

INVITED TALKS

Living Life to the Fullest: Long-term Relationships with Embodied Conversational Agents

Justine Cassell, *Professor of Communication Studies and Computer Science, Northwestern University*

An *embodied conversational agent* (ECA) is a multimodal interface that adopts some of the properties of human face-to-face conversation, including producing and responding to verbal and nonverbal input and using conversational functions such as turn taking and feedback. ECAs rely on the visual dimension of interacting with an animated character on a screen. Generating conversational behavior for ECAs therefore depends on insights from graphics, vision, speech recognition and synthesis, artificial intelligence, human-computer interface design, and computational linguistics.

My work in this interdisciplinary domain (a) highlights the relationship between discourse phenomena and nonverbal behaviors in conversations with computers and between humans mediated by computers, (b) demonstrates their rule-based generativity at a number of levels, and (c) evaluates their effect on human-computer interaction. In this address I will talk about generation of language and graphics (nonverbal behaviors for animated agents) from both underlying concepts and typed text. I will describe new work that extends notions of conversational interaction between computers and humans to include engaging in social chit-chat, establishing common ground, corroborating and criticizing. And I will demonstrate implementations (and their evaluations) ranging from handheld devices to graphical online worlds, information kiosks and interactive learning systems for young children.

Anthropomorphic systems such as these embodied conversational agents have generated considerable controversy—some go so far as to imagine nightmare scenarios in which sentient virtual humans take over thinking from humans. In this talk I will no doubt simultaneously assuage some old fears, and evoke some new nightmares with a description of a new world where embodied conversational agents become our closest confidants.

Some Scientific and Engineering Challenges for the Midterm Future Of AI

Edward Feigenbaum, *Kumagai Professor of Computer Science and
Co-Scientific Director, Knowledge Systems Laboratory, Stanford University*

When the terms “intelligence” or “intelligent” are used by scientists, they are referring to a large collection of human cognitive behaviors—people thinking. When life scientists speak of the intelligence of animals, they are asking us to call to mind a set of human behaviors that they are asserting the animals are (or are not) capable of. When computer scientists speak of artificial intelligence, machine intelligence, intelligent agents, or computational intelligence, we are also referring to that set of human behaviors.

When Turing proposed what we now call the “Turing Test” in 1950, he thought that a computer would pass his test for intelligence by 2000. But the set of behaviors called “intelligence” proved to be more multifaceted and complex than he or we imagined.

This talk proposes a set of grand challenges for AI that are based on modifications to the Turing Test. The challenges are aimed at scientific knowledge and reasoning (i.e. “Einstein in the box” as differing from, for example, robotics). The challenges require for successful performance: natural language read-

ing and understanding abilities, and machine learning for knowledge acquisition. But the challenges proposed do not involve the full spectrum of common sense reasoning abilities that the original Turing Test requires. And it may be possible to meet these challenges successfully in a mid-range future of 20–30 years, or even less if we focus and get busy.

Fast Adaptation with Random Neural Networks

Erol Gelenbe, Dennis Gabor Chair, *Imperial College, London*

We will describe how the recurrent structure of random neural networks, and their approximation and convergence properties, can be exploited to adaptively control large systems such as packet networks on the one hand, and intricate texture patterns at the other end. The talk will summarize the underlying theory, and present working systems based on these principles.

The Semantic Web—Bringing AI to the World Wide Web

Jim Hendler, *Professor of Computer Science, University of Maryland*

The world wide web is often referred to as a web of information, but is it? When you ask a query on the web you get pointers to pages, not answers. If you're looking for something beyond text, you're often unable to find it. The next generation of the web, already in the works, aims to fix this by making more of the content on the web “understandable” to the programs that help us find, filter, and use what is out there. In this talk, I will describe this new generation of the web, discuss some of the technologies that will help to power it, and consider some of the ways in which it may be used to create new and powerful web applications beyond the capabilities of the current web. I will also discuss future directions for semantic web research.

Machine Learning for Decoding Human Brain States from Functional MR Images

Tom Mitchell, *Professor of Computer Science, Carnegie Mellon University*

Over the past decade, functional magnetic resonance imaging (fMRI) has emerged as a powerful new instrument to observe activity in the human brain. A typical fMRI experiment can produce a three-dimensional image characterizing the human subject's brain activity every half second, at a spatial resolution of a few millimeters. fMRI is already causing a revolution in the fields of psychology and cognitive neuroscience.

In this talk, I will consider the role for machine learning algorithms in analyzing fMRI data. In particular, I focus on training classifiers to decode the cognitive state of a human subject based on their observed fMRI brain activation. I will present several case studies in which we have trained classifiers to distinguish cognitive states such as whether the human subject is looking at a picture or a sentence, and whether the word the subject is viewing is a word describing food, people, or buildings. I will describe the results in these fMRI studies, and examine the machine learning methods needed to successfully train classifiers in the face of such extremely high dimensional (10⁵ features), extremely sparse (tens of training examples), noisy data sets.