AI is a huge field

What is AI...

One definition:

“Building programs that enable computers to do what humans can do.”

For example:
read, walk around, drive, play games, solve problems, learn, have conversations…
How do we measure success?

“Building programs that enable computers to do what humans can do.”

there are many interpretations of this goal…

human vs. rational

thinking

Think like a human
Cognitive Modeling

Think rationally
Logic-based Systems

vs.

Act like a human
Turing Test

Act rationally
Rational Agents

How is AI viewed in popular media?

What challenges are there?

Perception
• perceive the environment via sensors

Computer vision (perception via images/video)
• process visual information
• object identification, face recognition, motion tracking

Natural language processing and generation
• speech recognition, language understanding
• language translation, speech generation, summarization
What challenges are there?

Knowledge representation
- encode known information
- water is wet, the sun is hot, Dave is a person, ...

Learning
- learn from environment
- What type of feedback? (supervised vs. unsupervised vs. reinforcement vs ...)

Reasoning/problem solving
- achieve goals, solve problems
- planning
- How do you make an omelet? I'm carrying an umbrella and it's raining... will I get wet?

Robotics
- How can computers interact with the physical world?

What can we currently do?

Understand spoken language?
- speech recognition is really good, if:
  - restricted vocabulary
  - specific speaker with training
- Gotten quite good in the last few years and shows up in lots of places:
  - Mac has built-in dictation software
  - Siri is pretty good (though there’s more than speech recognition going on there)
  - Google allows you to search via voice command

- What does the spoken language actually mean (language understanding)?
  - much harder problem!
  - many advances in NLP in small things, but still far away from a general solution

Speak?
- Understandable, but you wouldn’t confuse it for a person
- Can do accents, intonations, etc.
- Better with restricted vocabulary
- Loquendo
- Dealing with facial expression is challenging

Kismet (MIT)
What can we currently do?

**Drive a car?**

- Freeway driving is relatively straightforward
- Off-road a bit harder
  - see DARPA grand challenges (2004, 2005)
- And urban driving is even trickier
  - See DARPA urban challenge (2007)
  - Google's autonomous vehicle

What can we currently do?

**Identify emotion?**

- This is hard!
- Some success in text
  - movie reviews
  - blogs
  - twitter
  - dealing with sarcasm is hard
- Some success with faces
  - strongly biased by training data
  - works best when exaggerated

What can we currently do?

**Reasoning?**

- Success on small sub-problems
- General purpose reasoning is harder
  - Wolfram Alpha
  - OpenCyc
What can we currently do?

Walk?
- Robots have had a variety of locomotion methods
- Walking with legs, is challenging
- Differing terrains, stairs, running, ramps, etc.
- Recently, a number of successes
  - Honda’s Asimo
    - [http://www.youtube.com/watch?v=W1czBcnX1Ww](http://www.youtube.com/watch?v=W1czBcnX1Ww)
  - Sony QRIO
    - [http://www.youtube.com/watch?v=9vwZSFQ4EHg](http://www.youtube.com/watch?v=9vwZSFQ4EHg)
  - Boston Dynamic’s Big Dog
    - [http://www.youtube.com/watch?v=W1czBcnX1Ww](http://www.youtube.com/watch?v=W1czBcnX1Ww)

When will I have my robot helper?

Fold a pile of towels?
- UC Berkeley towel folding robot:
  - [http://www.youtube.com/watch?v=gy5g33S0Gzo](http://www.youtube.com/watch?v=gy5g33S0Gzo)
How do we make a computer "smart"?

Computer, clean the house!

Um, OK...??

That one's got no chance...

Fundamental problem of AI

Reasoning with knowledge and uncertainty

Search

Reasoning with Utility

Many different ways of making an agent intelligent

Learning