CNN theory

梁鼎

Outline

Nueral Networ

Structure

Training

Convolutional

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Convolution

Pooling

Nonlinear

Innerprodu

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Difference

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July 13, 2015

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Attention

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Build your own CN

- Only basic theory
- No formulas
- Mainly images

How do human learn from data

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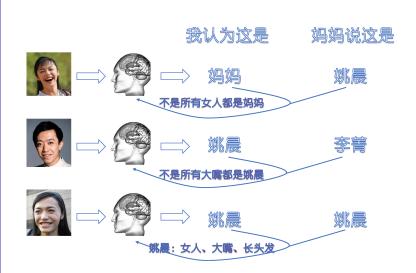
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What we want

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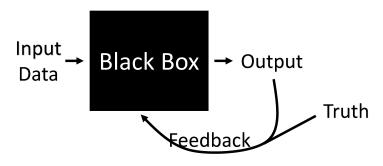


Figure: Make machine learn as people

Pipe

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Figure: Control the pipes to let water flow into correct target

Minist Demo

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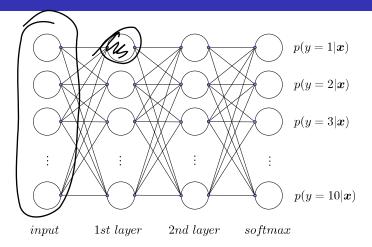


Figure: A demo neural network for digits recognition. Paramters are those pipes, controling the input data (water) flowing into every exit.

Neurons

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Outlin

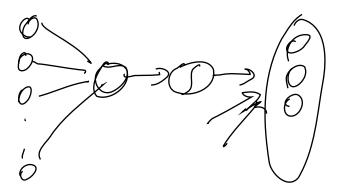
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- 1 Linear combination of all the neuron outputs of last layer
- Pass through an active unit, bringing nonlinear components



Training steps

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Build your own CNI

- 1 Forward
- 2 Backpropagation
- 3 Update parameters



CNN structure

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CNN is an extended Nueral Network mainly designed for 2D input. More wonderful layers and extend 1D features to 2D feature maps.

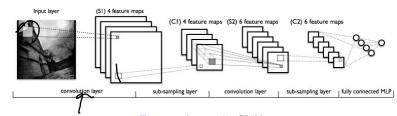


Figure: A simple CNN.

Convolution

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Structure Convolution

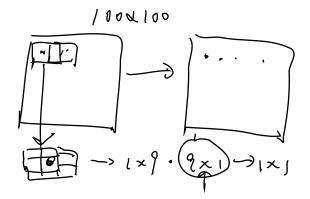
Pooling

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Innerproduct Loss Layer

Loss Layer Build your own CNI Difference

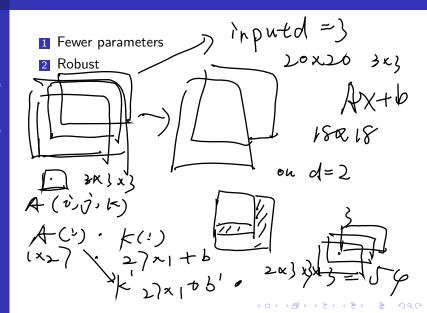
- 1 Actually is still inner product
- 2 Combined with location infomation
- 3 Done locally



Convolution

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Convolution



Pooling (Subsampling)

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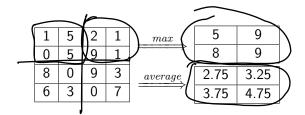
Convolut Pooling

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Build your own CNI

- Preventing from overfitting
- Translation invariant
- 3 Max or average and so on
- 4 Simple



Nonlinear

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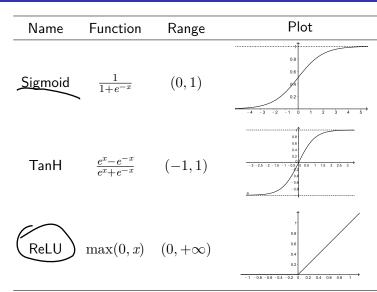
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Innerproduct

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Traditional Neural Networks

2 Large Parameter Space

Loss Layer

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Loss Layer Build your own Softmax Loss – Classification

2 Euclidean (L2) Loss – Regression

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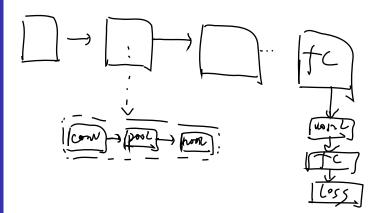
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- 1 Dimension
- 2 Fewer parameters
- More types of layers
- 4 Avoiding overfitting

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Thanks!