Chapter 35. The Quest Continues


Lecture Notes on Artificial Intelligence, Spring 2012

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35.3 Summing Up
  Four main categories of this book

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Overview of Chapter 35

- Some of the research projects underway in AI laboratories.
  - Specialized Systems
  - Applicable Systems

- There are more issues on “human-level artificial intelligence”.

- The idea of this book is summarized in four main categories.
  - Complete AI systems / Architectures / Processes / Representations
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35.1 In the Labs
35.1.1 Specialized Systems (1/2)

- **Content-Based Image Retrieval**
  - Current Image search techniques are based on the description text but there does not always exist text
  - Researches regarding content-based image search are underway

Figure 35.1: Searching for objects in images. (From James Philbin et al., “Object Retrieval with Large Vocabularies and Fast Spatial Matching,” CVPR, 2007.)
35.1.1 Specialized Systems (2/2)

- **Meaning-Based Web Search**
  - Powerset, a commercial company, developed an Internet search engine using natural language.
  - The search engine understands the intention of the queries.

- **Legged Robots**
  - BigDog, a four-legged walking robot developed by Boston Dynamics, which performs most advanced motions and extremely stable.

Figure 35.2: Marc Raibert (left) and BigDog (right).
35.1.2 Broadly Applicable Systems

Robotics

- STAIR, STanford AI Robot, is a general purpose robot project headed by Andrew Ng
- It navigates and interact with objects and intelligently converse with people
- Infers how to pick up objects, even it has never seen before, from the experience
- There are similar projects to STAIR, namely
  - HERB, Home Exploring Robotics Butler
  - DOMO
  - SMARTPAL V
35.1.2 Broadly Applicable Systems (1/3)

Figure 35.3: STAIR unloading a dishwasher at the Stanford AI Lab.

Figure 35.4: HERB (top left), DOMO (top right), and SMARTPAL V (bottom).
35.1.2 Broadly Applicable Systems (2/3)

- **Intelligent Assistants**
  - Disembodied agents that help people by recognizing, learning and reasoning situations by themselves
  - PAL (Personal Assistant that Learns), CALO (Cognitive Assistant that Learns and Organizes), COMPANIONS

Figure 35.5: CALO's functions.
35.1.2 Broadly Applicable Systems (3/3)

- **Learning by Reading**
  - Common-sense and specialized knowledge is the key to intelligence
  - Various approaches has been pursued
    - Hand-coding millions of small pieces of knowledge
    - Statistical machine learning
    - Build programs that can read natural language text
  - The third, also known as Learning by Reading (LbR)
    - In 1999, DARPA funded Prof. Tom Mitchell to research “automatically building computer-understandable knowledge base” from WWW.
    - Now, several researchers are also working on LbR
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35.2 Toward Human-Level Artificial Intelligence
35.2.1 Eye on the Prize

- Human Level Artificial Intelligence
  - Artifacts that can do most of the things that humans can do – specifically those things that are thought to require “intelligence”
  - The study is to proceed on the basis of intelligence can in principle be so precisely describe that a machine can be made to simulate it – John McCarthy
  - We are on the threshold of an era that will be strongly influenced, and quite possibly dominated, by intelligent problem-solving machines – Marvin Minsky
  - Singularity is near. If HLAI is achieved, machine enters into a runaway reaction of self-improvement cycles, which makes intelligence singularity – Ray Kurzweil et al.
35.2.2 Controversies

- **What is measure for HLAI?**
  - Turing Test
  - Fraction of acceptably performing jobs of humans done by machines

- **Some asserted that HLAI is not the goal**
  - Airplanes fly different from birds. Why the machine intelligence has to mimic human.
35.2.3 How Do We Get It?

- **John McCarthy’s two approaches**
  - Simulate how the brain works
    - Hierarchical modeling of neural networks belongs here – Mumford, Hinton, Hawkins, Dean, etc.
  - Write programs that mimic human intelligent behavior

- **Marvin Minsky’s two methods**
  - Advanced resources given initially
  - Fantastic exploratory processes found in the evolution

- **Alan Turing’s approach**
  - Instead of simulating the adult mind, simulate that of child and get educated
  - By stepping the stages, intelligence will emerge
35.2.4 Some Possible Consequences of HLAI

- This subsection is about so much about rather philosophical or moral issues when there comes the HLAI in the future.

- Here, we omitted the contents because of the limit of pages.
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35.3 Summing Up
Four main categories of this book

- **Complete AI systems**
  - Ones that do things

- **Architectures**
  - Organizational principles for AI systems

- **Processes**
  - Routines that actually do the work

- **Representations**
  - Structures that are created, modified, and accessed by processes
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Appendix
The Quest Continues

- Prediction of actualization years of AI Technologies

<table>
<thead>
<tr>
<th>Product</th>
<th>Median prototype date</th>
<th>Median commercial date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic medical diagnostician</td>
<td>1976</td>
<td>1980</td>
</tr>
<tr>
<td>Robot servant capable of performing all household tasks</td>
<td>2000</td>
<td>2010</td>
</tr>
<tr>
<td>Voice-operated typewriter</td>
<td>1985</td>
<td>1992</td>
</tr>
<tr>
<td>Automatic high-quality language translator of text</td>
<td>1987</td>
<td>1995</td>
</tr>
<tr>
<td>Robot chauffeur for driving on city streets and country highways</td>
<td>1992</td>
<td>2000</td>
</tr>
</tbody>
</table>

- Some of them are quite a ways off
- Author predicts and believes that “human-level AI” will be eventually achieved

SRI’s 1973 prediction of when certain “products” would be realized (Delphi method)