Commonsense Reasoning for Interactive Applications

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Computers Suck

You need to restart your computer. Hold down the Power button for several seconds or press the Restart button.

Veuillez redémarrer votre ordinateur. Maintenez la touche de démarrage enfoncée pendant plusieurs secondes ou bien appuyez sur le bouton de réinitialisation.

Sie müssen Ihren Computer neu starten. Halten Sie dazu die Netzwerk-Sekunden gedrückt oder drücken Sie die Taste.

We could not complete your iTunes Store request. An unknown error occurred (-9838).

There was an error in the iTunes Store. Please try again later.
Computers are too damn complicated.
Why do they do this to us?

Because they don’t know anything about us

They don’t know what we want them to do

They’re not part of our everyday lives

They get wrapped up in their own bullshit
Three big issues

Complexity

Can’t keep growing interfaces simply by adding new functions

Instructability

How do we tell computers what we want them to do?

Risk

What happens if something goes wrong
What to do about it?

Give computers a better understanding of people’s goals, context, capabilities

Intelligent defaults, fail-soft design, contextual inference, goal-oriented interfaces

Smartphones, smart homes, smart…
Integrating AI / HCI

AI stuck on “Turing Test” complete AI

AI stuck on math+algorithms

HCI paralyzed by fear of AI failures (e.g. Clippy)

HCI stuck on designing for low-functionality interfaces, not on sustainable path for interface innovation
Hypothesis: Common sense reasoning is the key to making usable/helpful applications

Minority viewpoint: Minsky, Lenat...

So, let’s collect Commonsense and figure out how to

• Reason with it
• Integrate it into interfaces
Integrating AI / HCI

AI stuck on “Turing Test” complete AI
AI stuck on math+algorithms
HCI paralyzed by fear of AI failures (e.g. Clippy)
HCI stuck on designing for low-functionality interfaces
But does it “make sense” to work on Common Sense?

How much Commonsense is in a person’s head?

Isn’t Commonsense knowledge hopelessly vague, ambiguous, context-dependent?

Isn’t it different for different people, cultures?

What if it makes a mistake in the interface?
Good news: It’s feasible

A person lives for 3 billion seconds
CSK much less, maybe 10s to 100s millions
Storing / search that much stuff OK today

Will show you many CSK applications to convince you of utility
Big Data / Machine Learning

Hot topic – where we are in Moore’s Law

Learning from observation / learning from knowledge

What’s correlated / What’s interesting/ important

Complementary techniques, hijack math for aggregation

Some signs coming together, e.g. “deep learning”
Open Mind Common Sense

http://openmind.media.mit.edu

Welcome to Open Mind Common Sense!

Computers don't currently know the basic things about the world that we consider "common sense." Here, you can help build a database of such knowledge in simple English sentences. The computer will analyze these sentences to connect concepts and draw new conclusions from the things you teach it.

Getting started

If you want to interact with OpenMind and teach it new things, log in to get started!

Languages

Open Mind is collecting knowledge in multiple languages:

- English: 1032498 statements
- Traditional Chinese: 356277 statements
- Portuguese: 233440 statements
- Korean: 14952 statements
- Japanese: 14546 statements
- Dutch: 6065 statements
- Hungarian: 2154 statements
- French: 204 statements
- Spanish: 157 statements
- Italian: 98 statements
Open Mind Common Sense

“Crowdsourced” Common Sense
Direct typein, games, mining
12 years, 20K users
1 Million English statements, + other languages
CN5 on order of 10 million + web resources
Open Mind Commons - Speer

Knowledge about fruit

Similar objects to fruit: food, apple, cookie, vegetable, potato
fruit is referred to with these phrases: fruit, a fruit, Fruit, fruits, Fruits, some fruit, some fruits, Some fruit, an fruit, A fruit

An inquiring mind wants to know...

Is this generally true?
You are likely to find a fruit in a kitchen.
Yes / No / Doesn't make sense / Why do you ask?

Is this generally true?
You are likely to find a fruit in a restaurant.
Yes / No / Doesn't make sense / Why do you ask?

Is this generally true?
You are likely to find a fruit in a table.
Yes / No / Doesn't make sense / Why do you ask?

Current knowledge

→ An apple is a kind of fruit. by kyonn
Score: 39

→ orange is a type of a fruit. by jaegwon
Score: 31

Recently learned

→ taking final exams is for passing a class.
(by rspeer)
→ dish could be broken. (by rspeer)
→ You would study because you have a test.
(by rspeer)
→ You would take final exams because you are being tested. (by hawaii)
→ the beach is wet. (by hawaii)
→ Cookies are sugary. (by rspeer)
→ apricots are a kind of fruit. (by rspeer)
→ a laptop is a kind of portable computer.
(by rspeer)
→ a laptop is a kind of computer.
(by rspeer)
→ A lake is wet. (by rspeer)
## Effect of the parser

<table>
<thead>
<tr>
<th>What the contributor says</th>
<th>What OpenMind hears</th>
</tr>
</thead>
<tbody>
<tr>
<td>A goldfish is a type of carp that makes a nice pet</td>
<td>A goldfish is a carp</td>
</tr>
<tr>
<td>A nightgown is a long, loose garment worn to bed</td>
<td>A nightgown is a garment</td>
</tr>
<tr>
<td>A uniform is a special outfit worn by members of a group</td>
<td>A uniform is an outfit</td>
</tr>
<tr>
<td>A foot is a unit of measurement equal to twelve inches</td>
<td>A foot is a unit of measurement</td>
</tr>
<tr>
<td>A hut is a small, simple shelter</td>
<td>A hut is a shelter</td>
</tr>
</tbody>
</table>
# ConceptNet relations

<table>
<thead>
<tr>
<th>Label</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>IsA</td>
<td>Hockey is a sport.</td>
</tr>
<tr>
<td>PartOf</td>
<td>A finger is part of a hand.</td>
</tr>
<tr>
<td>AtLocation</td>
<td>You are likely to find a book in a library.</td>
</tr>
<tr>
<td>MadeOf</td>
<td>Windows are made of glass.</td>
</tr>
<tr>
<td>UsedFor</td>
<td>Pens are used for writing.</td>
</tr>
<tr>
<td>CapableOf</td>
<td>Boats can float on water.</td>
</tr>
<tr>
<td>HasProperty</td>
<td>Sunsets are beautiful.</td>
</tr>
<tr>
<td>Desires</td>
<td>A person wants love.</td>
</tr>
<tr>
<td>CausesDesire</td>
<td>Being cold would make you want to light a fire.</td>
</tr>
<tr>
<td>Causes</td>
<td>The effect of having a haircut is to have shorter hair.</td>
</tr>
<tr>
<td>MotivatedByGoal</td>
<td>You would do housework because you want to have a clean house.</td>
</tr>
<tr>
<td>HasSubevent</td>
<td>One of the things you do when you read a book is turn pages.</td>
</tr>
<tr>
<td>HasFirstSubevent</td>
<td>The first thing you do when you go for a drive is get in the car.</td>
</tr>
<tr>
<td>HasLastSubevent</td>
<td>The last thing you do when you take a shower is dry off.</td>
</tr>
<tr>
<td>HasPrerequisite</td>
<td>If you want to get fit, you should lift weights.</td>
</tr>
<tr>
<td>DefinedAs</td>
<td>Death is the end of life.</td>
</tr>
<tr>
<td>ReceivesAction</td>
<td>An apple can be eaten.</td>
</tr>
<tr>
<td>ObstructedBy</td>
<td><em>(Quando se tenta dormir, um problema encontrado pode ser insônia.)</em></td>
</tr>
<tr>
<td>CreatedBy</td>
<td>Music is created by composing.</td>
</tr>
</tbody>
</table>
ConceptNet - Liu, Singh, Eslick
What AnalogySpace can do

It can generalize from sparsely-collected knowledge

It can identify the most important dimensions in a knowledge space

It can classify concepts along those dimensions

It can create ad-hoc categories (and classify accordingly)

It can confirm or question existing knowledge
Commonsense knowledge in user interfaces

Intelligent defaults
Goal-oriented interfaces
Recommender systems
End-user programming
End-user debugging
Applications in Interface
Agents

Predictive typing, Speech recognition
Storytelling with Media Libraries
Detection and mitigation of online bullying
Opinion Analysis
Goal-oriented interfaces for Consumer Electronics
Mobile to-do lists, location-aware context-sensitive maps
Translation, language learning & multi-lingual communication
Help and customer service
Recommendation systems, scenario-based recommendation
Programming and code sharing in natural language
... and more
Let’s beat some Common Sense into computers!