Neural Networks Pt. 2

W. Guss & P. Kuznetsov

Feed-Forwar Neural Networks

How They Work Universal Approximation (Briefly)

Training
Nonconve

Error-

Backpropagatio

Neural Networks Workshop: Training and Stochastic Gradient Descent

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Overview



W. Guss & P. Kuznetsov

Feed-Forward Neural Networks

How They Work Universal Approximation (Briefly)

Fraining
Nonconvex
Optimization
ErrorBackpropagation

Deep Lea

Today we use and train Feed-Forward Artificial Neural Networks

- 1 Feed-Forward Neural Networks
 - How They Work
 - Universal Approximation (Briefly)
- 2 Training
 - Nonconvex Optimization
 - Error-Backpropagation
- 3 Deep Learning



Perceptron Review

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[TODO: IMAGE OF PERCEPTRON AND SIGN FUNCTIO]

Perceptrons are neural computation units which make weighted decisions:

$$p(\mathbf{x}) = \begin{cases} 1 & \text{if } \sum w_i x_i + b \ge 0 \\ 0 & \text{otherwise} \end{cases}$$
$$= \frac{\text{sign}(\sum w_i x_i + b) + 1}{2}$$

- Perceptrons are not powerful enough, as seen last time with XOR.
- What if we want real valued output for tasks like predicting the temparature or stock prices?

Feedforward Neural Networks

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[TODO: IMAGE OF FEED FORWARD NETWORK]

- Feedforward Artifical Neural Networks (ANNs) are the *continuous* extensions of perceptrons.
- ANNs can have many layers and different nodes which are fully connected.
- Generally, the more layers and nodes, the greater the computational power of the network!
- The intuition behind this model is that each neuron in the network makes a weighted decision like the perceptron.
 Many stacked decisions allows for extremely complex logic.

Blocks of Highlighted Text

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Block 1

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Block 2

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Block 3

Suspendisse tincidunt sagittis gravida. Curabitur condimentum, enim sed venenatis rutrum, ipsum neque consectetur orci, sed blandit justo nisi ac lacus.

4 D > 4 P > 4 E > 4 E >

Multiple Columns

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Heading

- Statement
- Explanation
- 3 Example

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer lectus nisl, ultricies in feugiat rutrum, porttitor sit amet augue. Aliquam ut tortor mauris. Sed volutpat ante purus, quis accumsan dolor.

Table

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Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table: Table caption

Theorem

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Theorem (Mass-energy equivalence)

$$E = mc^2$$

Verbatim

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Example (Theorem Slide Code)

```
\begin{frame}
\frametitle{Theorem}
\begin{theorem}[Mass--energy equivalence]
$E = mc^2$
\end{theorem}
\end{frame}
```

Figure

Neural Networks Pt. 2

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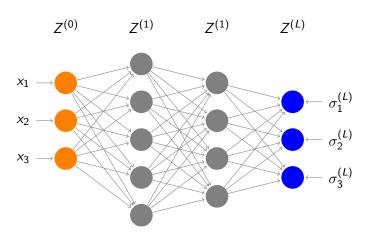


Figure: An example of a feed-forward ANN, ${\cal N}$ with four layers.

Citation

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An example of the \cite command to cite within the presentation:

This statement requires citation [Smith, 2012].

References

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John Smith (2012)
Title of the publication

Journal Name 12(3), 45 – 678.

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The End