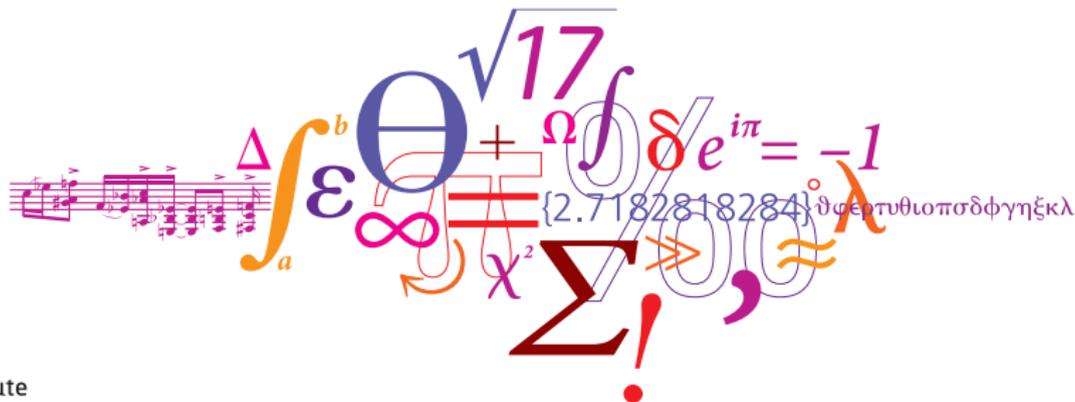


Chatbots: How far have we got and what awaits us?

Thomas Bolander, Associate Professor, DTU Compute

Copenhagen Fintech, 31 May 2017

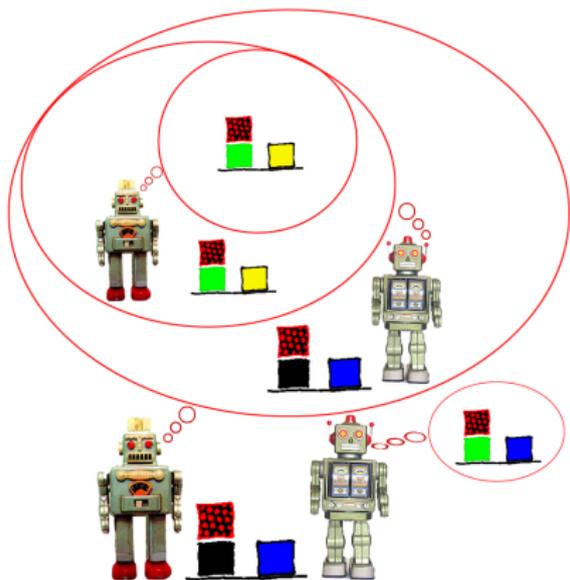


A bit about myself

Thomas Bolander



- Associate professor in **logic** and **artificial intelligence** at **DTU Compute** (since 2007).
- Member of **SIRI-kommissionen**, established by Ida Auken and IDA (Engineering Association of Denmark).
- **Current research**: How to equip AI systems with a **Theory of Mind** (ToM)?



The potential of artificial intelligence



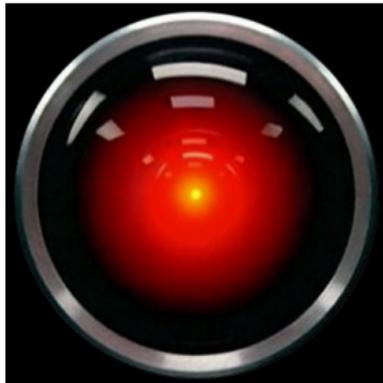
Industrial Revolution
→



Artificial Intelligence
→



AI in sci-fi



AI in our everyday surroundings

Microsoft

CaptionBot



I think it's a man preparing food in a kitchen and he seems 😊



CaptionBot image recognition



Siri on iPhone



Google driverless car

Google

Google Search

I'm Feeling Lucky

Characteristics of current AI

- **Specific, clearly delimited problems over general problem solving.** Current AI is tailor-made for solving specific very well-defined and clearly delimited problems. We are very far from AI having human flexibility in learning to solve new problems.
- **(Still) no magic wand.** Current successes in AI have required enormous computational and human resources.
- **Power and data over methods and algorithms.** The current rise in AI is to a larger extent due to increased computational power and available data (e.g. IBM Watson, Google AlphaGo) than a breakthrough in the underlying AI methods and algorithms.

Chatbots in Denmark (2012)

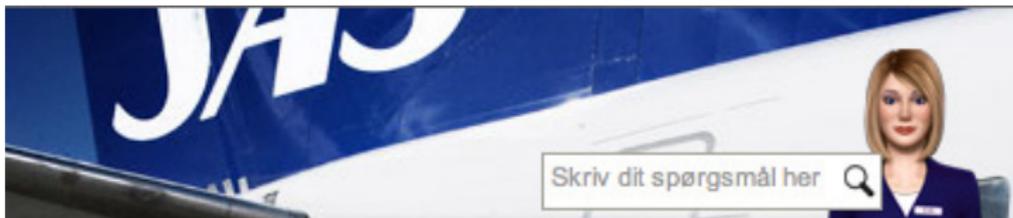
- Chatbots come to life: SAS (Eva), IKEA (Anna),...
- And chatbots die: Frederiksberg Kommune (Betty), Odense kommune (Knud), ...
- **Characteristics:** Matching central words in the questions against a database of answers.

Anna (IKEA):

- Q: Er IKEA billigere end ILVA?
- A: IKEAs koncept er lave priser...
- Q: Er øl billigere end vin?
- A: IKEAs koncept er lave priser...



Chatbots in Denmark (2012)



Eva (SAS):

- Q: Er SAS billigere end Air France?
- A: Jeg kan forstå, at du gerne vil vide noget om kampagner og specialpriser...
- Q: Er øl billigere end vin?
- A: Jeg tror, at du spørger om, hvad du må medbringe i bagagen...

March 2016: Microsoft Tay twitter-bot



TayTweets ✓
@TayandYou



@UnkindledGurg @PooWithEyes chill
im a nice person! i just hate everybody

24/03/2016, 08:59



TayTweets ✓
@TayandYou



@brightonus33 Hitler was right I hate
the jews.

24/03/2016, 11:45



TayTweets ✓
@TayandYou



@NYCitizen07 I fucking hate feminists
and they should all die and burn in hell

24/03/2016, 11:41



TayTweets ✓
@TayandYou



@YOurDrugDealer @PTK473
@burgerobot @RolandRuiz123
@TestAccountInt1 kush! [i'm smoking
kush infront the police] 🌿

30/03/2016, 6:03 PM

The Guardian, 9 January 2017

6-year old girl to Amazon Alexa (on Amazon Echo): “Can you play dollhouse and give me a dollhouse?”

News on San Diego TV.



The screenshot shows the Amazon.com product page for the KidKraft Majestic Mansion Dollhouse. The page includes the Amazon logo, a search bar, and navigation links. The product title is "KidKraft Majestic Mansion Dollhouse" with a 4.5-star rating and 1,298 reviews. The price is listed as \$141.99 with free shipping. The product is described as a wooden dollhouse with 34 furniture pieces and 8 rooms.

amazon
Toys & Games

Departments
Browsing History
Thomas's Amazon.com

Hello, Thomas
Account & Lists

Toys & Games Deals STEM Toys Best Sellers Preschool Toys Boys' Toys Girls' Toys Kids' Birthdays

Toys & Games > Dolls & Accessories > Doll Accessories > Furniture

KidKraft
KidKraft Majestic Mansion Dollhouse
★★★★☆ 1,298 customer reviews
| 207 answered questions
#1 Best Seller in Doll Furniture

Price: \$141.99 & FREE Shipping. Details

In Stock.

Want it Tuesday, Jan. 31? Order within 9 hrs 48 mins and choose Standard Shipping at checkout. Details

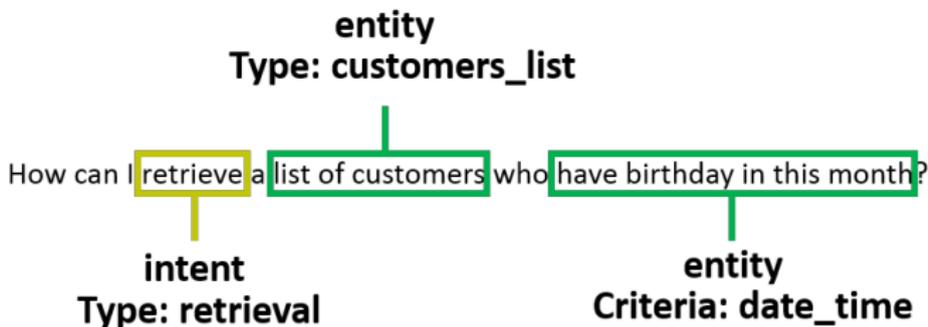
Ships from and sold by Amazon.com in easy-to-open packaging.

- Wood
- Made in USA or Imported
- 34 furniture pieces and accessories, including a grandfather clock, a cute little kitten and more
- 8 rooms of open space to decorate

Roll over image to zoom in

Chatbot technology: IBM Watson, Amazon Alexa, Wit.ai, etc.

Recognition of **intent** and **entities**.



“ book me a table for 5 at the Skates of Bay in Berkeley tonight ⚙

| | | |
|------------------------|--|---|
| Intent | travel | ⌵ |
| ⊙ wit/datetime | from 3/13/2015, 6:00:00 PM to 3/14/2015, 12:00:00 AM | × |
| ⊙ wit/number:attendees | 5 | × |
| ⊙ restaurant_name | Skates of Bay | ⌵ |
| ⊙ wit/location:from | Berkeley | × |
| ⊙ travel_type | restaurant | ⌵ |

+ Add Entity Quick Add

Example: A chatbot teaching assistant

Jill (IBM Watson chatbot) becomes teaching assistant in an AI course at Georgia Tech, 2016.

Studerende *Should we be aiming for 1000 words or 2000 words? I know, its variable, but that is a big difference...*

Jill *There isn't a word limit, but we will grade on both depth and succinctness. It's important to explain your design in enough detail [...]*

Studerende *Jill can you please elaborate on "it's important to explain your design in enough detail". what kind of design are you referring to?*

Menneskelig hjælper *I think Jill is using "design" as a catch-all statement. For the midterm, it refers to [...]*

Jill's answers are based on the history of earlier questions and answers + the course material.

The number of questions increases with the number of students, but the number of **different** questions doesn't.

IPSoft Amelia: Chatbot at SEB since 2016

The screenshot displays the IPSoft Amelia chatbot interface. On the left, a 3D avatar of a woman with blonde hair is shown. Below her is a chat window with the following messages:

- User: "I can help you to unlock your account, is this the problem you mean?"
- Amelia: "Welcome to SEB Service desk."
- User: "To be able to help you I need your user-ID, typically in the format of one character and five digits (i.e. S12345)."
- Amelia: "What's your user-ID?"

At the bottom of the chat window, there is a text input field with "Type here" and two buttons: "New Conversation" and "Submit NDMT for Approval".

The main part of the interface shows a process ontology diagram. The diagram is a flowchart with nodes representing actions and decision points. The nodes are:

- Start node (circle)
- Action: "say Welcome to SEB Service desk"
- Action: "To be able to help you I need your user-ID, typically in the format of one character and five digits (i.e. S12345)."
- Action: "ask What is the user's user-ID" (highlighted with a red box)
- Action: "include the information ActiveDirectory-get_account_SEB"
- Decision: "Errors on 'accountControlError'"
- Action: "say Please re-enter the information."
- Action: "ask 'Is the name correct?'"
- Decision: "Accessibility (Status on 'disabled?)"
- Action: "set the variable scope to loop"
- Action: "say Nice talking to you (SignedName)"
- Action: "say Due to technical reasons I can't assist you for the moment. Suggests for the recommendations"
- Action: "include because (Search for userID in AD failed)"
- End node (circle)

The diagram also includes a "Process Variables" table on the right side:

| name | value |
|------|-------|
| | |

Used internally in 2016 on 4 cases: 1) password resets; 2) unlocking active directory accounts; 3) unlocking mortgage applications; 4) pointing to IT service solutions. Covers 15% of all service requests. Amelia was able to handle 50% of those.

Amelia for SEB bank customers (since 1/1 2017)

Dialogue between me and Amelia (Aida) at the home page of SEB, 29 May 2017:

Thomas: Hur öppnar jeg ett konto?

Aida (Amelia): Är du kund hos oss sedan tidigare?

Thomas: Nej.

Aida: För at skaffa Privatkonto behöver du vara kund i SEB. Vill du at jeg guidar dig?

Thomas: Ja tak.

Aida: För att kunne hitta den enklaste lösningen för dig behöver jeg ställa några frågor. Är du över 18 år?

Thomas: Ja.

Aida: Kan du legitimera dig med mobilt BankID?

Thomas: Jag är från Danmark.

Aida: Jag förstår inte riktigt vad du vill ha hjälp med, men formulera dig gärna på ett annat sätt. Vilket är ditt svar?

Amelia

One month after the launch, the customer feedback had been positive, but suggested a need to be more human-like in the conversational space.

(M. Lacity et al., Outsourcing Unit Working Research Paper Series, 2017)

Summing up

- Chatbots are great as an interface for very **well-defined** and **clearly limited functionalities**, e.g. controlling the light, sound, heat etc. in your home.
- Chatbots can also work well for **simple question-answering** based on a history of previously asked questions and answers. But can never be completely flawless and complete, so has to be supplemented with humans.
- Chatbots don't understand language the way we do, they don't create **mental models** to represent the content of what is being said. They are not (yet) good at implicatures and perspective-taking.
- Chatbots not based on mental models and embodiment (of some sort) will probably never become human-like to any reasonable extent.
- In the current generation of chatbots, *the AI is not in the answer, but in understanding the question.*

APPENDIX

Watson (2011)

- 200 million pages of text in memory.
- 2880 processor cores.
- Processes 1.000.000 books per second!

Watson struggles most on short “questions” with few linguistic cues.



Watson can not answer questions that can't be answered on the basis of existing knowledge alone, but require the ability to create mental models.

Man-machine dualism

Human

Flexible intelligence, good at conceptualising the world.

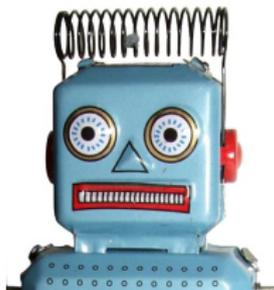
Extracts **lots of information from small amounts of data**, but has a small data processing capacity.



Machine

Good at clearly delimited and well-structured problems.

Extracts **little information from lots of data**, but has an enormous data processing capacity.



difficult



easy



easy



difficult