



UMassAmherst
The Commonwealth's Flagship Campus

Lecture 20

Machine Learning II

ECE 241 – Advanced Programming I
Fall 2021
Mike Zink



Introduction

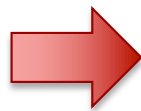
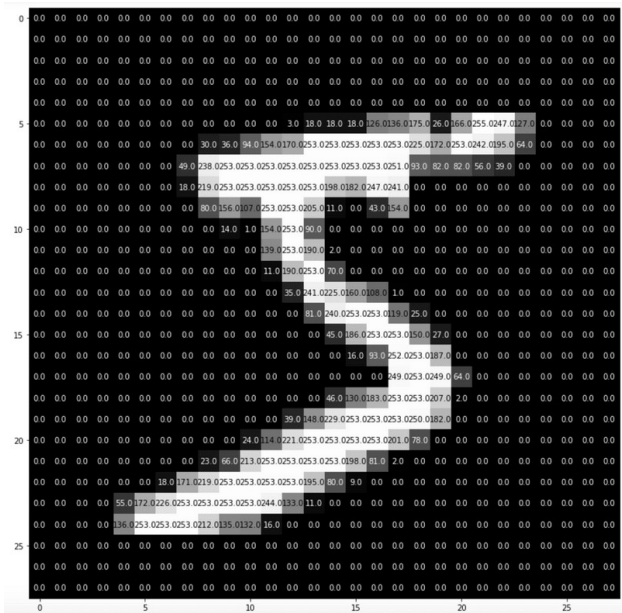
- Neural Networks
- Recognize handwritten digits

Data Set

- MNIST data set:
<http://yann.lecun.com/exdb/mnist/>
- 60,000 training images and 10,000 testing images
- Benchmark data set for machine learning



Process

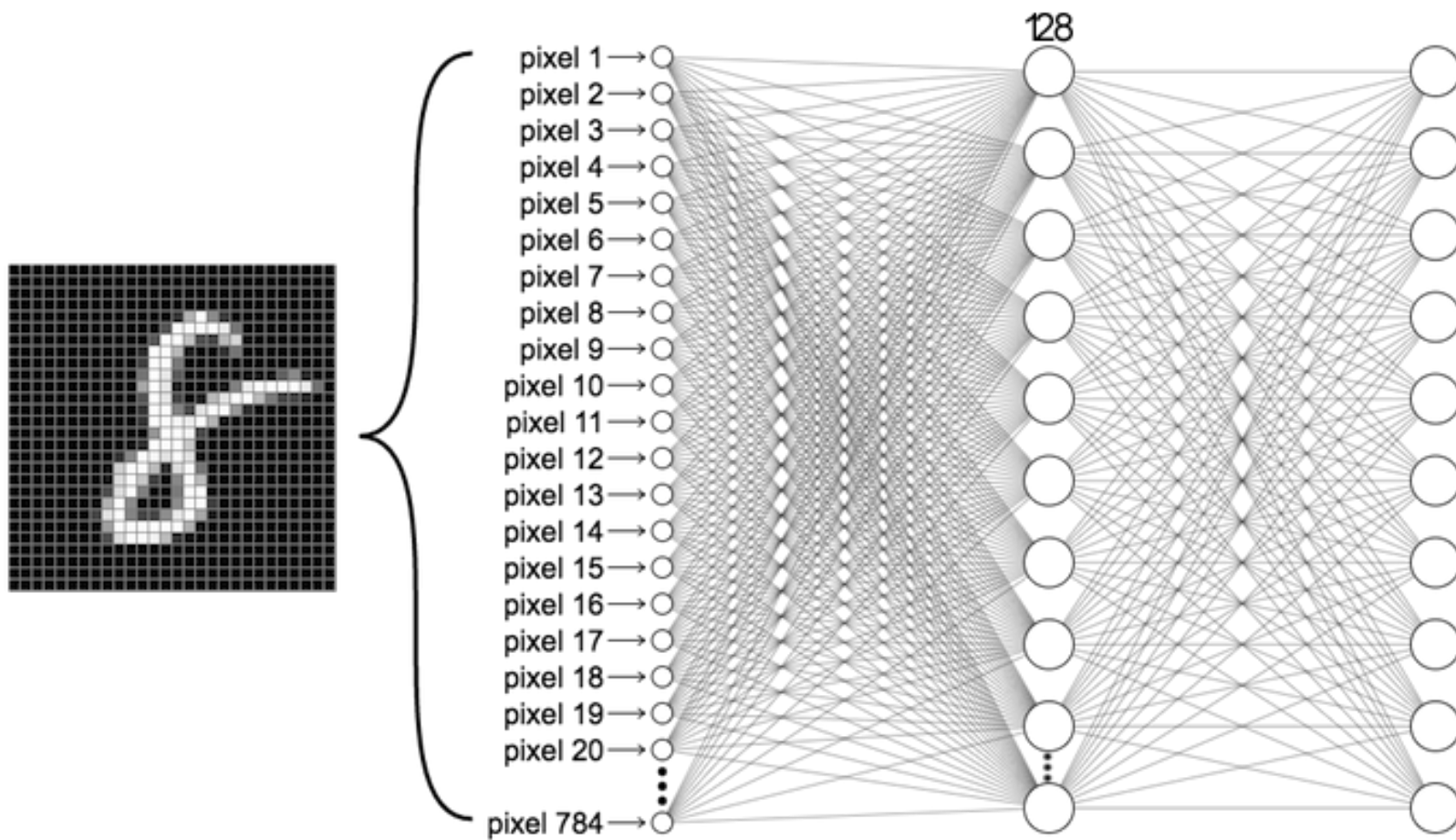


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- Normalized to fit into 28 x 28 pixel bounding box
- Grey scale
- Write a program that can do this?

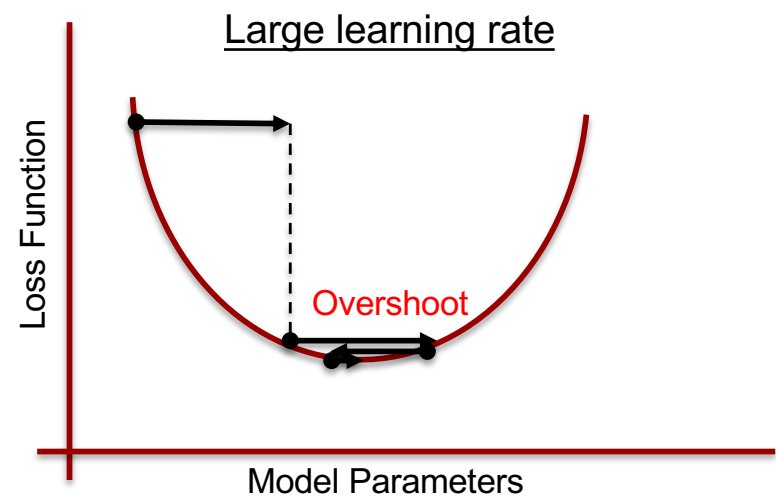
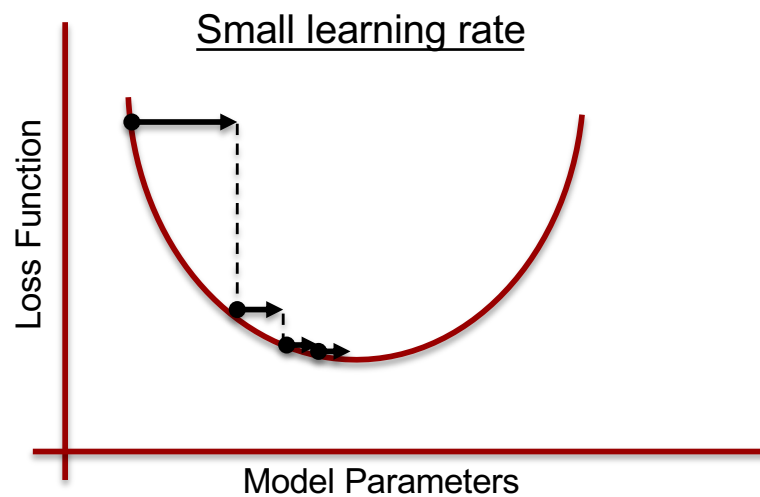
Neural Network

- Create Neural Network (NN) that can learn and recognize hand-written digits
- As name says, inspired by brain
- Many NN variants exist
- Understanding basic NN is requirement to understand more complex ones
- Classic example => “Hello World” of Machine Learning



Reducing Loss

- Gradient descent
 - the derivative of the loss function with respect to the model parameters.
- Learning rate
 - Multiply the gradient by a scalar



Optimizing computation

- In large data sets, calculating the gradient descent on billions of data points can be very computationally intensive.
- Computing the gradient descent in a small fraction of the data set produces similar results. This is called **Stochastic Gradient Descent**.
- An intermediate solution, is computing the gradient descent in a small batch of data. This approach is called **Mini-Batch Gradient Descent**.

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