History, motivations and core themes of AI by Franklin

Artificial Intelligence

September 4, 2019

Announcements

- Piazza accounts created - need to activate it (see email)
- Office-hours posted - suggest alternatives if needed
- Python tutorial posted online along with test yourself quiz (forthcoming)

For The Cambridge Handbook to Artificial Intelligence

History, motivations and core themes of AI

By Stan Franklin

Introduction

This chapter is aimed at introducing the reader to field of artificial intelligence (AI) in the context of its history and core themes. After a concise preamble introducing these themes, a brief and highly selective history will be presented. This history will be followed by a succinct introduction to the major research areas within AI. The chapter will continue with a description of currents trends in AI research, and will conclude with a discussion of the current situation with regard to the core themes. The current trends are best understood in terms of AI history, its core themes and its traditional research areas. My goal is to provide the reader with sufficient background context for understanding and appreciating the subsequent chapters in this volume.

Overview of Artificial Intelligence core themes

The history of artificial intelligence may be best understood in the context of its core themes and controversies. Below is a brief listing of such AI distinctions, issues, themes and controversies. It would be well to keep these in mind during your reading of the rest of this chapter. Each of the themes will be expanded upon and clarified as the chapter progresses. Many of these result from their being, to this day, no agreed up definition of intelligence within the AI community of researchers.

Today's Agenda

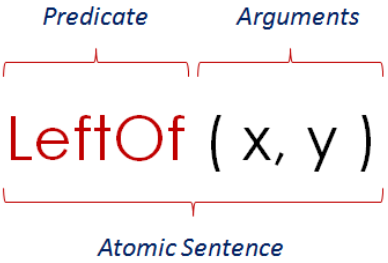
- Overview of reading
- Discussion of your questions
- In-class activity
- Additional topics on intelligence

Overview of the Reading

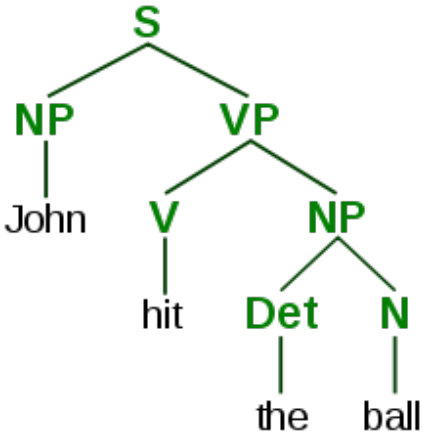
Any clarification questions on the reading?

The Core Themes

Symbolic AI

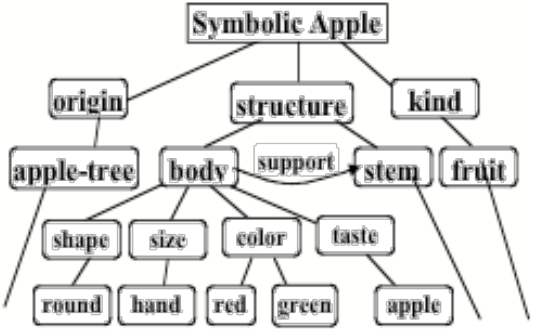


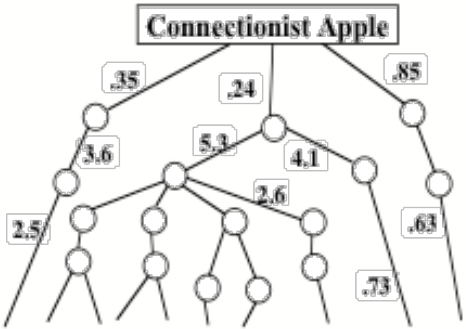
A proposition



A parse tree

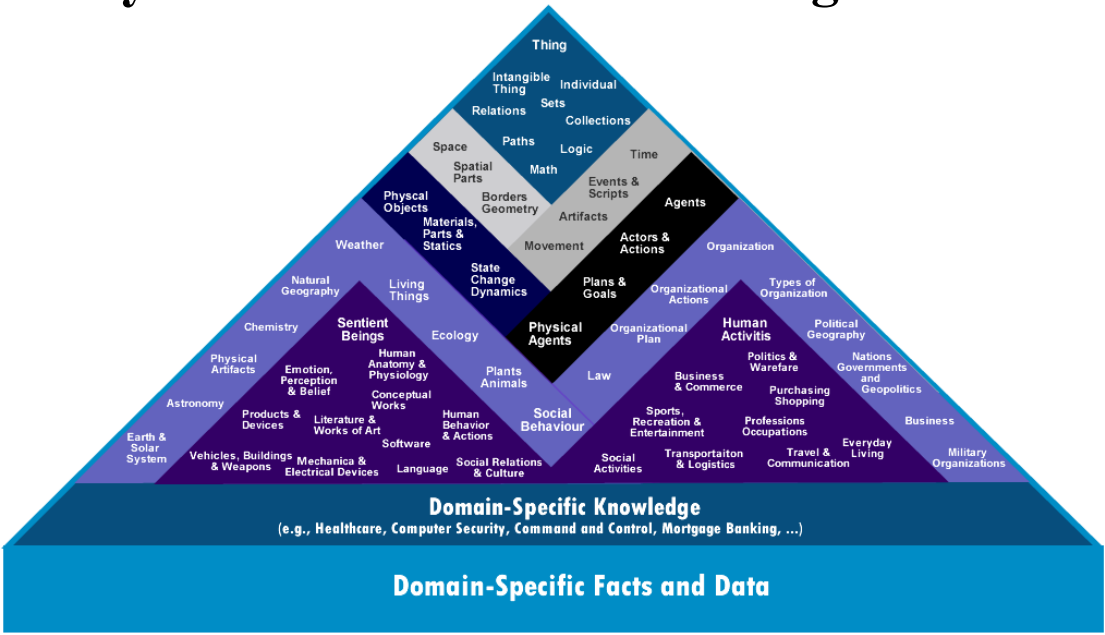
Symbolic (left) vs. Connectionist (right)





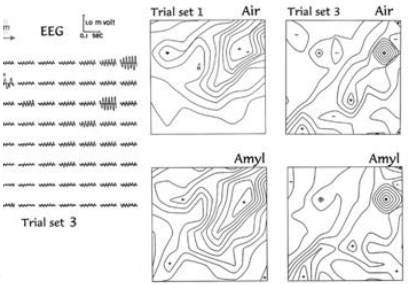
over 1.5 Million "facts, rules-of-thumb and heuristics" for reasoning about the objects and events of everyday life.

Cyc: Common sense knowledge base

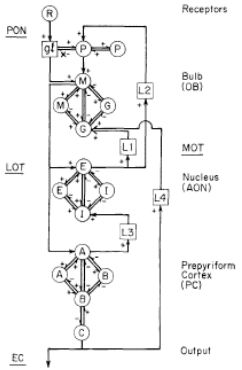


Representations: Who Needs Them?

WALTER J. FREEMAN
CHRISTINE A. SKARDA



Biologists by tradition have seldom used the term *representation* to describe their findings. Instead they have relied on phrases such as "receptor field" on the sensory side and "command" or "corollary discharge" on the motor side when discussing neural control of sensation and motion in goal-directed behavior. Such words connote dynamic process rather than symbolic content. One might suppose that this neglect of a now common word reflects diffidence about discussing so-called higher functions of the brain, owing to a humbling lack of understanding of the brain's complexity. Inspection of biology textbooks belies this view. Biologists have shown no lack of hubris in pontificating about the properties of the brain supporting mental functions. On the contrary, they have always taken pride in being uniquely qualified to explain brain function to anyone willing to listen.

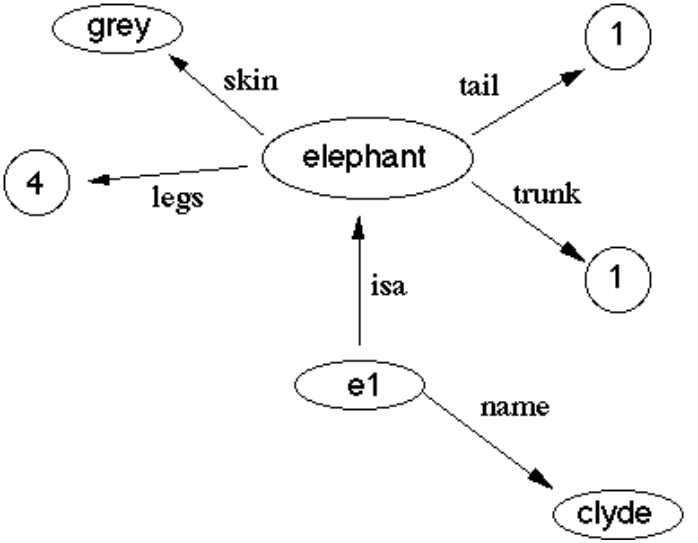


The Core Themes

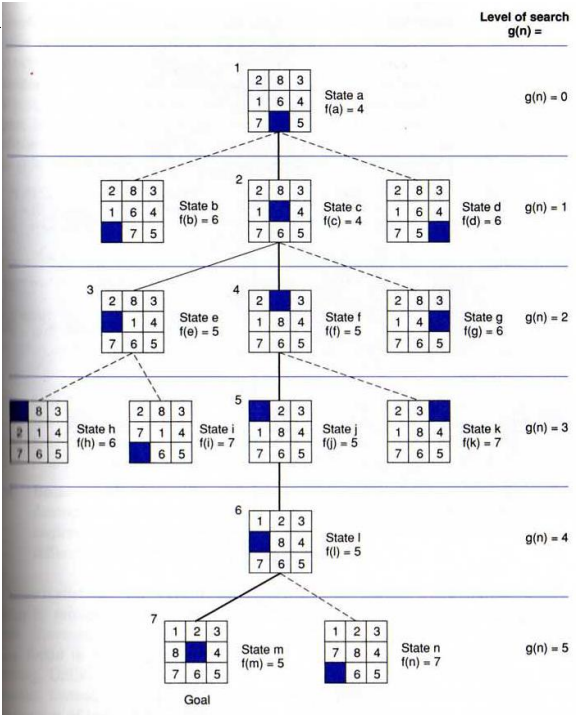
- Smart software vs. Cognitive Modeling
- Symbolic AI vs. Neural Nets
- Reasoning vs. Perception
- Reasoning vs. Knowledge
- To Represent or Not
- Brain in a Vat vs. Embodied AI
- Narrow AI vs. Human Level Intelligence

Major Research Areas

Semantic network



Heuristic Search (a search space)



Planning (the STRIPS planner)

Open ... / Close ...

Open door dx.

OPEN(dx)

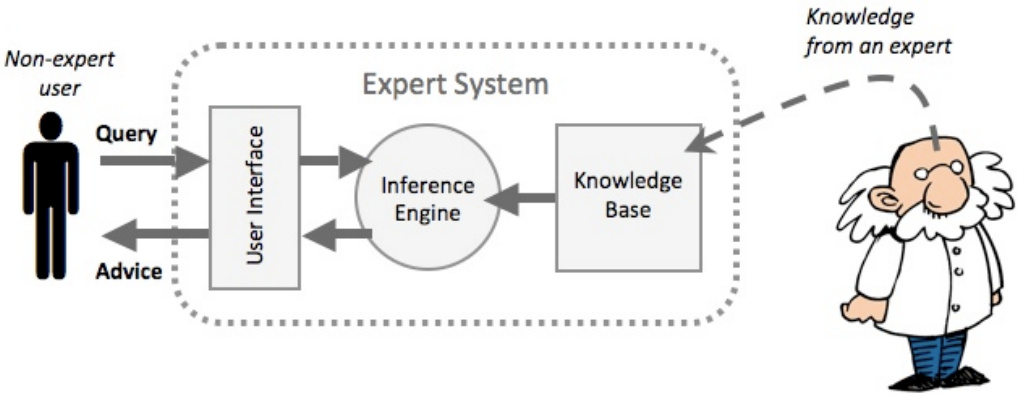
Preconditions: NEXTTO(ROBOT, dx), TYPE(dx,DOOR), STATUS(dx,CLOSED)
Deletions: STATUS(dx,CLOSED)
Additions: *STATUS(dx,OPEN)

Close door dx.

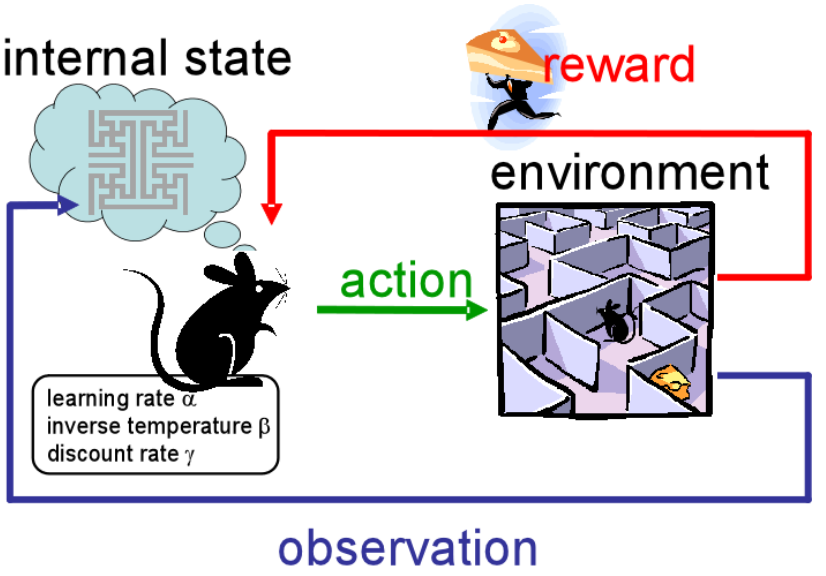
CLOSE(dx)

Preconditions: NEXTTO(ROBOT,dx), TYPE(dx,DOOR), STATUS(dx,OPEN)
Deletions: STATUS(dx,OPEN)
Additions: *STATUS(dx,CLOSED)

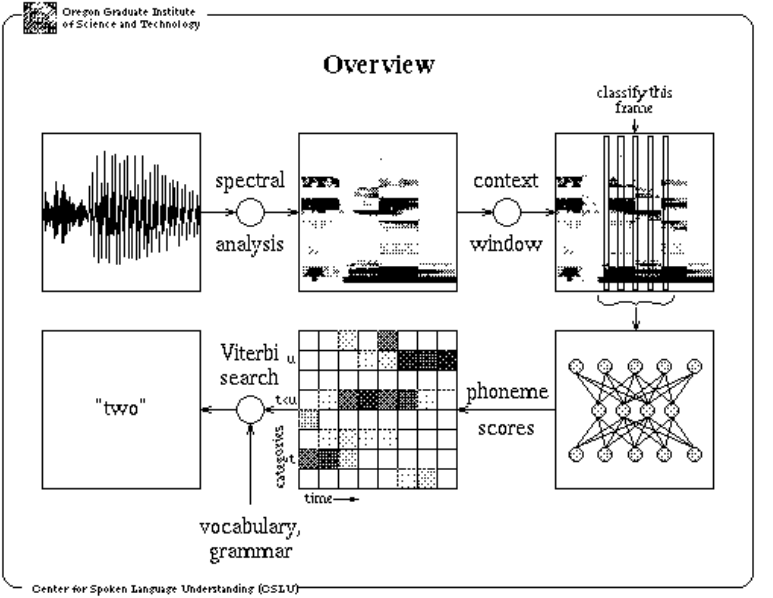
Expert Systems (architecture)



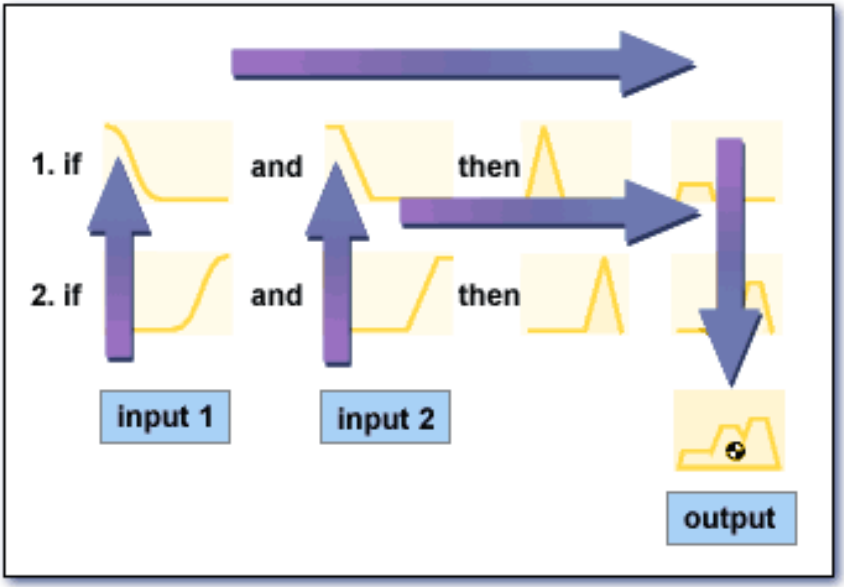
Machine learning: Reinforcement Learning



Natural Language Processing (speech recognition shown below)

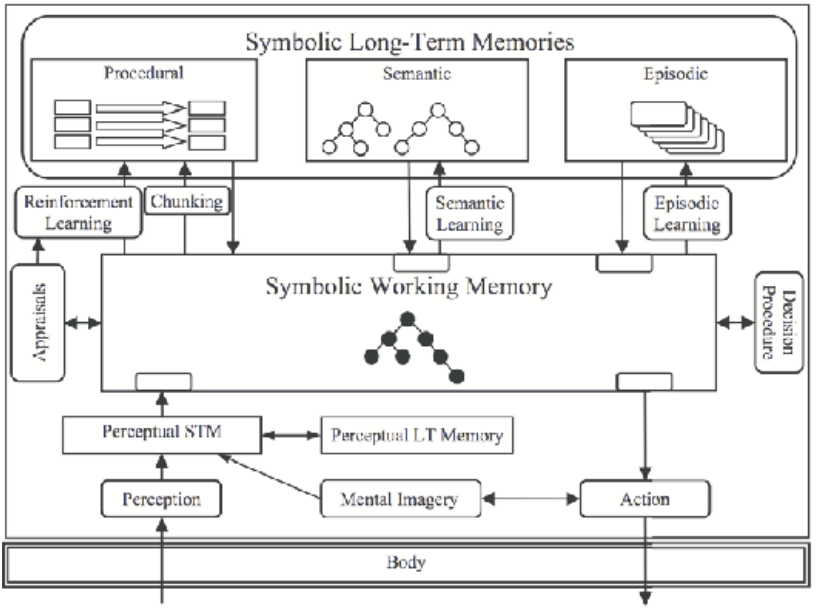


Fuzzy logic



Soft computing: Evolutionary computing

Cognitive Architectures



Major Research Areas

- Knowledge Representation and Reasoning
- Heuristic Search
- Planning
- Expert Systems
- Machine Vision
- Machine Learning
- Natural Language Processing
- Robotics
- Fuzzy logic
- Cognitive Architectures

How can you distinguish an AI from an ordinary computer program?

Is it an Agent, or just a Program?: A Taxonomy for Autonomous Agents

Stan Franklin and Art Graesser
Institute for Intelligent Systems
University of Memphis

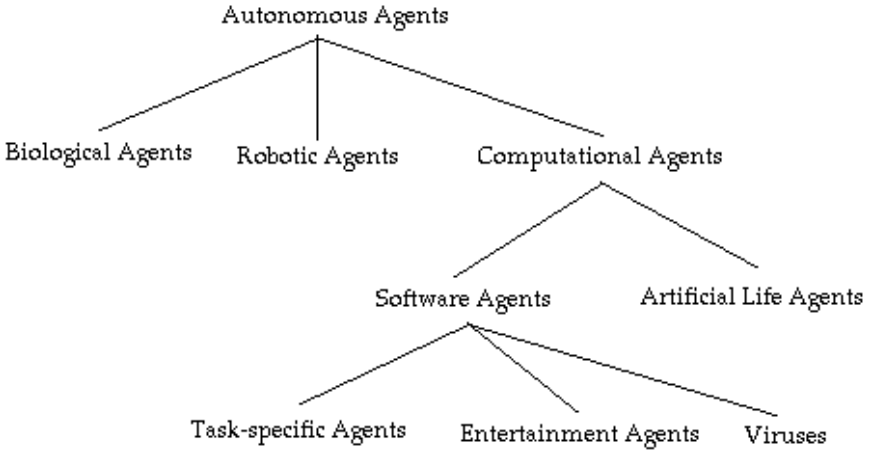
Proceedings of the Third International Workshop on Agent Theories, Architectures, and Languages, Springer-Verlag, 1996.

Abstract

The advent of software agents gave rise to much discussion of just what such an agent is, and of how they differ from programs in general. Here we propose a formal definition of an autonomous agent which clearly distinguishes a software agent from just any program. We also offer the beginnings of a natural kinds taxonomy of autonomous agents, and discuss possibilities for further classification. Finally, we discuss subagents and multiagent systems.

An **autonomous agent** is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and *so as to effect what it senses in the future*.

Autonomous Agents



Your Discussion Questions

Current State of AI

- **Aaron Barge.** If Narrow AI is at one of a spectrum and Human Level Intelligence is at the other end of a spectrum. What is our current position on that spectrum and, are there more levels or categories that could or should be defined on the spectrum, to either show or limit progress?

- **Andy Kim.** Research shows that AI can cover a variety of tasks and behave like "humans." Is there a limit to AI? Do we know potential tasks that machines will never be able to replicate?

Core Themes of AI

- **Connor Dowd.** Out of the various Core Theme disagreements, two seem to be already resolved. That being said, what Theme 'disagreement' is most likely to get resolved next, given recent innovations and high-profile adoptions of AI on online platforms and other growing fields?

Symbolic AI and Neural Nets

- **Arthur Pellegrino.** This article briefly mentions the distinction between symbolic and non-symbolic AI. Are there some tasks that non-symbolic AI can do that symbolic AI can't, or vice versa?

Is an AI Winter coming?

- **Jay Hayward.** Do you speculate there will be a "great filter" or "wall" that machines will be unable to overcome to continue development?

- **Kyle Heinze.** Franklin frequently relates moments of artificial intelligence in a seasonal manner. He describes the current age as an AI 'summer', contrary to a previous AI 'winter'. Does this comparison consider for another possible 'winter' for AI in the future? What could cause this?

Is this AI?

- **Graham Harper.** Could recent safety features in cars such as auto-braking and cruise control that maintains distance be considered examples of AI? Is any system that exists in a changing environment and is able to react to it considered AI?

Cognitive Modeling

- **Elizabeth Robinson.** What have we learned about human intelligence and the human brain through failures and successes with neural nets?

- **Trevor Buck.** How different is a Neural Net from the human brain?

Narrow vs Strong AI

- **Adam Rosa.** What future of AI seems more certain: refined specialized intelligence or complex general intelligence?

- **Robert Gomez.** If we had a collection of "weak AI" that could solve as many problems as we could think of, would that collection of "weak AI" together be considered an instance of "strong AI"?

Distinguishing and combining, Narrow and General AI?

- **Cassidy Carpenter.** The text suggests that a computer that can be programmed to learn does not fall within the bounds of doing only what it was programmed to do. However, if you programmed the computer to learn, wouldn't it's learning only be due to the programmer allowing it to learn

https://tinyurl.com/AIF19-ICA2