Hebbian Equivelance of Backpropagation

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April 5, 2017

Overview

Motivation

Rundown

Current Results

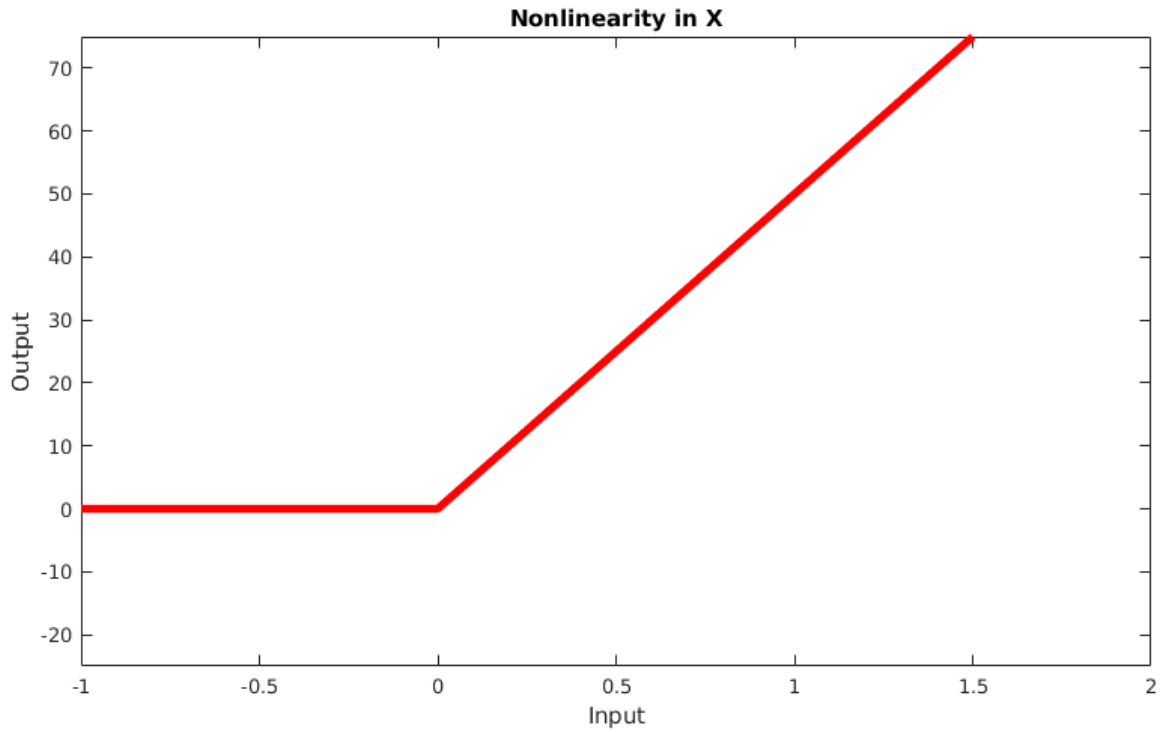
Motivation of problem at hand

- Preprocessing in olfactory system
- Dendritic connections
- Local algorithm vs. backpropagation

Network explanation

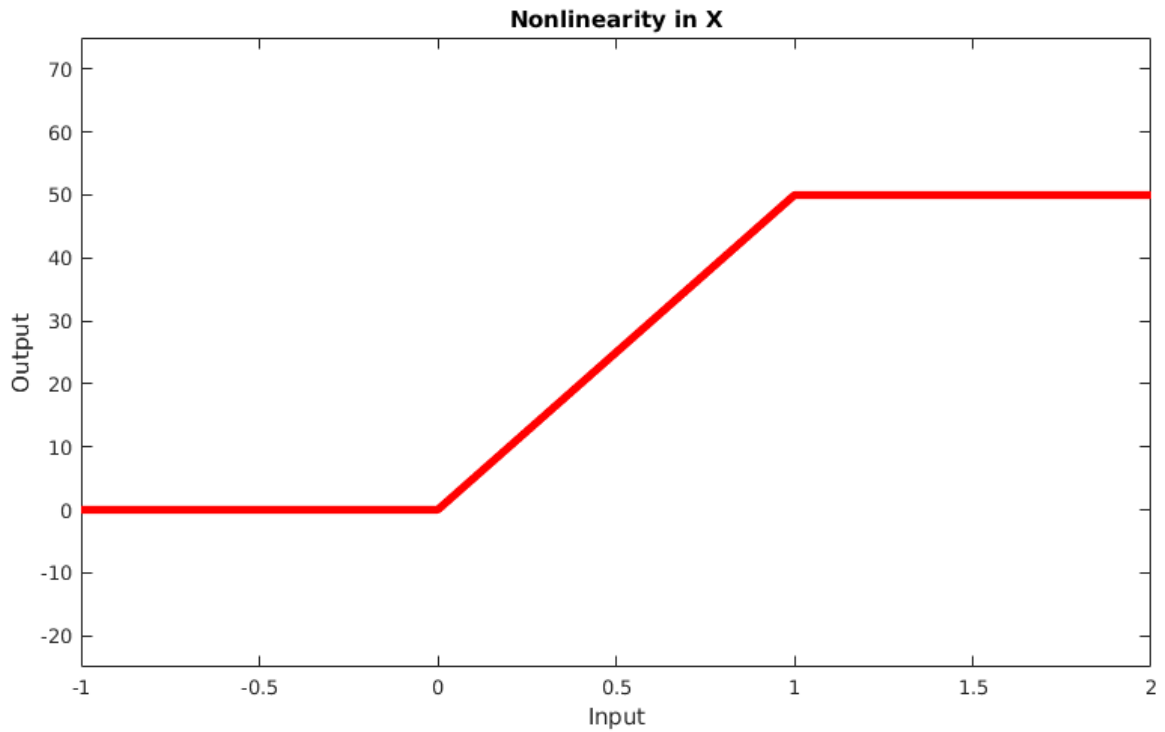
ReLU

- Rectified Linear Unit



ReSU

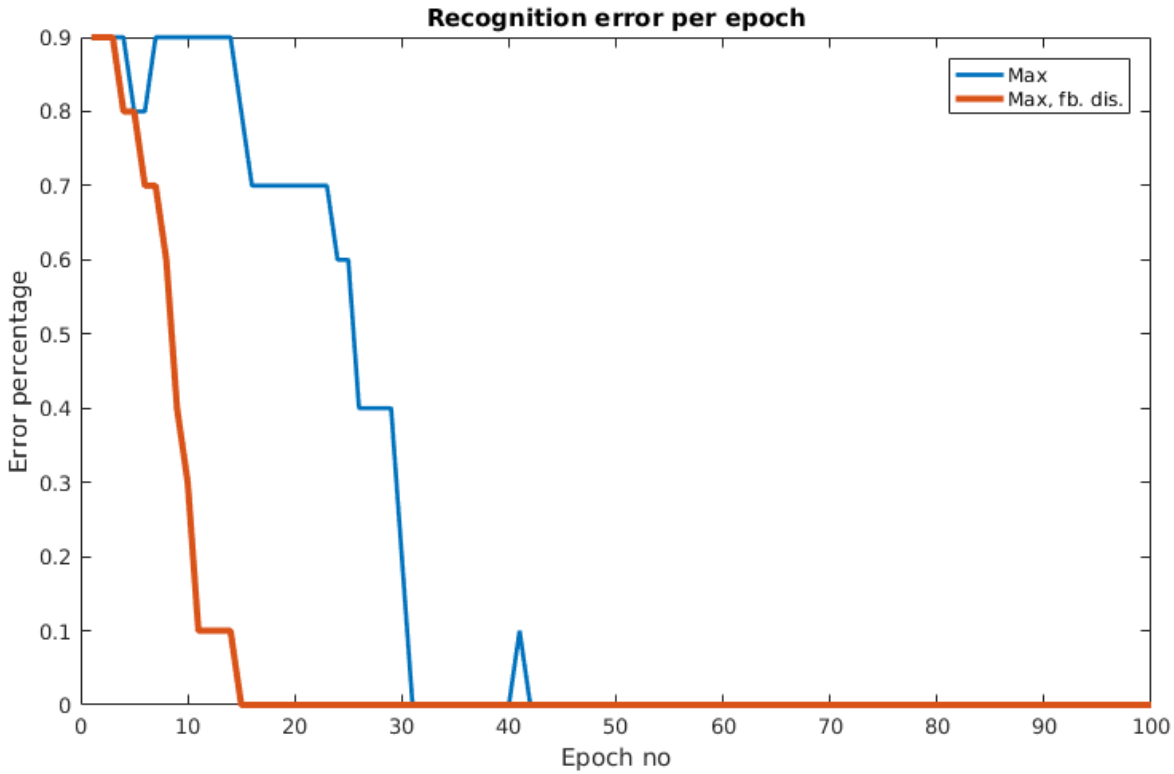
- Rectified Sigmoidal (or Switching) Unit



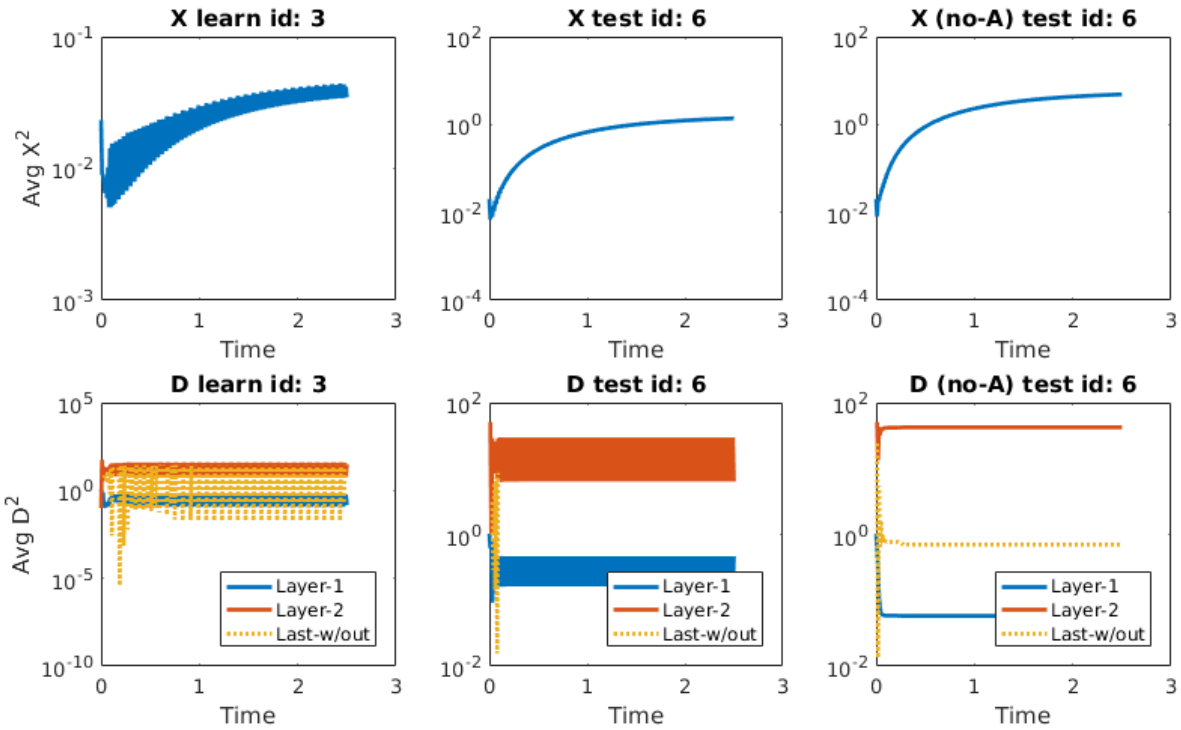
Single layer, 10 digits, results

- Learning is happening.

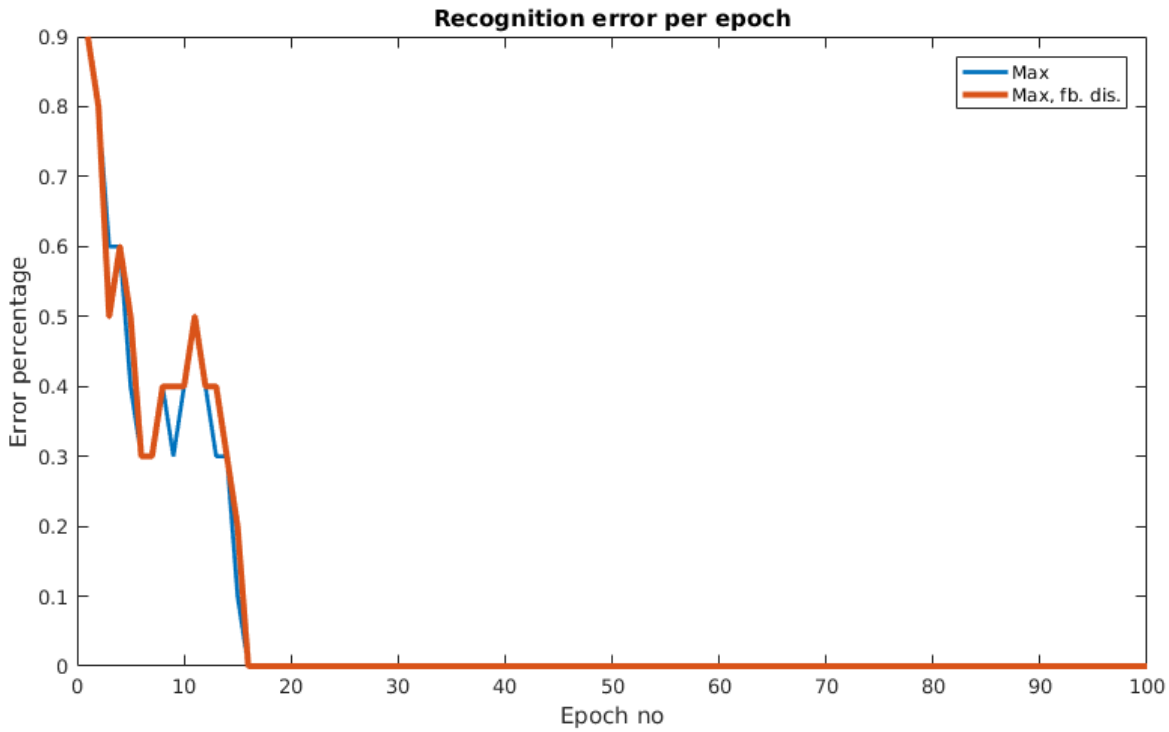
Single layer, 10 digits, A is fixed; Error



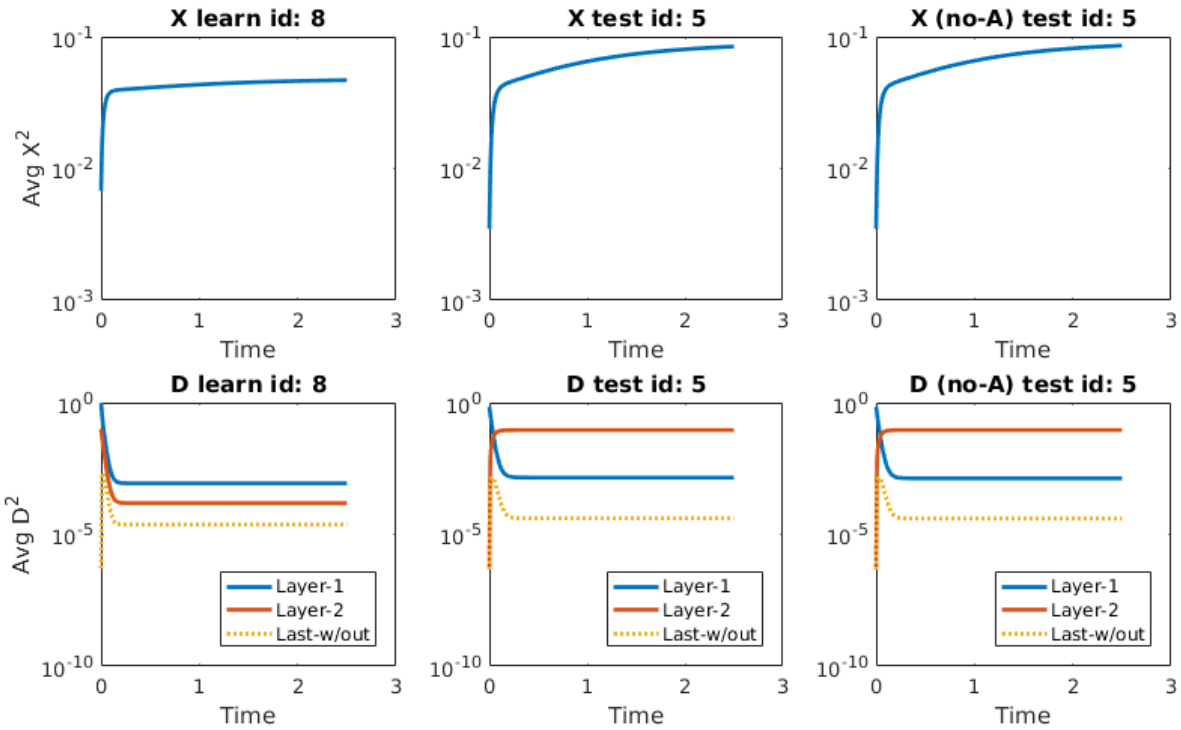
Single layer, 10 digits, A is fixed; Layer Average



Single layer, 10 digits; Error



Single layer, 10 digits; Layer Average



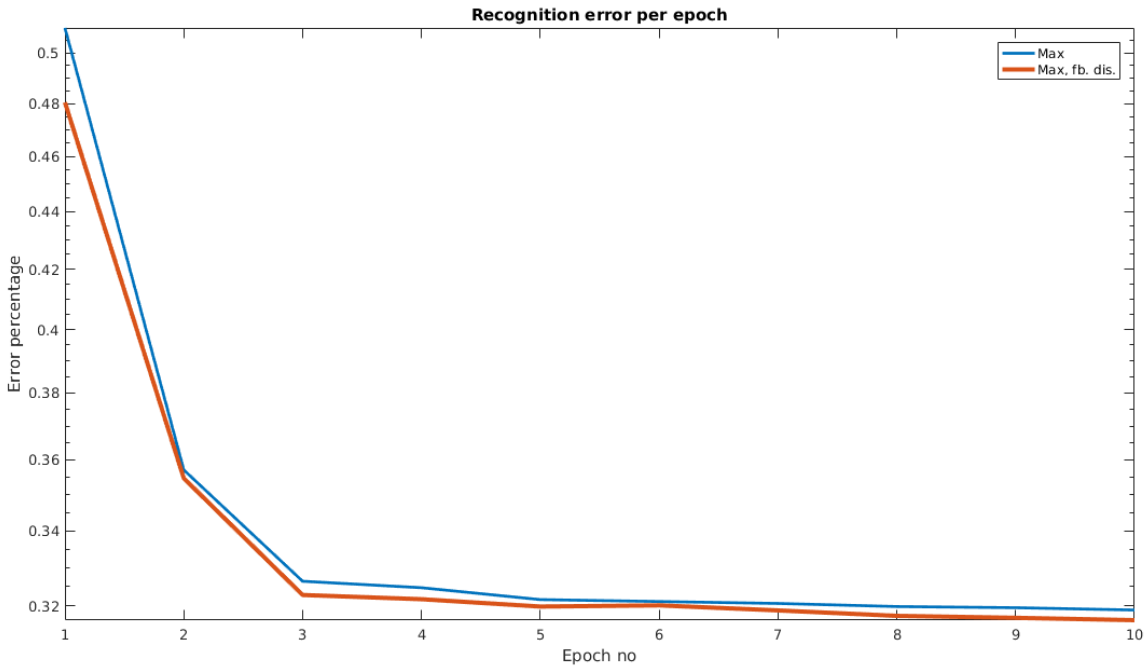
Single layer, entire MNIST dataset, results

- Better results when last layer feedback to X is blocked
- Better results when A layer is fixed to identity
- Initial hurdle with error rate going up is decreased
- Biasing rules work, but no improvement over performance
- ReLU and ReSU similar performance

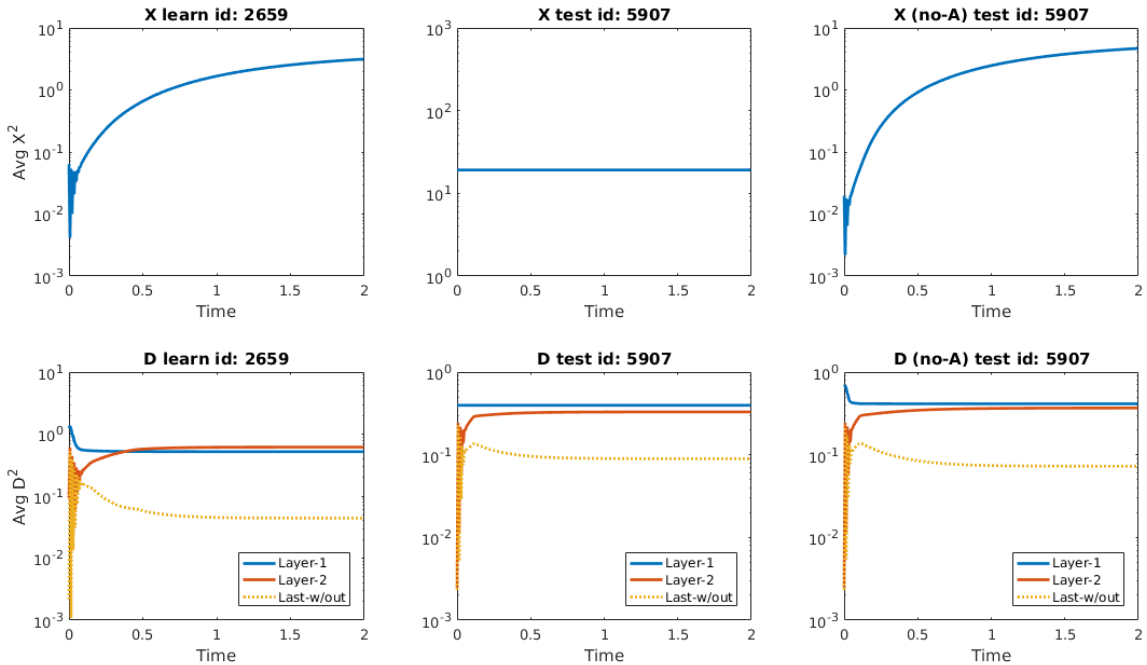
Single layer, example; parameters

- A is fixed at identity.
- Bias is learned
- Steepness is 10
- Learning rate is 5×10^{-8}
- Learning rate not adaptive
- Weight decay is not used
- Simulation time $= 2$
- simulation time steps $= 0.007$
- Nonlinearity $=$ ReLU

Single layer, example; errors



Single layer, example; averages



Dual layer, entire MNIST dataset

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