

# Chapter 35. The Quest Continues

**The Quest for Artificial Intelligence, Nilsson, N. J., 2009.**

**Lecture Notes on Artificial Intelligence, Spring 2012**

Summarized by Kim, Jiseob and Kim, Soo-Jin

Biointelligence Laboratory  
School of Computer Science and Engineering  
Seoul National University

<http://bi.snu.ac.kr>

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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

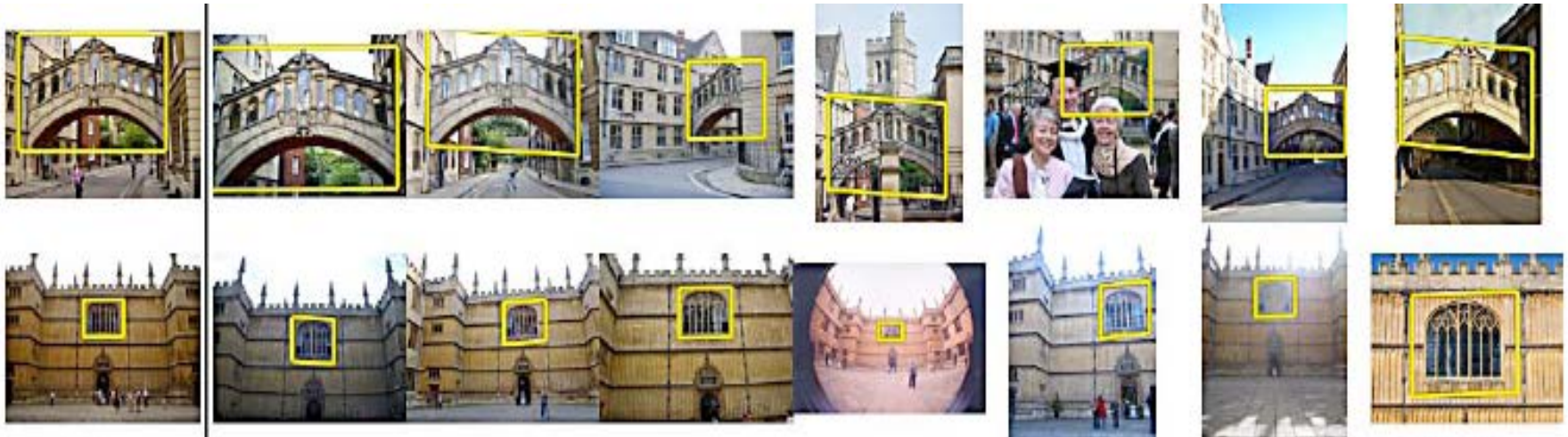


Figure 35.1: Searching for objects in images. (From James Philbin et al., "Object Retrieval with Large Vocabularies and Fast Spatial Matching," *CVPR*, 2007.)

# 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)

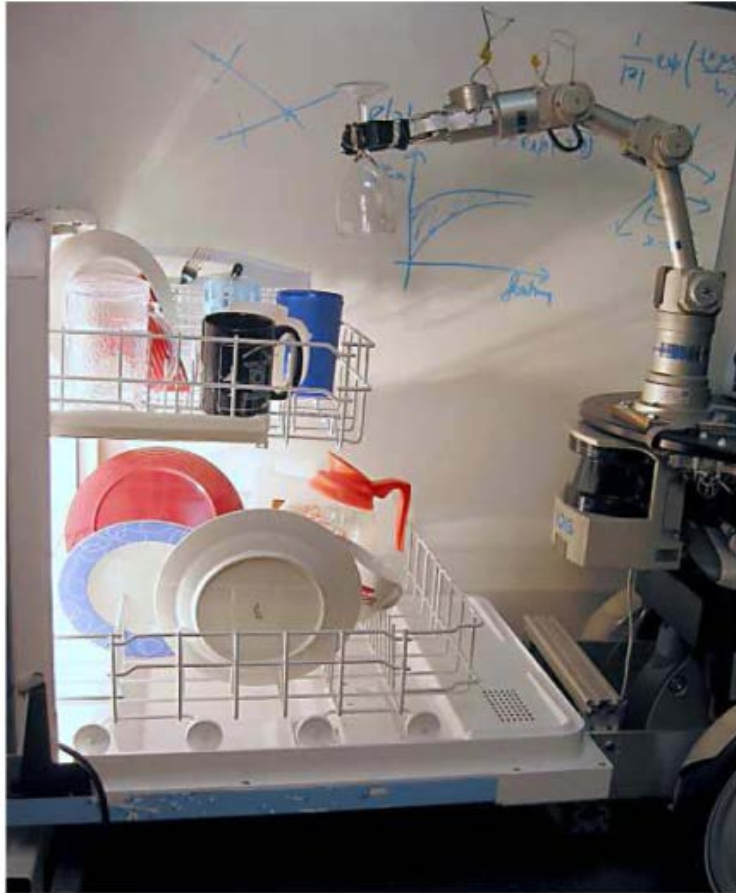


Figure 35.3: STAIR unloading a dishwasher at the Stanford AI Lab.



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

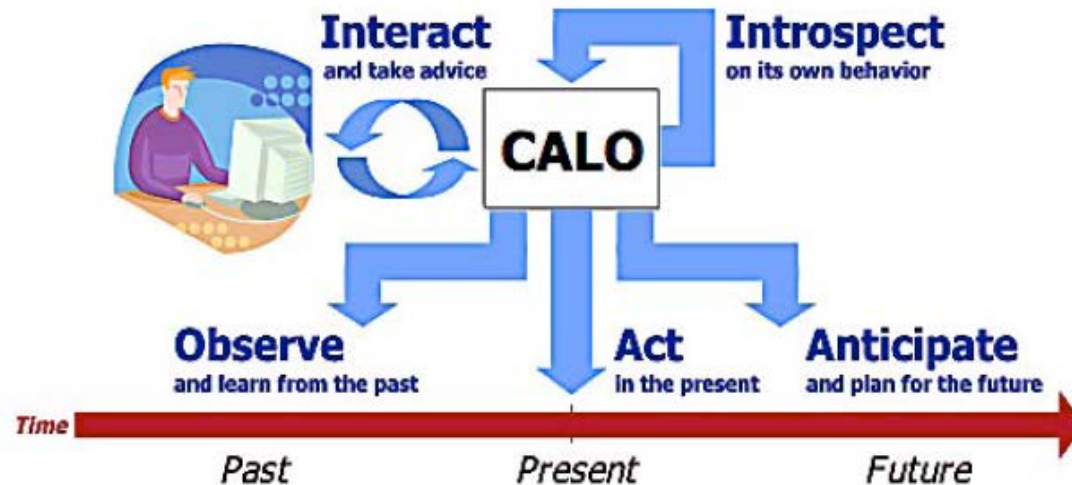


Figure 35.5: CALO's functions.

# 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

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

SRI's 1973 prediction of when certain "products" would be realized (Delphi method)

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