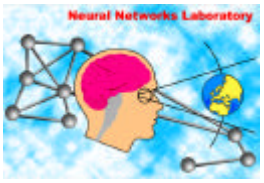


Technological Educational Institute Of Crete
Department Of Applied Informatics and Multimedia
Neural Networks Laboratory

Introduction To Neural Networks

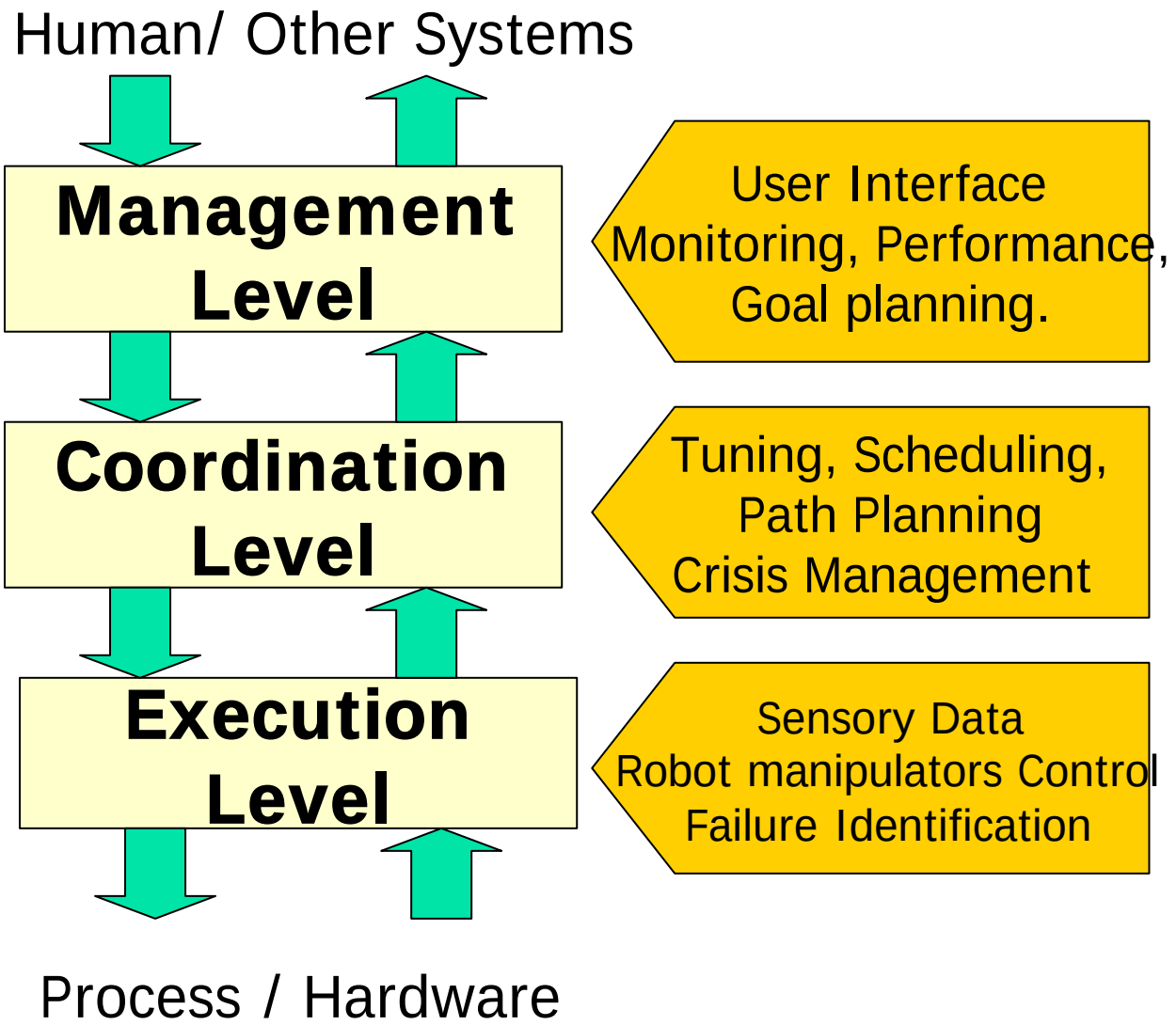
Prof. George Papadourakis, Ph.D.

Part III

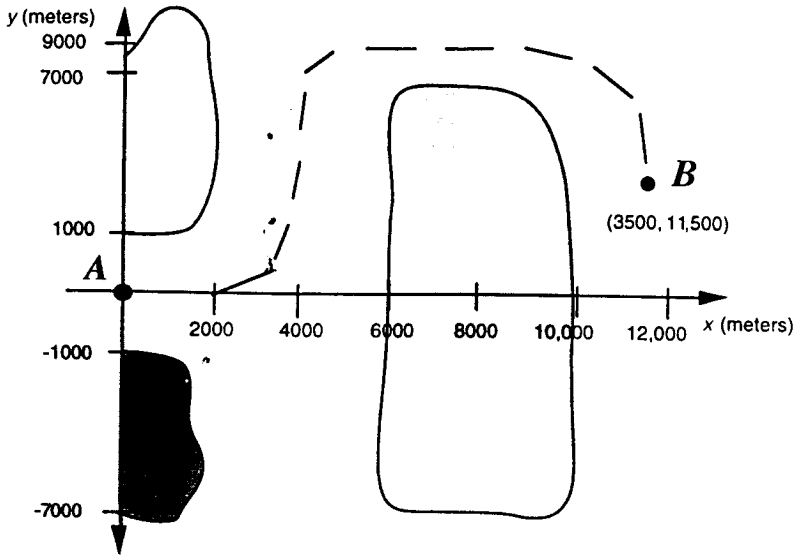
Application To Robotics

Intelligent Autonomous Control

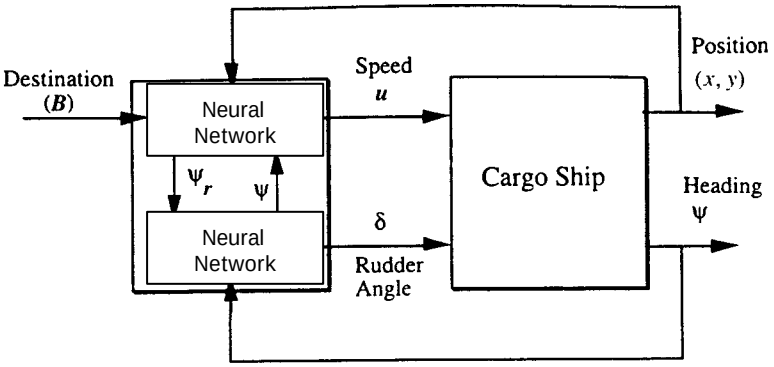
- Hierarchical Levels of operation



Case Study: Ship Steering



Map of islands for an autonomous navigation ship.



Controller Architecture for cargo Steering

Why Neural Networks ?

- Non linearity
  - Non linear models are difficult to build. Assuming linearity
  - NN Flexibly maps almost any non-linear function.
- Multivariate nature.
  - NN can map multiple cross input-output couplings.
- On line training for adaptive system identification.
- Parallel processing devices.

System Identification

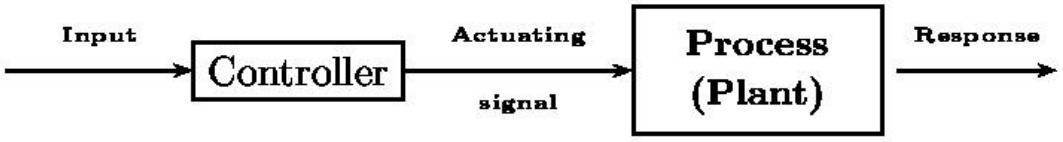
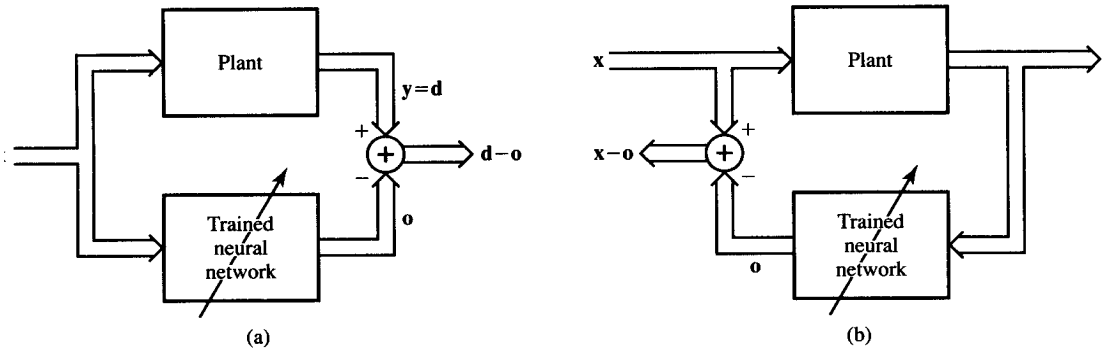


Illustration of control problem

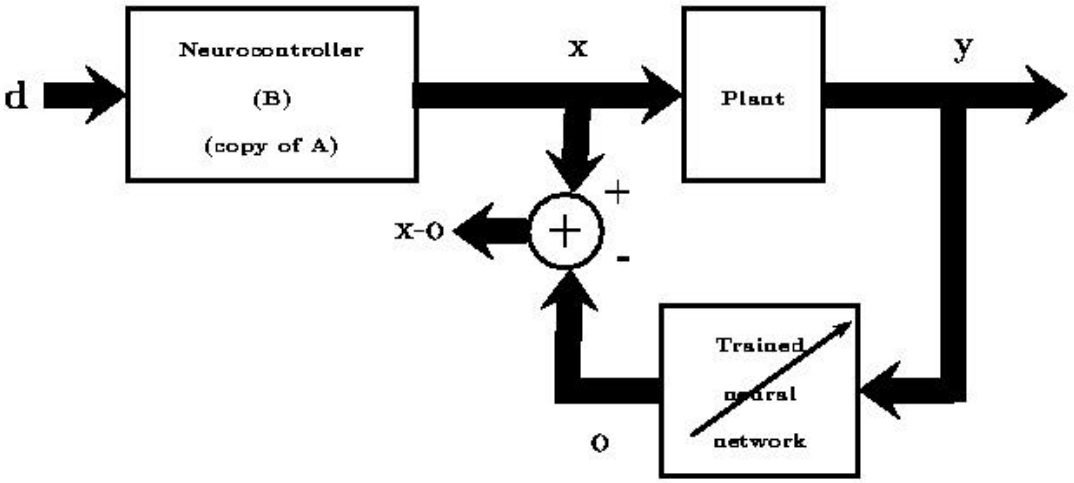
SYSTEM IDENTIFICATION:

The formulation of a mathematical model of a system from experimental data.

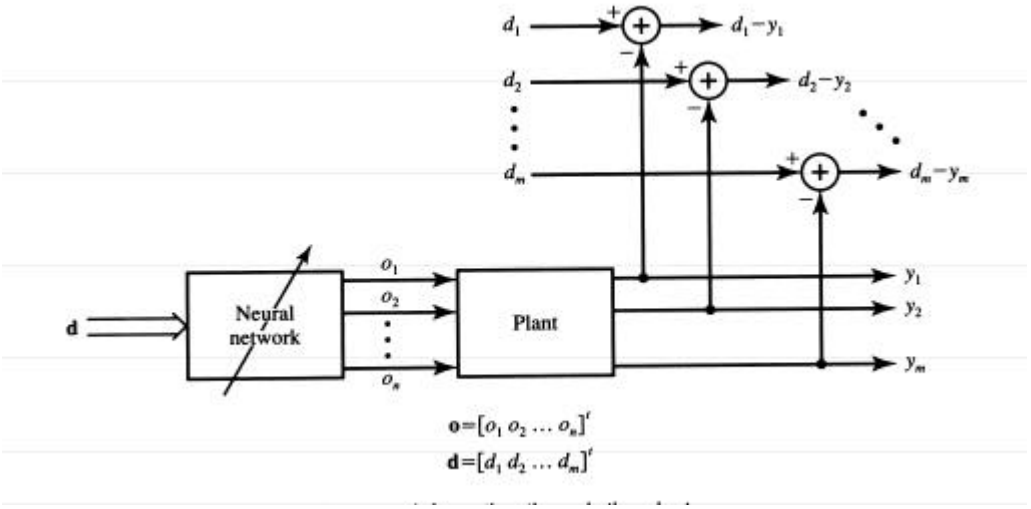


Neural network configuration for system identification
a) Forward identification
b) Inverse identification

Basic control architecture

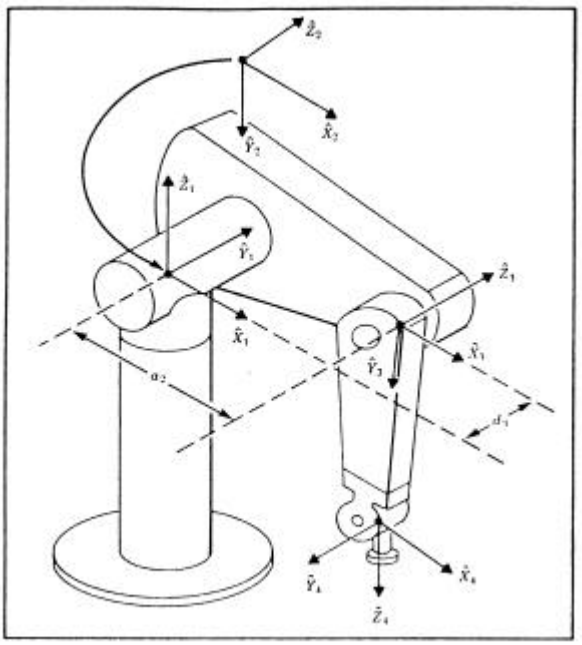


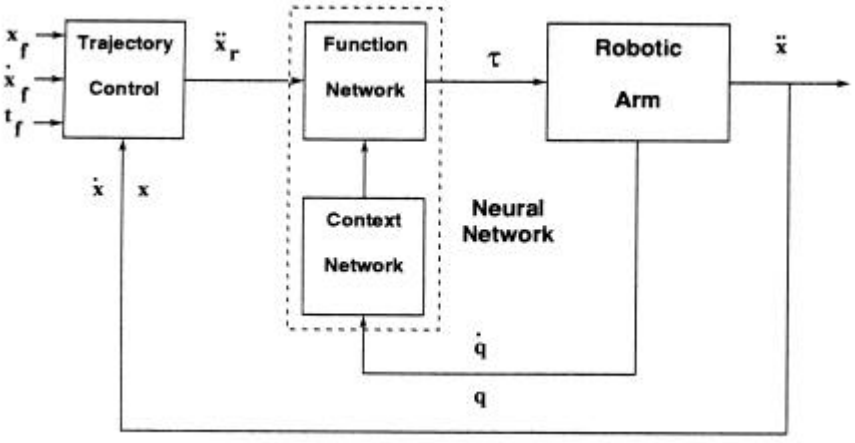
Feedforward control with plant inverse learning.



Back propagation of errors thought time.

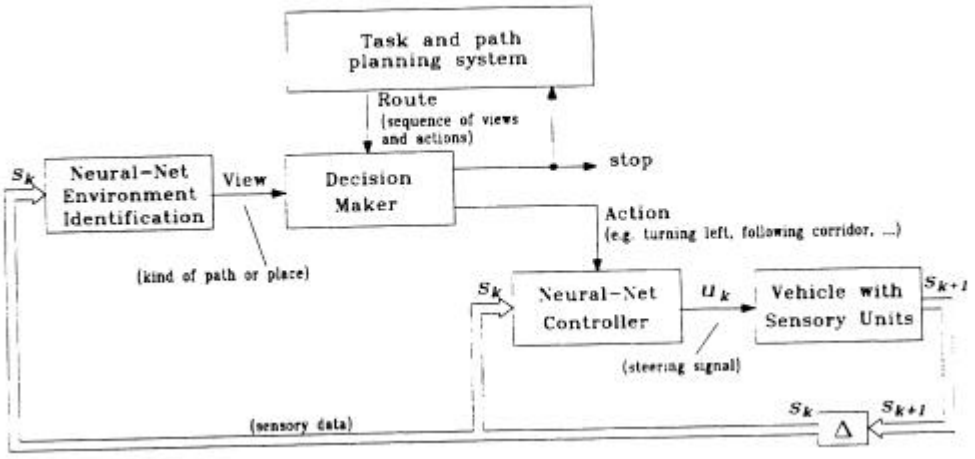
Control of a robotic manipulator



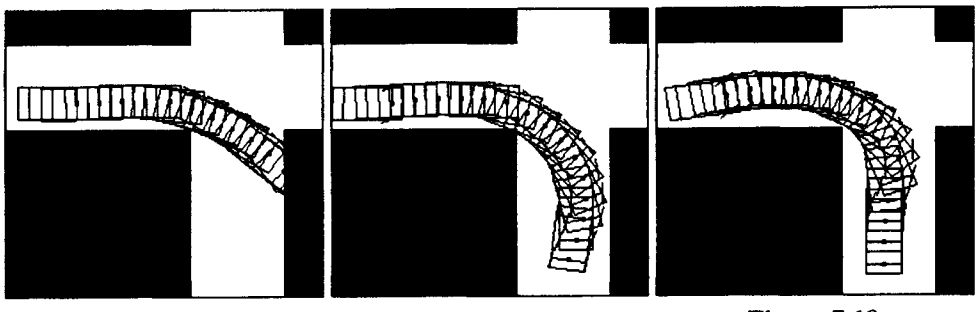


Feed forward control of a Robotic Arm.

Path Planning and Obstacle avoidance



Block diagram of the navigation system. Specialized NNs perform different tasks.



a) Before training, b) 1 , c) 5 training cycles