Multi Layer Networks

What can be Computed?
Convex Areas

- Convex Areas
- Arbitrary Areas
- General Transformations

2 Usage

- System Identification
- ALVINN
- NetTalk
- Data Compression

Örjan Ekeberg	Brain Modeling and Machine Learning	Örjan Ekeberg	Brain Modeling and Machine Learning
What can be Computed? Usage	Convex Areas Arbitrary Areas General Transformations	What can be Computed? Usage	Convex Areas Arbitrary Areas General Transformations
		Multi Layer Feed-Forward Networks	

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What can a thresholded two layer network compute?



With $w_1 = w_2 = w_3 = 1$ and $\theta = 2.5$ the second layer operates as an AND-gate.



Multi Layer Feed-Forward Networks

What happens if the area is not convex?



Arbitrarily complex areas can be extracted provided there are enough hidden units

Brain Modeling and Machine Learning

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What can be Computed? Usage

Convex Areas Arbitrary Areas General Transformatic

Capabilities

Operates like a general "Learning Box"!



Function Approximation



Multidimensional Mapping



"Mimic" an existing system



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What can be Computed? Usage ALVINN Verta Corr

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What can be Computed? Usage

Data Compression

ALVINN



Brain Modeling and Machine Learning

Data Compression

What can be Computed? Usage NetTalk NetTalk Speech Synthesis "Hello" \longrightarrow Phoneme \longrightarrow Coded pronunciation

Trained using a large database of spoken text

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Train with $\vec{x} = \vec{y}$ (auto-association) Forces the network to use a compact encoding of the patterns.