بسم الله الرحمن الرحیم

علوم شناختی

جلسه ۱۱ (الف)

مدل‌های پردازش اطلاعات الهام گرفته شده از اعصاب

Neurally Inspired Models of Information Processing

کاظم فولادی قلعه
دانشکده مهندسی، دانشکدگان فارابی
دانشگاه تهران

http://courses.fouladi.ir/cogsci

PART 2:
MODELS AND TOOLS

CAMBRIDGE
UNIVERSITY PRESS

Chapter 5:
Neural Networks and Distributed Information Processing

CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE

Chapter 5.1: Neurally inspired models of information processing

CAMBRIDGE UNIVERSITY PRESS

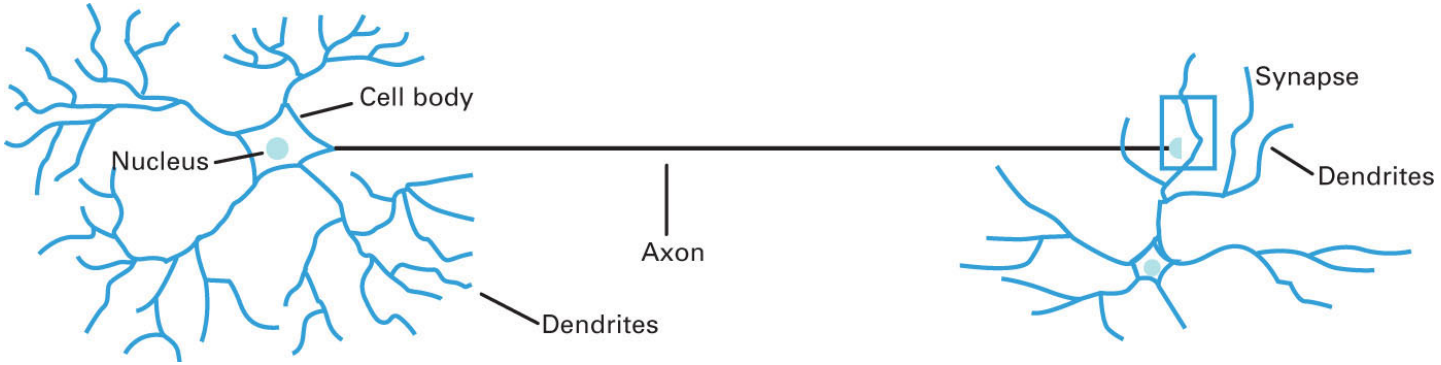
Overview

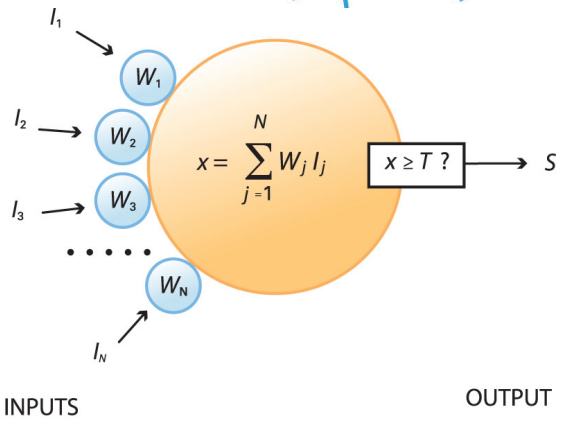
- Introduce basic principles of connectionist networks
- Introduce different types of activation function

Features of connectionist networks

- Exploit parallel processing
- Can be used to model multiple satisfaction of soft constraints
- Do not feature explicit (content-specific) rules
- Exhibit graceful degradation
- Intended as models of information-processing at the algorithmic level
- Capable of learning

Neurons and network units



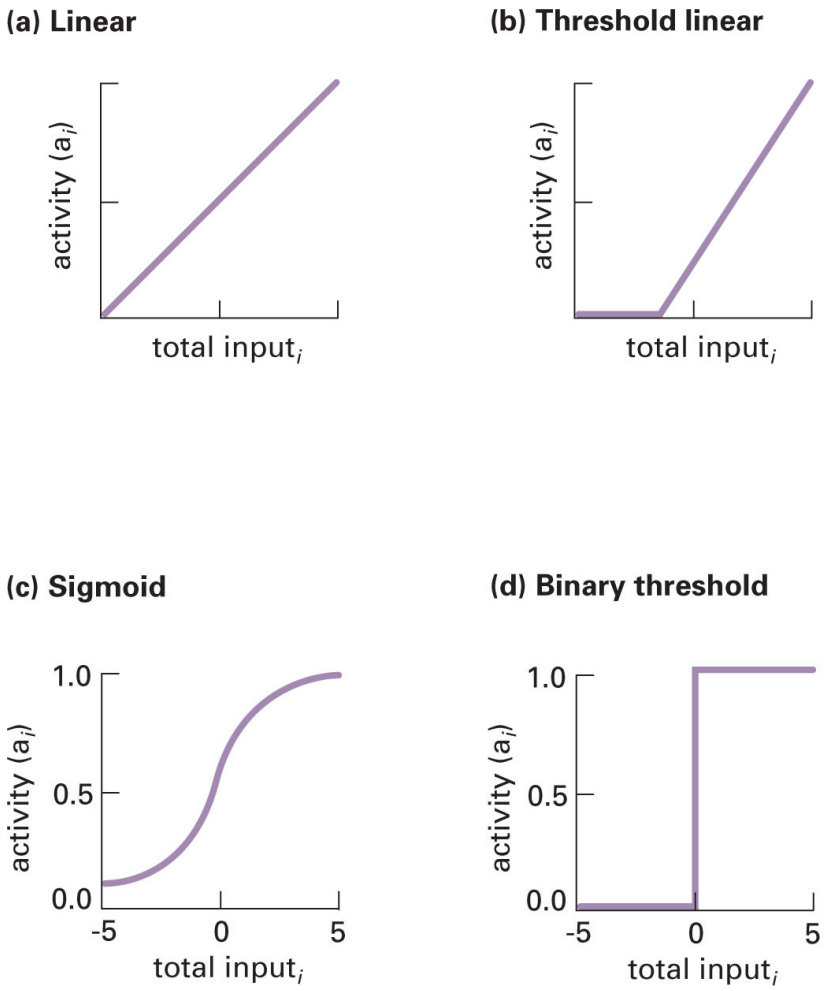


I_i	Input $_i$
W_i	The weight attached to input $_i$
T	The threshold of the neuron
X	The total input to the neuron
S	The output signal

Fig. 2
An artificial neuron:

I_i	Input *i*
W_i	The weight attached to input *i*
T	The threshold of the neuron
X	The total input to the neuron
S	The output signal

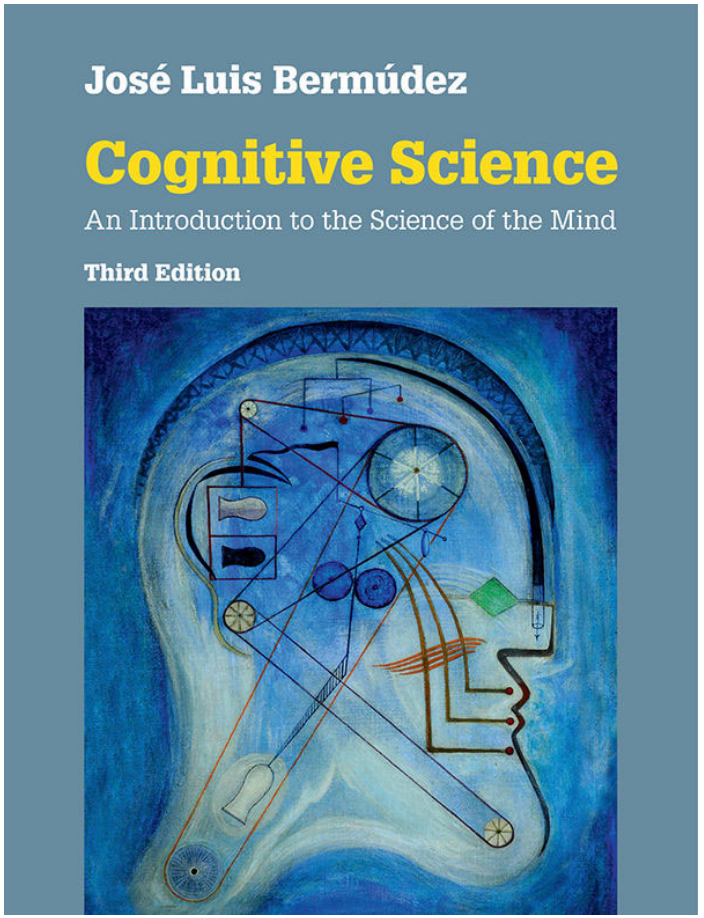
Activation functions



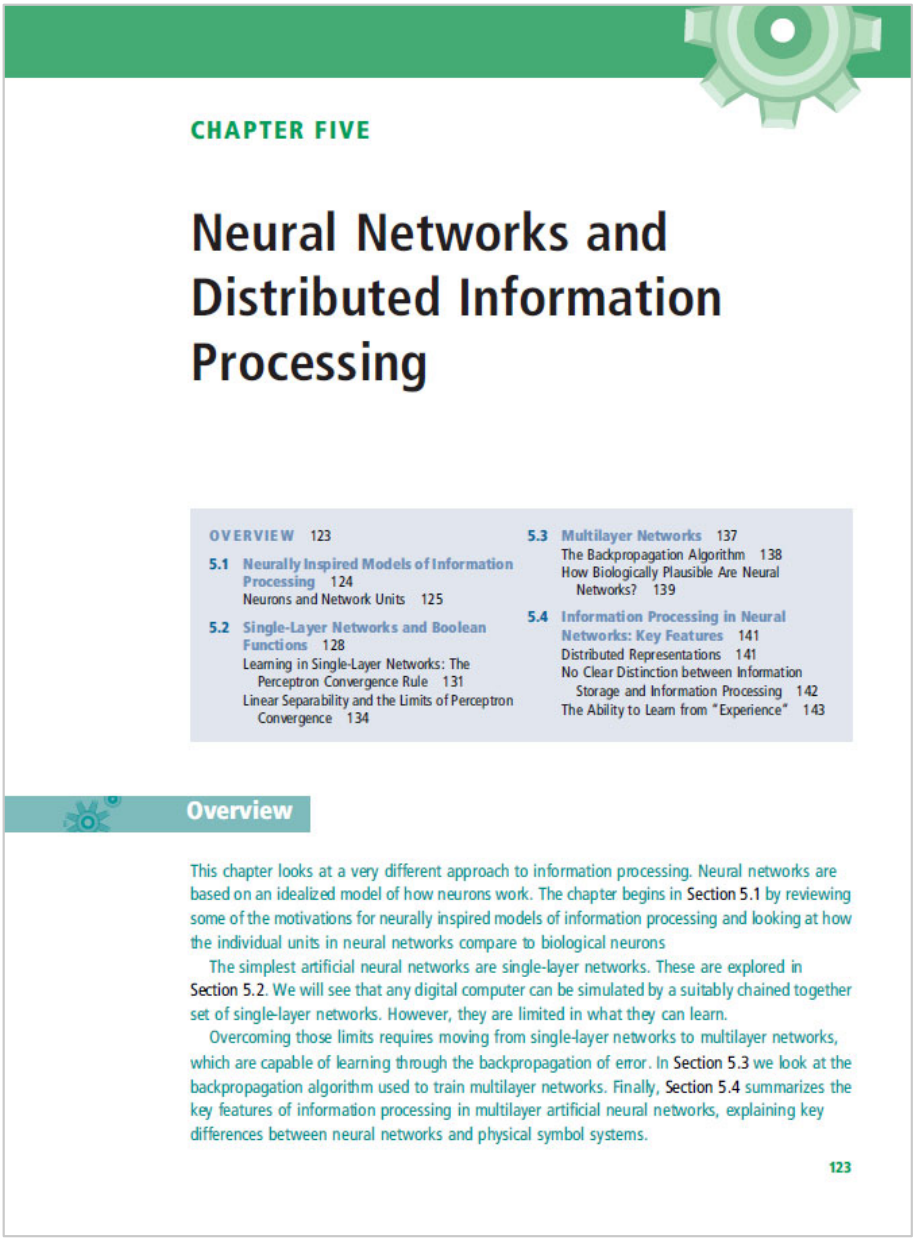
Networks and layers

- Basic distinction
  - Single-unit networks [a.k.a. single layer networks]
  - Multilayer networks
- Different learning rules
- Only multilayer networks have hidden units

منبع اصلی



José Luis Bermúdez,
Cognitive Science:
An Introduction to the Science of the Mind,
3rd ed., Cambridge University Press, 2020.
Chapter 5 (Section 5.1)



CHAPTER FIVE

Neural Networks and Distributed Information Processing

Overview

This chapter looks at a very different approach to information processing. Neural networks are based on an idealized model of how neurons work. The chapter begins in Section 5.1 by reviewing some of the motivations for neurally inspired models of information processing and looking at how the individual units in neural networks compare to biological neurons

The simplest artificial neural networks are single-layer networks. These are explored in Section 5.2. We will see that any digital computer can be simulated by a suitably chained together set of single-layer networks. However, they are limited in what they can learn.

Overcoming those limits requires moving from single-layer networks to multilayer networks, which are capable of learning through the backpropagation of error. In Section 5.3 we look at the backpropagation algorithm used to train multilayer networks. Finally, Section 5.4 summarizes the key features of information processing in multilayer artificial neural networks, explaining key differences between neural networks and physical symbol systems.

123