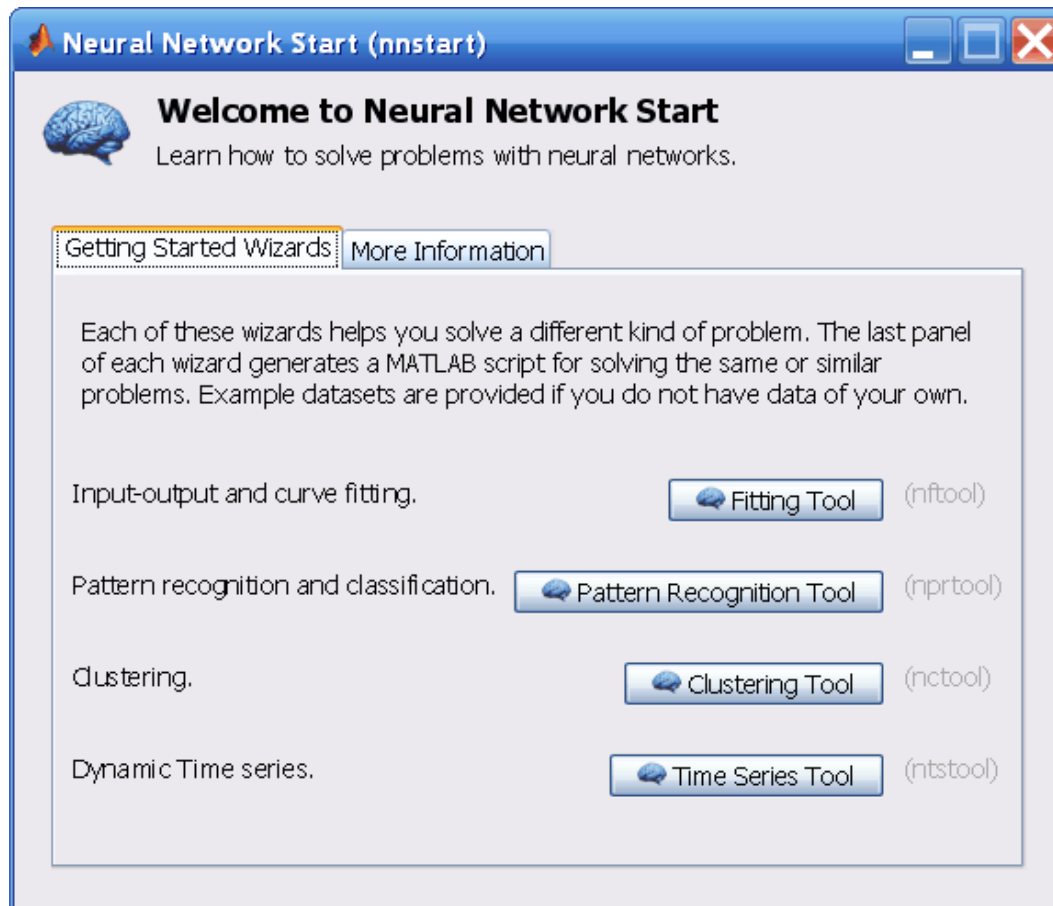
Neural Networks in Matlab

- What can we do with NN Toolbox?
 - Fit Data with a Neural Network
 - Classify Patterns with a Neural Network
 - Cluster Data with a Self-Organizing Map
 - Neural Network Time Series Prediction and Modeling

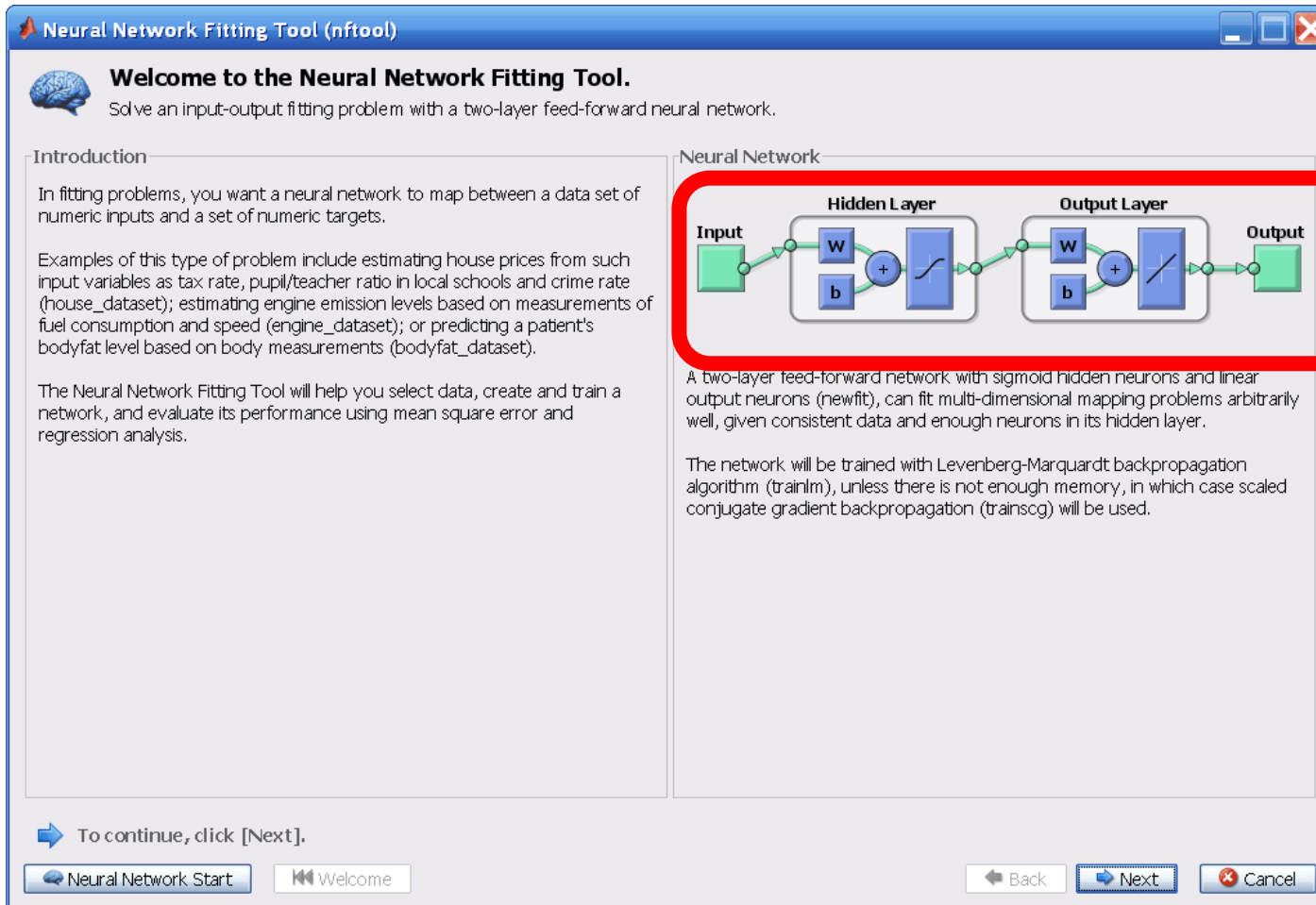


Neural Network Fitting Tool: GUI (1/7)

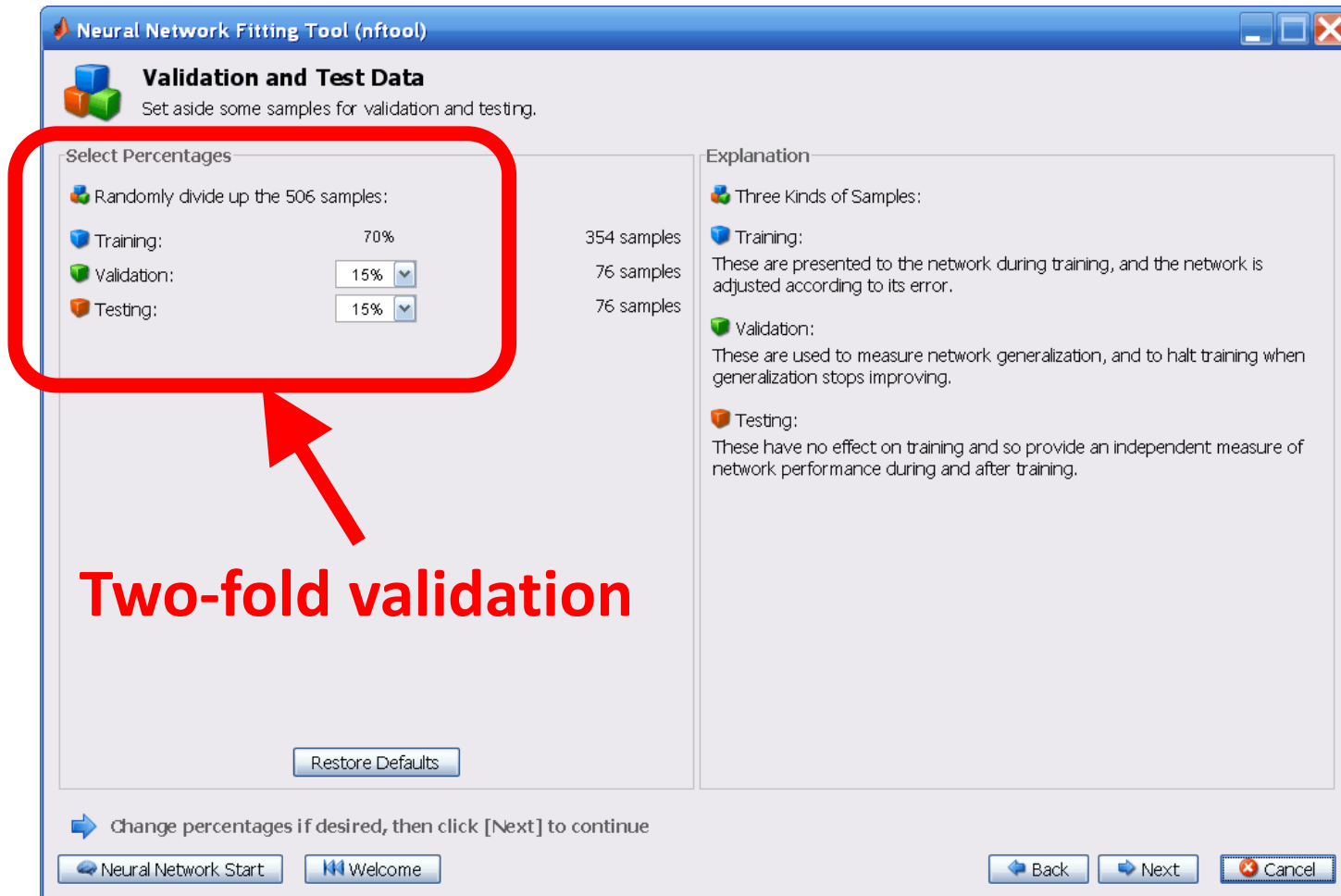
- nnstart



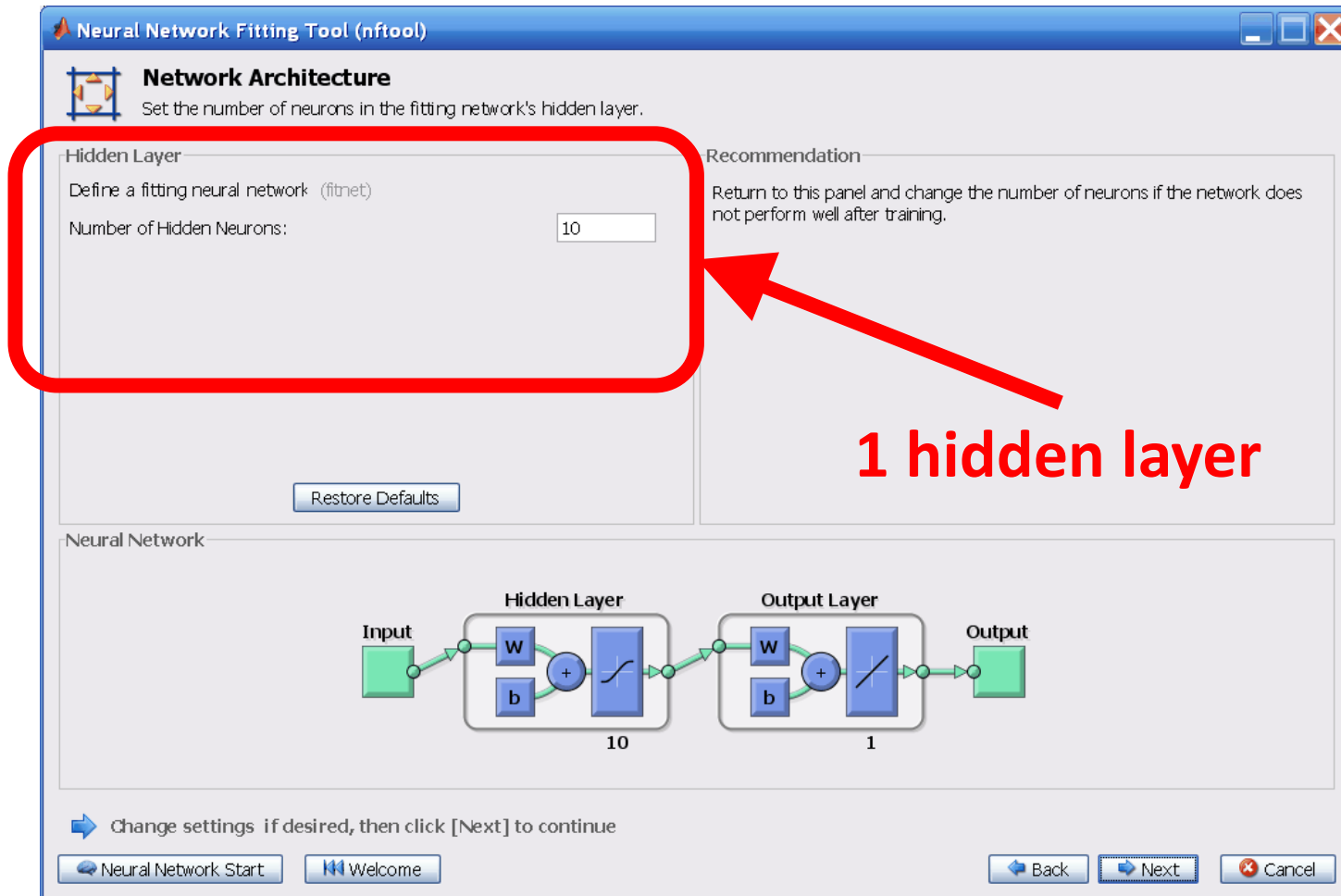
Neural Network Fitting Tool: GUI (2/7)



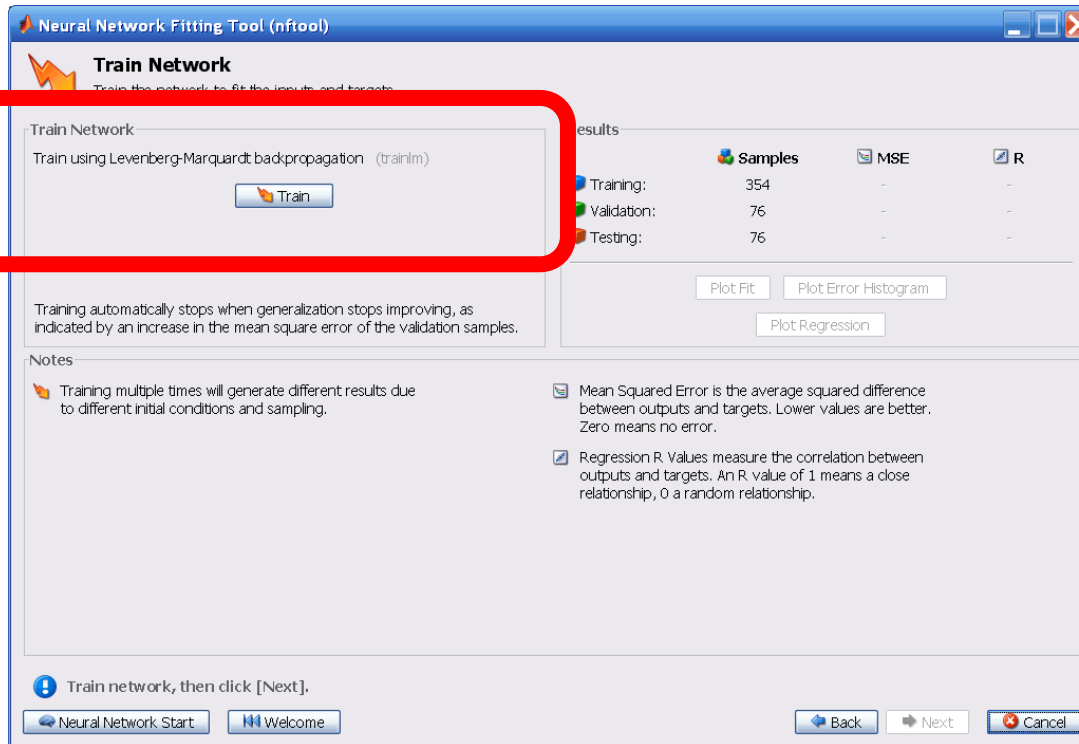
Neural Network Fitting Tool: GUI (3/7)



Neural Network Fitting Tool: GUI (4/7)

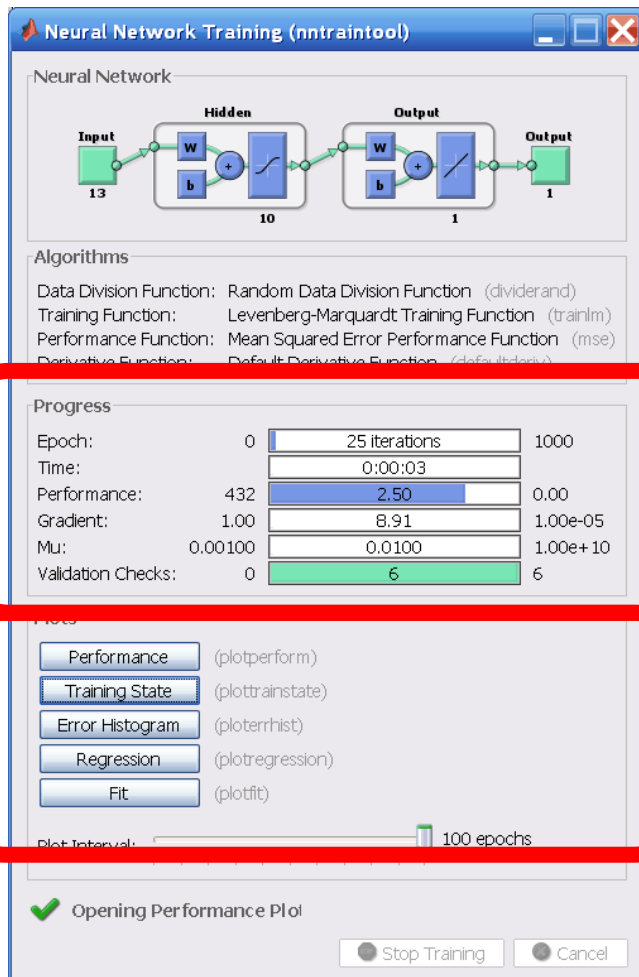


Neural Network Fitting Tool: GUI (5/7)



The **Levenberg–Marquardt** algorithm (LMA), also known as the damped least-squares (DLS) method, provides a numerical solution to the problem of minimizing a function, generally nonlinear, over a space of parameters of the function. These minimization problems arise especially in [least squares](#) curve fitting and nonlinear programming.

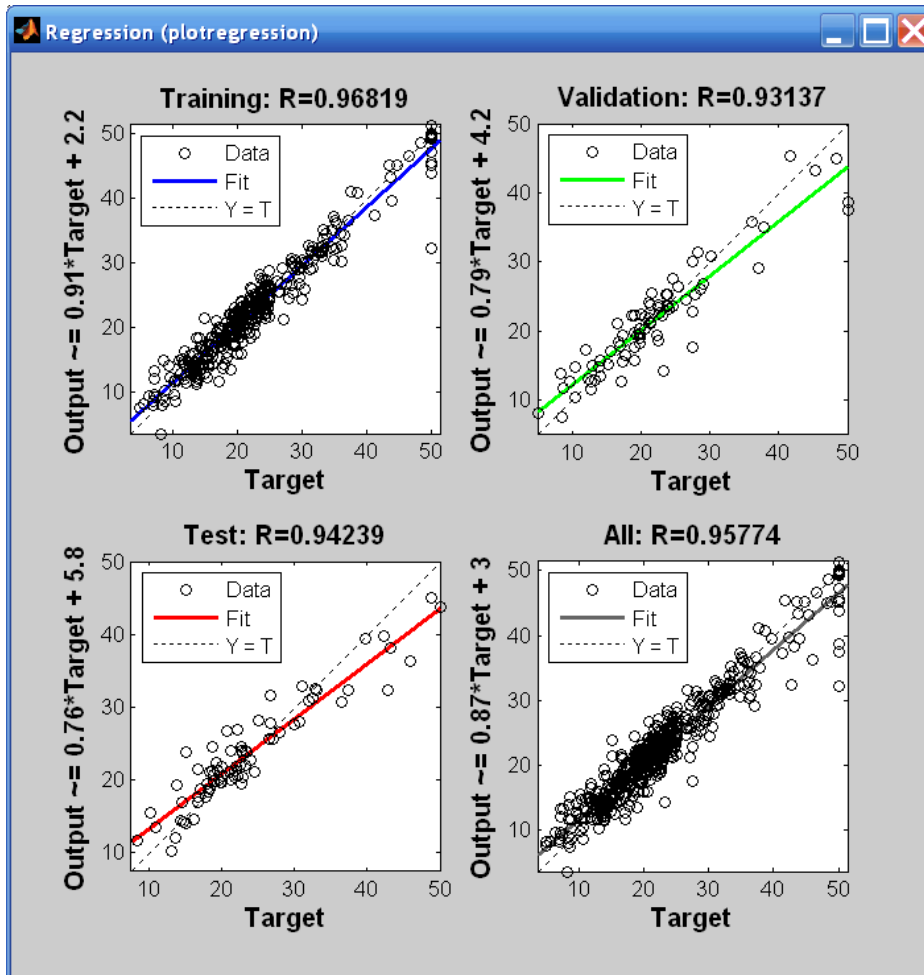
Neural Network Fitting Tool: GUI (6/7)



← Learning algorithm state

← Evaluate the performance of the training algorithm

Neural Network Fitting Tool: GUI (7/7)



- Why four results?
- We need to evaluate:
 - learning capability
 - generalization capability

Neural Networks in real applications

- The GUI has been used only for discussing basic concepts
- In real applications, it is better to use command-line functions



Neural Networks: Command-Line

- Learn by examples



- Exercises.pdf