Chapter 3: Frontiers of Artificial Intelligence

Top Ten Salient Sentence Strings

1. "AI technology opens whole new vistas of economic opportunity by enabling robots to work where people can't. Robots are of great values for all sorts of tasks that are too dangerous or costly for people to do. These might be mining or farming the sea bottom, eliminating agricultural pests by targeting them with insect-specific mechanical predators, or cleaning up industrial accidents."

2. "A separate class of assistive robots offers psychological as opposed to physical comfort. For instance, the therapeutic robot Paro provides the benefits of 'animal therapy' to cognitively impaired patients. Mimicking the appearance of a furry baby seal, it responds to holding, petting and so on. Paro has been shown to improve socialization, increase relaxation, and boost motivation. However, there artificially 'emotional' robots are not without controversy. MIT professor Sherry Turkle, who studies the social effects of technology, warns that mechanical devices that encourage emotional bonding are inherently deceptive and potentially harmful to human relationships."

3. "One of the most exciting recent developments in the field is known as 'swarm robotics.' Large collections of relatively simple uniform robots are programmed with rules, and when these are applied in aggregate to the entire group, the robots exhibit complex behavior, called 'emergent behavior.' This same effect is observed in anthills and beehives […]. Collections of these devices can work together to perform some task, for instance, locating people trapped in collapsed buildings or detecting toxic spills."

4. "Work in the field of computer vision has paralleled the transition from symbolic systems to machine learning. Early efforts focused on crafting algorithms that used specialized knowledge of visual images and descriptions of objects of interest to look for semantically meaningful elements like lines, regions and so on, which where often then aggregated into larger and more general entities. […] But the more modern approach is to use machine leaning, often specialized types of neural nets (called convolutional neural nets, or CNNs), to build models of objects from large collections of samples."

5. "Speech recognitions is considerably more difficult than processing written language, in large part because of the variability and noise inherent in audio steams of spoken language. Separating the 'signal' from the 'noise,' and transcribing it into the proper written words, is a daunting task for humans as well as computers, as any consumer of closed-captioning on TV can attest. But separating the vocalizations from background sounds is only the start of the problem. As early researchers in this field quickly discovered, there's no obvious break between words, contrary to what you may think when you listen to someone talk. Considerable meaning is also conveyed by how you vary your volume and tone."

6. "During the 1980s, a statistical technique called hidden Markov modeling (HMM) was applied to speech recognition problem, with promising results. Informally, HMMs process the stream of sound dynamically (left to right, so to speak), continually computing and updating the probability that one or more interpretations is the correct answer. This led to several commercially available speech recognition products, most prominently NaturallySpeaking from Dragon Systems. While a significant improvement over previous efforts, this approach was still insufficiently accurate for widespread adoption of the technology."

7. "A primary distinguishing factor between humans and other animals is our ability to use language. We use our words not only to communicate but to help us think, remember, assign things to categories, and label individuals. Language serves not only to describe but also to educate, create, imagine, indicate intentions, make commitments, and identify people of similar heritage, among many other things. Like us, languages evolve and tailor themselves to our needs, almost as though they were living creatures in their own right."

8. "While we talk about *computer languages*, the use of the term for these formal constructions is little more than an analogy, similar to the terms *machine learning* or *information superhighway*. Computer languages are designed for one purpose: to make it easier to program computers in a precise and unambiguous way. Programs that process computer languages, called compilers, were really formal methods for converting a more abstract but nonetheless rigorous specification of some computational process int oa form that can be executed on a particular computing device."

9. "The processing of natural language by computer limped along for many decades until someone tried a completely different approach: machine learning, and more particularly statistical machine learning methods. While earlier approaches required the hand-crafting of rules, the new approach mainly required access to large bodies of text, and such 'corpora,' as collections of text are called, became larger and easier to gather are more and more written language was available in computer-readable form."

10. "Now it may seem counterintuitive that a computer program, with no real-world experience and no knowledge of what the text is about, could do a reasonable job of translating one language into another, much less beat out a computer program crafted by a human who is an expert speaker of both languages. But given enough examples, that's exactly what these systems can do. One of the remarkable achievements of modern AI could be couched as a discovery in search of an explanation: how simply finding correlations between enough examples can yield insights and solve problems at a super-human level, with no deeper understanding or causal knowledge about a domain."