

Common Sense Reasoning for Interactive Applications

MAS 964: Common Sense Reasoning for Interactive Applications



What is Common Sense?

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Everyday knowledge about the world

The stuff that's "too obvious to say"

Things fall down, not up

A wedding has a bride and a groom

If someone yells at you, they're probably angry

If you are hungry, you can go to a restaurant to eat

... and the ability to use it easily when appropriate

Facts about Common Sense

Facts about Common Sense



There's a *lot* of it

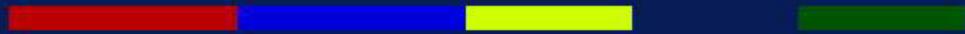
How much, nobody knows

You get it by learning and/or experiencing it

It is essential for understanding and acting

Common Sense in Story Understanding

Common Sense in Story Understanding



John went to a restaurant.

He sat down.

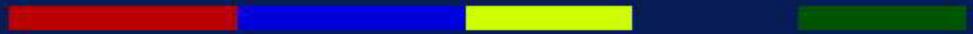
He waited 45 minutes.

He left in a hurry and slammed the door on his way out.

Why was John angry?

Common sense in the restaurant story

Common sense in the restaurant story



A restaurant is a place you go to eat.

People eat in a restaurant sitting down.

When people go to a restaurant, they expect a waiter to serve them within a few minutes.

People become angry when their expectations are not met.

If you slam a door, it is a way of expressing anger.

Common sense is shared knowledge

Common sense is *shared* knowledge



Common sense might be shared between

Almost everybody

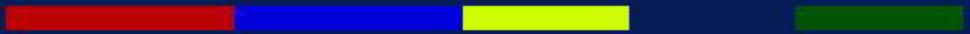
People in a particular culture only

A human and a computer

In communication, it is what you don't have to say
[or write down] because you expect the other party
to know it already

Common sense is not exact

Common sense is not exact



Almost all statements of common sense are “wrong”

There are always exceptions, contingencies

Birds can fly, except: penguins, injured birds, stuffed birds, ...

Maybe John got an important cell phone call

Common sense is about defaults, plausibility, assumptions

Common sense is about broad, but shallow reasoning

Controversial hypothesis

Controversial hypothesis



A big reason why computers seem so dumb is that they lack common sense

Common sense is the major bottleneck in making significant progress in Artificial Intelligence

Minsky, Lenat: We can make progress only by attacking the Common Sense problem directly

Collecting Common Sense Knowledge

Finding new ways of putting it to use

Objections to the Common Sense enterprise

Objections to the Common Sense enterprise



There's way too much of it

Maybe the “small size of infinity”

It's too squishy

Well, so are people

We can't trust computers to use it

We should be careful, but we've got to take some risks

Why now?

Why now?

Previous efforts in Common Sense have had only limited success

Now, we have

Several very large common sense knowledge bases

Better ways of using common sense knowledge

Motivation to use it in interactive applications

... so maybe it's time to give Common Sense another chance

Collecting Common Sense knowledge

Collecting Common Sense knowledge



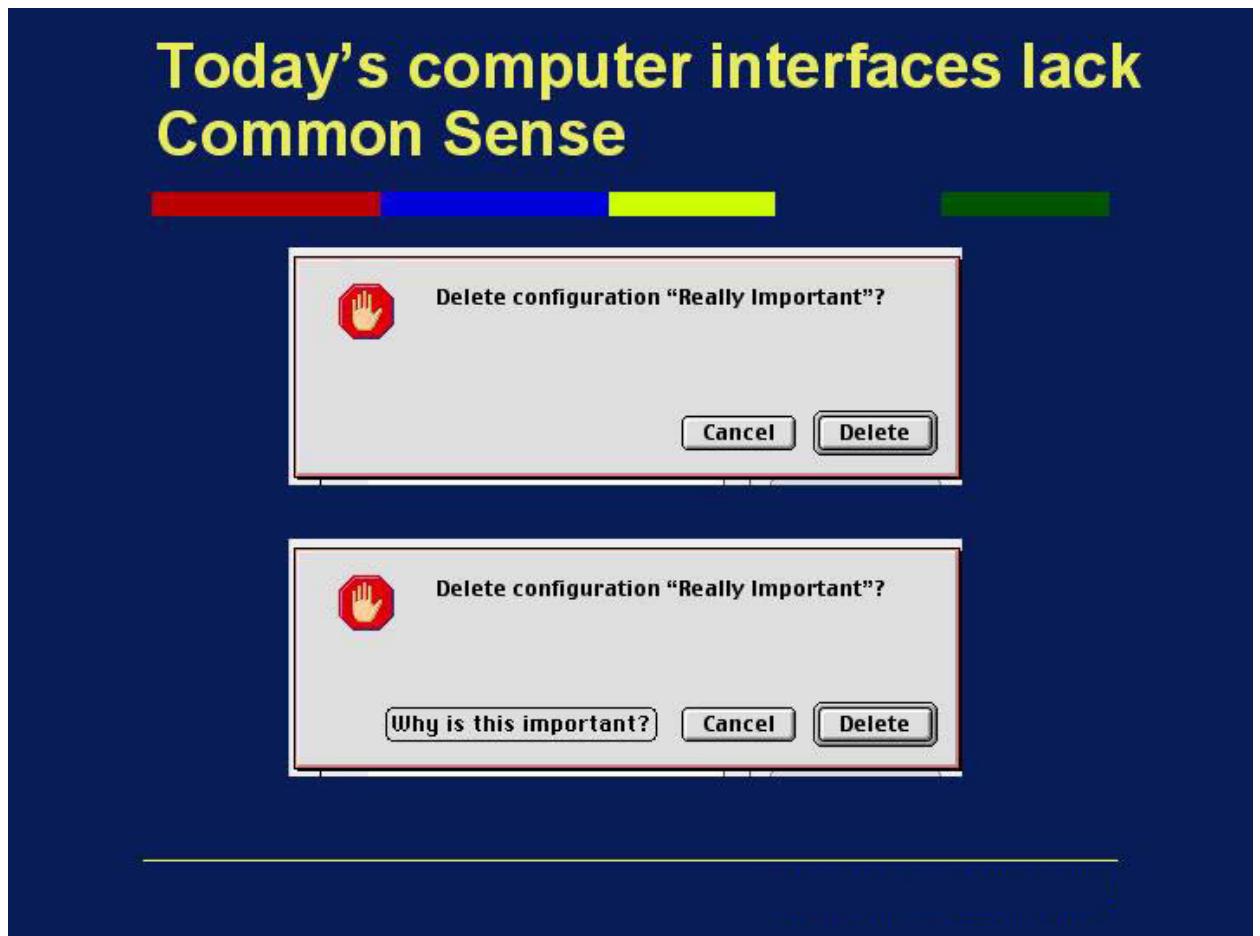
The big three:

CYC, Doug Lenat: ~3 million assertions

Open Mind, Push Singh: 0.5 million assertions

Thought Treasure, Eric Mueller: 0.2 million assertions

Today's computer interfaces lack Common Sense



What could we do if interfaces had Common Sense?

What could we do if interfaces had Common Sense?



Cell phones should know enough not to ring during a concert

Calendars should warn you if you schedule a business meeting at 2am

Transfer the files I need for this trip to my laptop

What kinds of applications are good candidates for Common Sense?

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Conversational applications

Question answering, Story understanding

(in general domains)

Software agents

Proactive, “reconnaissance” agents

(in interactive applications)

Conversational applications

Conversational applications

Show me a picture of someone who's disappointed.

**Jen Racine and Gea Johnson, the
favorites in the US Women's Olympic
Bobsled, were defeated by upstarts Jill
Bakken and Vonetta Flowers**

Henry Lieberman • MIT Media Lab

Conversational applications

Conversational applications

User is expecting an accurate answer to the question

System has only one chance to answer user's question

If the system doesn't get it right, the user will be disappointed

Software agents for interactive applications



Agent cast in the role of giving help or suggestions

Agent continuously running. If it doesn't get it now, it might later

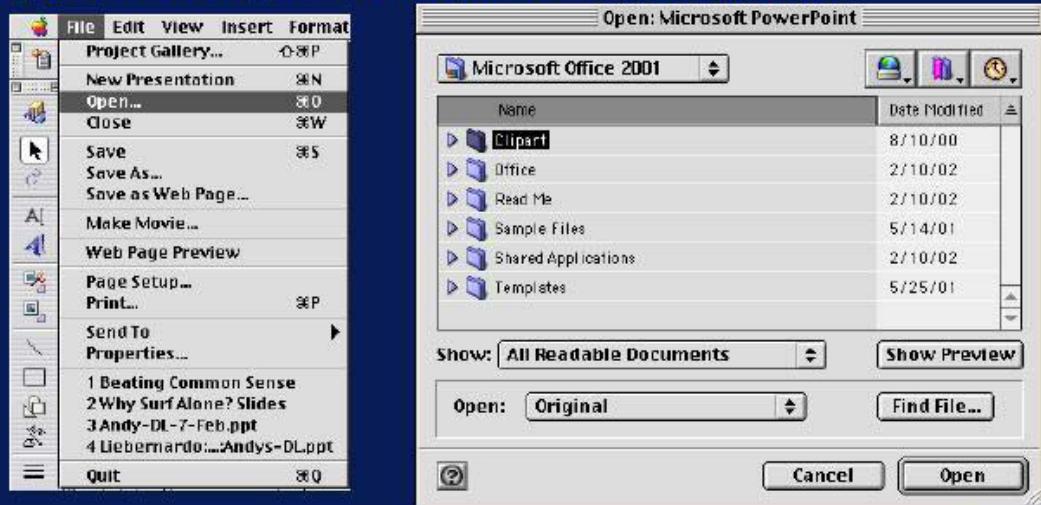
Agent expected to be helpful once in a while, not always

If agent is not helpful, user continues with their task

Many user interface situations are under constrained

Many user interface situations are *underconstrained*

System could present *any* directory, *any* files



Use common sense to provide context for better UI heuristics

Use common sense to provide context for better UI heuristics



Simple example: Most recently used files

Better: Who is the user? What're we working on?

System can anticipate what user is most likely to do

System can make most likely thing easiest to do

System can integrate applications, remove UI steps

Aria: Annotation and Retrieval Integration Agent

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Aria = Email/Web editor + Photo database + Agent

"Last weekend, I went to Ken and Mary's wedding..."

Aria: Annotation and Retrieval Integration Agent



Agent uses the *context* of the message to infer relevance of photos to text

Agent automatically *retrieves* relevant photos as message is typed

Agent automatically *annotates* photos with relevant text from message

Streamlined interaction: No dialog boxes, file names, cut and paste, load and save, typed queries, multiple applications, etc. etc. etc.

Common sense knowledge in Aria - Hugo Liu, Kim Waters

Common sense knowledge in Aria - Hugo Liu, Kim Waters

User input fed as query to Open Mind

User input fed as query to Personal Repository

Results used for query expansion in Aria's retrieval

Angela, the bride's sister, helped with decorations

The bridesmaid is often the bride's sister

The bride is Meloni. Meloni's sister is Angela.

What Open Mind knows about Weddings

What Open Mind knows about weddings

OPEN MIND *Teaching computers the stuff we all know*

Are you an artificial intelligence researcher? Download Open Mind today!

Welcome Tessa, to Open Mind! You have entered 124 items

Search: Other Activities · Information · Preferences · Logout

OpenMind

Search Results for wedding

Author	Knowledge
hayasi	A bride wears a wedding gown
hayasi	A bride and a groom are married in a wedding
Kohane	You can use a wedding ring to marry
jkasunic	going for a haircut is for a wedding
skoerber	Things that are often found together are: wedding gown, bouquet, bride, veil, groom

Common sense knowledge in Aria - Hugo Liu

Common sense knowledge in Aria - Hugo Liu, Kim Waters



Parsing natural language with WALI

Recognizing expressions:

Temporal

Referring to picture

Who/What/Where/When/Why

Henry Lieberman • MIT Media Lab

Goose: Goal Oriented Search Engine – Hugo Liu

Goose: Goal Oriented Search Engine - Hugo Liu



Common Sense vs. Mathematical inference

Common sense vs. Mathematical inference



Mathematical inference

Universally true statements

Complete reasoning

Depth-first exploration

Batch processing

Common Sense vs. Mathematical inference

Common sense vs. Mathematical inference



Common sense inference

Contingent statements

Incomplete reasoning

Breadth-first exploration

Incremental processing

Common Sense vs. Statistical techniques

Common Sense vs. Statistical techniques



Some large-scale, IR, numerical and statistical techniques have achieved success recently

Will statistical techniques “run out”?

Not necessarily opposed to knowledge-based approaches

Could we use these techniques to “mine” Common Sense knowledge?

Common Sense and the Semantic Web



There's now a movement to make "The Semantic Web" -- turn the Web into the world's largest knowledge base

Could this be a vehicle for capturing or using Common Sense?

We've got to untangle the Semantic Web formalisms

Could this be a way to integrate disparate Common Sense architectures (to solve the software eng. problems of Minsky's proposals)?
