Notes of Deep Learning[1]

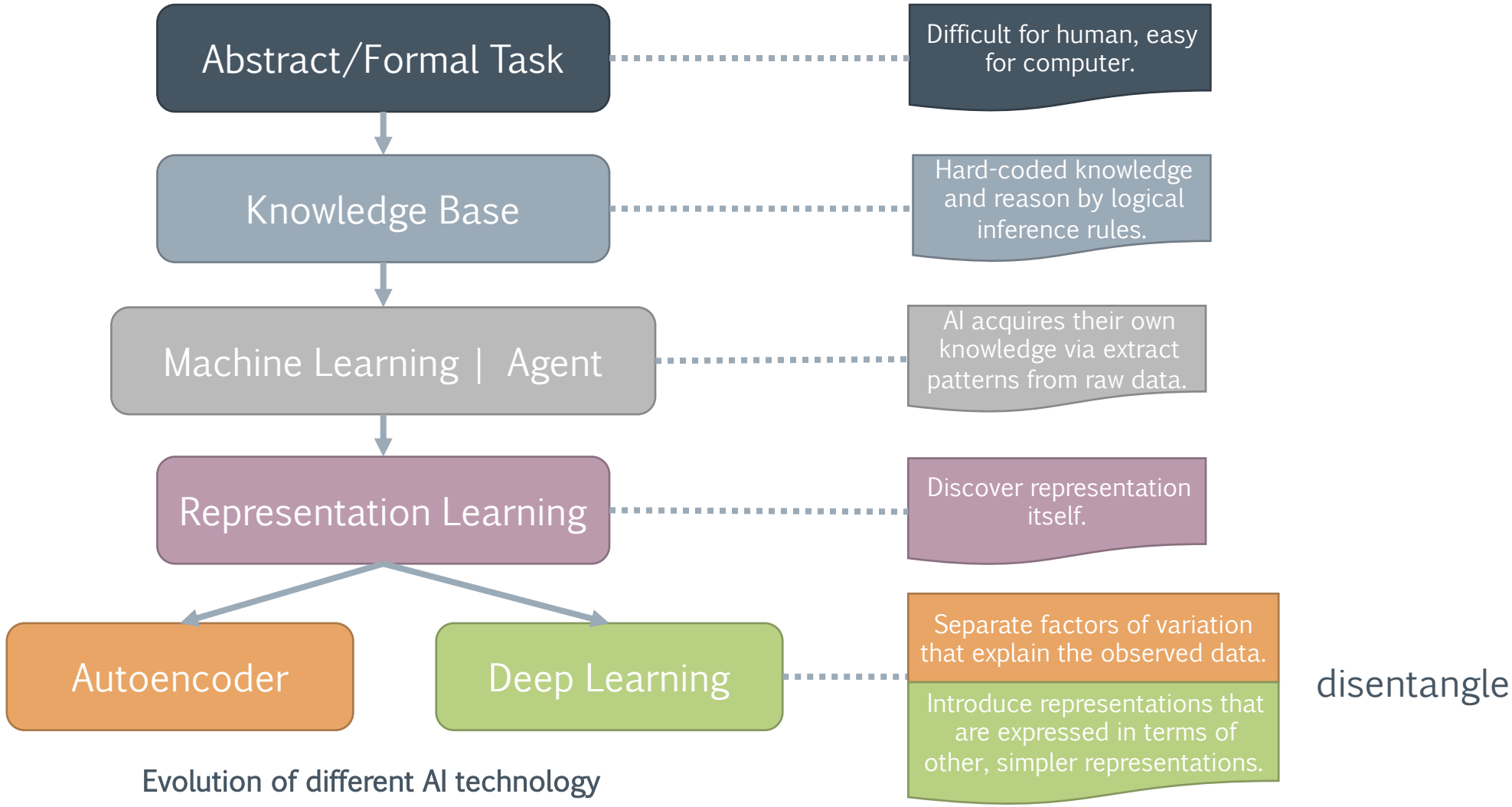
Introduction (chapter 1)

[1] Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. The MIT Press.

Introduction

- Challenge to artificial intelligence:
  - Solving the tasks that are easy for people to perform but hard for people to describe formally.
- Solutions with deep learning :
  - Learn from experience and understand the world in terms of a hierarchy of concepts, with each concept defined in terms of its relation to simpler concepts.

Introduction



Evolution of different AI technology

Introduction

- Perspectives of deep learning:
  - Learning the right representation.
  - Depth allows the computer to learn a multi-step computer program:
    - Each layer of the representation can be thought of as the state of the computer's memory after executing another set of instructions in parallel.
    - Not all of the information in a layer's activations necessarily encodes factors of variation that explain the input.
    - The representation also stores state information that helps to execute a program that can make sense of the input.

Introduction

- Depth of a model
  - Depth of the computational graph:
    - Number of sequential instructions that must be executed to evaluate the architecture.
  - Depth of the probabilistic modeling graph:
    - Depth of the graph describing how concepts are related to each other.
  - Compare with ‘shallow’ model:
    - The study of models that either involve a greater amount of composition of learned functions or learned concepts than traditional machine learning does.
  - But it is still a technique that allows computer systems to improve with experience and data.

Introduction

- Relation between different AI disciplines

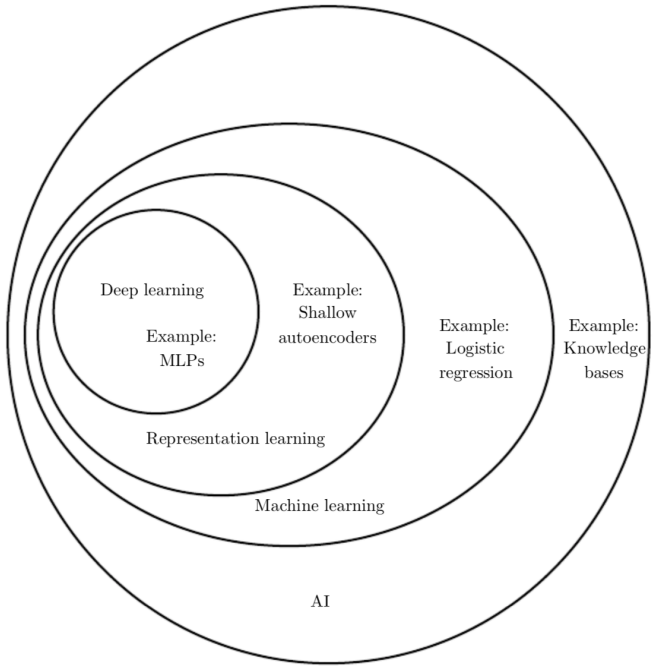


Figure 1.4: A Venn diagram showing how deep learning is a kind of representation learning, which is in turn a kind of machine learning, which is used for many but not all approaches to AI. Each section of the Venn diagram includes an example of an AI technology.

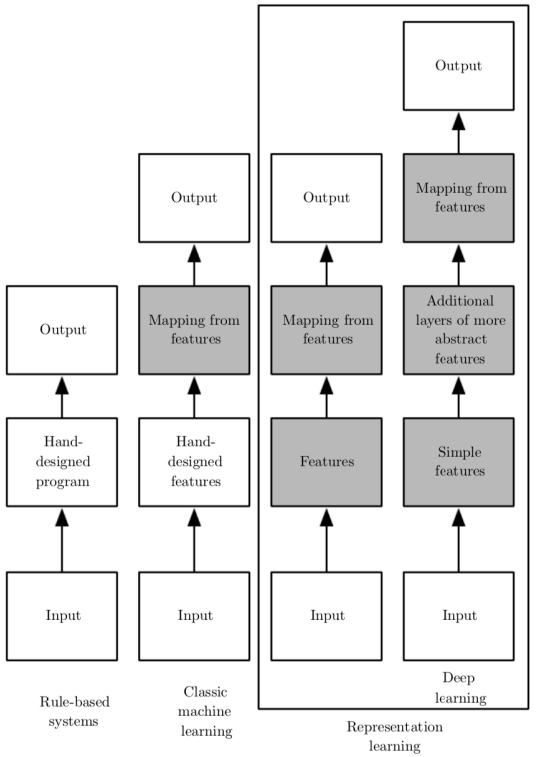


Figure 1.5: Flowcharts showing how the different parts of an AI system relate to each other within different AI disciplines. Shaded boxes indicate components that are able to learn from data.

Introduction

- Organization

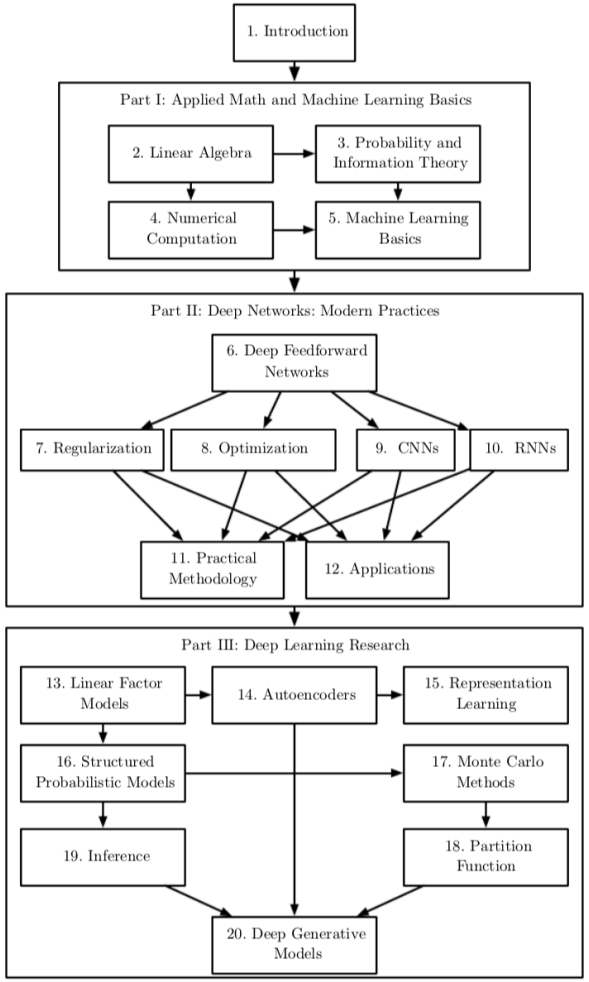


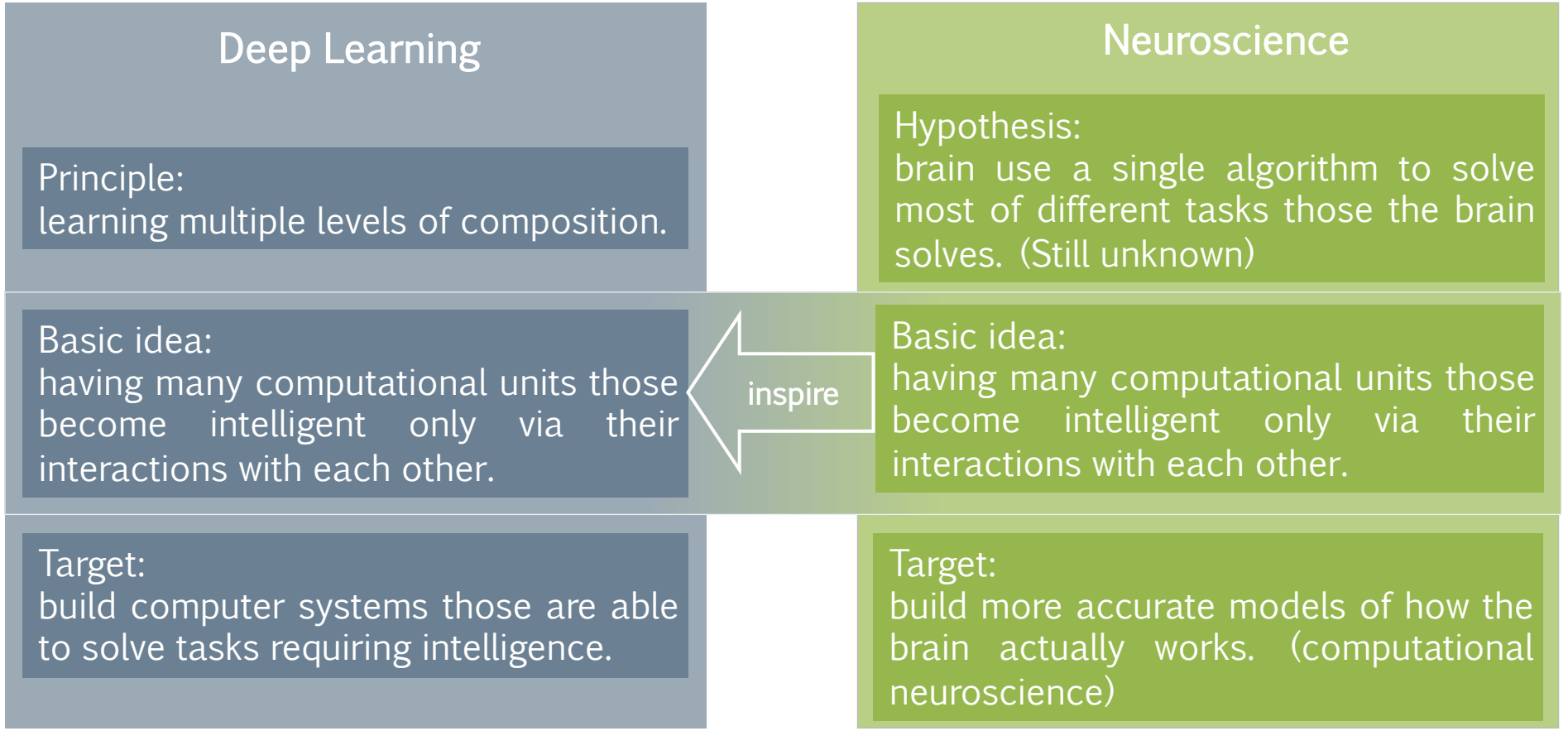
Figure 1.6: The high-level organization of the book. An arrow from one chapter to another indicates that the former chapter is prerequisite material for understanding the latter.

Introduction

- Neural perspective on deep learning:
  - To reverse engineer the computational principles behind the brain and duplicate its functionality.
  - To understand the brain and the principles that underlie human intelligence apart from their ability to solve engineering applications.
  - Deep Learning ≠ Neuroscience

Introduction

› Deep learning vs Neuroscience :



Introduction

- Connectionism:
  - A large number of simple computational units can achieve intelligent behavior when networked together:
  - Distributed representation*:
    - Each input represented by many features, each feature involved in the representation of many possible inputs.
  - Back-propagation

Introduction

- Changes:
  - Increasing dataset sizes
  - Increasing model sizes
  - Increasing accuracy, complexity and real-world impact

To be continued...