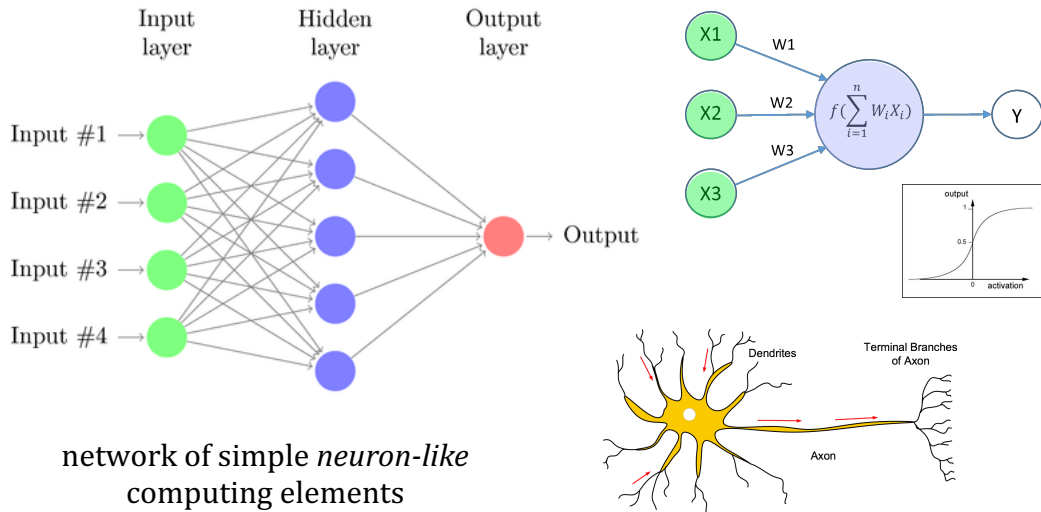
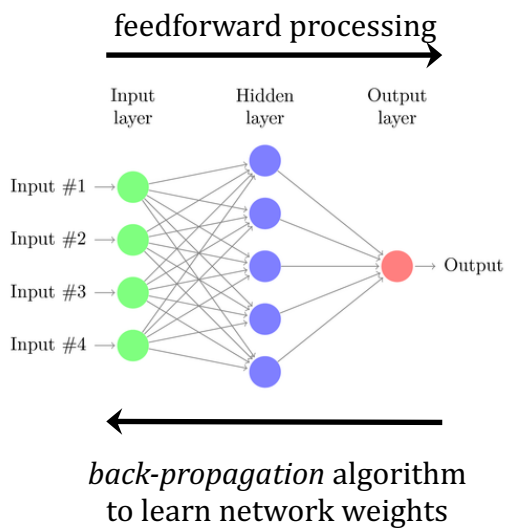


Artificial Neural Networks



Learning to Recognize Input Patterns



network weights can be **learned** from training examples (mapping from inputs to correct outputs)

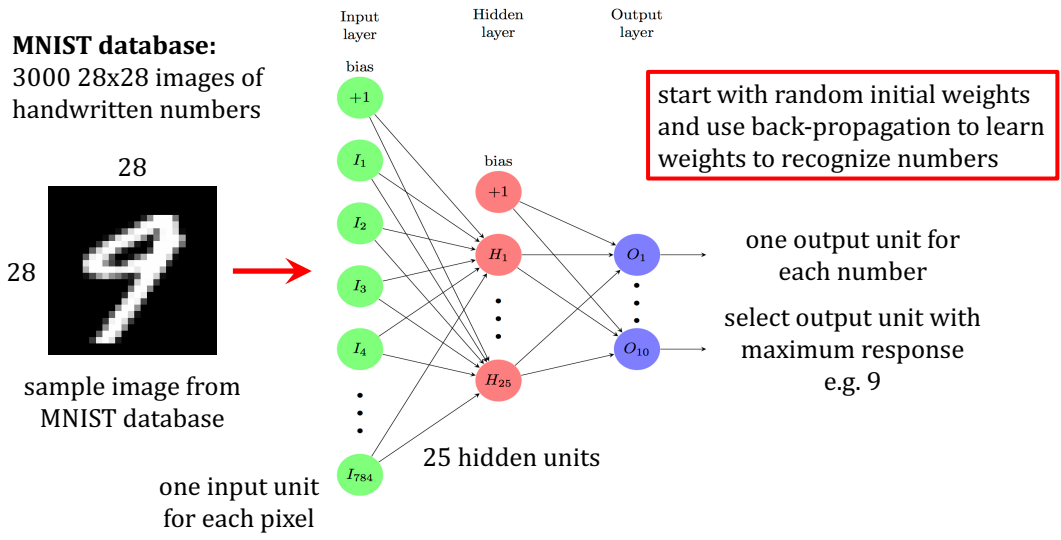
back-propagation:

iterative algorithm that progressively reduces error between computed and desired output until performance is satisfactory

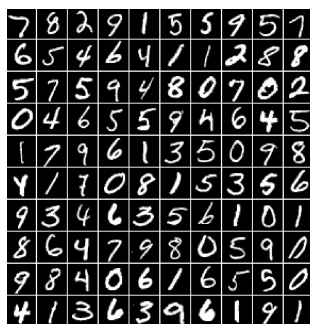
on each iteration:

- compute output of current network and assess performance
- compute weight adjustments from hidden to output layer that can reduce output errors
- compute weight adjustments from input to hidden units that can enhance hidden layer
- change network weights, using rate parameter

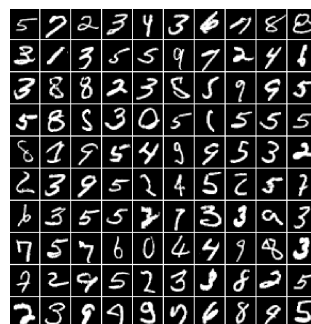
Example: Learning Handwritten Digits



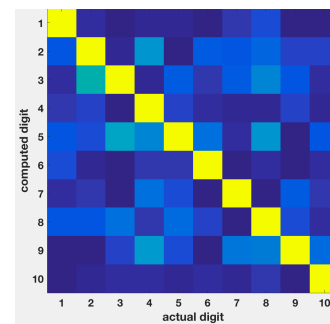
Results: Learning Handwritten Digits



correct examples



wrong examples



confusion matrix

overall classification accuracy: 87.1%