

Introduction to AI

Final Individual Assignment

Fall 2019

UiO : Universitetet i Oslo



Suresh Sapkota

First iteration	3
1. Concepts , definitions and history of interaction with AI.	3
1.1. Three definitions of AI	3
1.2 Robots and AI systems	4
1.3. The two definitions of Robot	5
2. Relation between AI and Robot	5
3.Universal Design and AI systems	6
Second iteration	8
4.Characteristics of AI-infused systems.	8
5. Human-AI interaction design.	9
6. Chatbots / conversational user interfaces.	11
6.1. Guidelines in Amershi et al.2019	12
Third iteration	13
7. Human Robots collaboration:	13
8. Levels of automation:	14
References:	16

First iteration

Concepts, definition and history of interaction with AI. • Human Robot Interaction. • Universal Design and Interaction with AI.

1. Concepts , definitions and history of interaction with AI.

The journey to understand whether machine can think started much earlier in 19s. John McCarthy along with Alan Turing give a term Artificial Intelligence in 1955 and later in 1956 after a huge academic conference started AI as a field (Jeffery). Five years later Alan Turing wrote a paper on the notion of machines being able to simulate human beings and the ability to do intelligent things, such as play Chess [Turing50].

1.1. Three definitions of AI

“Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning, reasoning and self-correction.” (Special Report: Artificial intelligence apps come of age, 2011)

2. The *Encyclopaedia Britannica* states, “ artificial intelligence (AI), the ability of a digital computer or computer controlled robot to perform tasks commonly associated with intelligent beings”. intelligent being means those who can adapt to changing circumstances. (B.j. Copeland, 2011)

3. Artificial Intelligence (AI) is the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving and pattern recognition. (Amazon , no date). Amazon is distributing their AWS platform to different users, where users can implement accordingly.

I would like to define AI as a computer driven machine, controlled and manipulated by human technology to solve the cognitive problems in a

limited time. By this, i mean AI is a machine but it can compete work with human or can do what human can do in an efficient way.

While reading different articles on AI, i found many interesting facts and use of AI by different companies but the one which attracted me is how Amazon uses machine learning. “Amazon.com has launched AWS(amazon web services) to allow other business to enjoy the same IT infrastructure, with agility and cost benefits”. This shows that Amazon is using AI as a service platform. AWS and [amazon.com](https://www.amazon.com) develop tools to develop simple-to-use theorem to solve pragmatic problems for every business. These tools are first tested in the scale and mission critical environment of [amazon.com](https://www.amazon.com) before they are sent to users.

I would like to connect my understand of AI with the movie *Avengers endgame*, how machine learning gave Thanos a soul? (The universe belong to marvel , 2019). Digital Domain, one of the digital effect firms hired for this movie, used a sophisticated machine learning software named Masquerade to make the performance of motion capture more realistic and natural (The universe belong to marvel). If there were not AI used in this process, they would have to do all this manually, which would take more time and the result also won't be as effective as it is today.

1.2 Robots and AI systems

The term Robot comes from a Czech word, robot, meaning “forced labor”(The wired guide to robots). The word was first used to denote a fictional humanoid in a 1920 play by Czech writer, Karel Capek. But the word was invented by his brother Josef Capek.

The modern concept came into use after industrial revolution. In 1954 George Devol invented the first digitally operated and a programmable robot named the Unimate. later in 1956, along with his friend Joseph Engelberger, Devol formed the world's first robot company. The modern robots were used in factories for manufacturing which helped to minimised the production cost and time.

1.3. The two definitions of Robot

1. “A robot is a machine especially one programmable by a computer which is capable of carrying out a complex series of actions automatically”(Oxford dictionary). This means a robot is a physical machine which can perform different tasks in accordance to human preference.
2. Cambridge states Robot as a machine controlled by a computer that is used to perform jobs automatically(Cambridge dictionary). They also call it as an emotionless machine which can perform effectively then humans in certain tasks.
3. While looking both the definitions above, i can simply explain explain Robot as a emotionless machine, controlled by computers, which performs task automatically inefficient way. This means a robot is a machine built by humans to perform similar task as humans but only in certain circumstances, only what human ask them to do.

2. Relation between AI and Robot

As from the definitions and discussion on both AI and robots in above paragraphs. We clearly see that AI is a computer program designed for tasks normally requiring human intelligence, while robot is a machine that completes difficult tasks automatically. AI could be use to control and build robots. Yes “a robot” is different from “an AI”.AI doesn’t need to move while the robot have moments. AI is not necessarily a physical machine except bot programs like Chatbot. Chatbot can be describe as a artificially intelligent robot. AI acts as a brain while robot acts as the body. but there are some similarities as well. A robot can actually have AI and both of them are operated by human intelligence. If we go back to the second definition of AI , it says AI is a “computer controlled robot to perform tasks commonly associated with intelligent beings”. This means AI is also a robot which performs complicated tasks with the help of human intelligence. And hence, i can conclude AI is a part of robot. Technology is building to produce

intelligent robots but a robot alone is not an AI. It is only a machine that performs tasks controlled by humans.

While talking about contemporary robot, i always used to wonder on the robots which looks like human, talks like human, and works like human, which is known as **humanoid robot**. A humanoid robot is a robot with its body shape built to resemble the human body. Humanoid robot have head , body , legs and arms similar to human body. It has sensors to sense its surroundings and get different measurements, and several motors installed into it helps the robot to move its part. For example the human robot **Sophia** which uses artificial intelligence, visual data processing and facial recognition. It can reply your questions, it has a recognition sensor and cameras in her eyes, which makes her smarter over time¹. She can recognise faces, sustain eye contact and recognise individuals and can proceed visual data.(Mallonee, Laura). Sophia can hold speeches, interviews and can hold conversation using natural language subsystem.

3.Universal Design and AI systems

“Universal design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability.”(NDA, 2014) .

A product should be designed/build for everyone who wish to use it. Nobody should be excluded only because they are differently able, they lack something that other have. Universal design should meet the need of diverse people, both majority and minority groups. As we know that if an environment is accessible, usable, convenient and pleasure to use , everyone benefits. Universal design creates products and services that meet peoples’ needs. It should be used to the greatest possible extent, in the widest possible possible range of situations. Everyone should be included. That is why we call universal design a good design.

Artificial Intelligence is developing faster and speeding up exponentially. It is a future of growth. Human research is continuously focused in developing the artificial intelligence. “Experts say the rise of artificial intelligence will make most people better over the next decade”(Pwe research centre,

¹ https://www.youtube.com/watch?v=W0_DPi0PmF0

Artificial intelligence and the future of humans, 2018). AI is a new factor of production and has the potential to introduce new sources of growth, changing how work is done and reinforcing the role of people to drive growth in business. It helps people saving their time and work load. for example chatbots are helping people to find solutions quicker and in more efficient way. This chatbot has a great future in development. Although the growth of intelligence in chatbot take over job of few people in customer service but there the consumer side is always brighter. But there is always a question in my mind as other people have; as emerging algorithm-driven artificial intelligence(as perviously talked in Sophia) continues to spread, will people be better off than they are today?(Pew Research center, 2018).

I think AI has a potential of including majority of population in the world. It has a great future and can be a good example of universal design. More and more industries are being influenced by AI, and our society is transforming everyday. Over the next few years we will witness the world being entirely disrupted by improvements in AI and machine learning. The research shows, during the last few years the development of machine learning has been increased rapidly. AI is including people from various services, such as; driving assistant, solving larger and complex problems, robots that has capacity to communicate and counselling people.

Second iteration

- *Characteristics of AI-infused systems.*
- *Human-AI interaction design.*
- *Chatbots / conversational user interfaces.*

4.Characteristics of AI-infused systems.

Many product nowadays consist the functionality enabled by artificial intelligence(AI). As per today every individual is using or carrying AI-infused mobile device. These AI-infused device helps in managing emails, finding locations and so on. One good example of Ai-infused system which is currently taking the lead in digital voice assistant market is SIRI.

The author of “Guidelines for AI-infused system, states that “Ai-infused systems may demonstrate unpredictable behaviours that can be disruptive, confusing, offensive and even dangerous”. I think these are the main characteristics in todays’ Ai- infused system. Unlike other systems, AI-infused system rely on probability and thus are more uncertain and less accurate.They are inconsistent as they are developing/learning over time. They may react differently from person to person, place to place, and other contexts. such as the functioning of Siri is highly dependent on the accent of the person. “AI-infused systems react differently depending on lighting or noise conditions that are not recognised as distinct to end users”(Amershi et el. 2019).

Users expectation of technology is impacted by various external factors such as knowledge, understanding and the experience users have from pervious technology based devices. AI now needs to introduce additional factors impacting user expectations and acceptance of modern AI- infused technologies(Kochelnik et al. 2019) which can address the current challenges. Amershi created guidelines for AI-infused system in human computer interaction (HCI) community. She created 18 guidelines after multiple iterations of evaluation with HCI users. Those guidelines are meant to be the possible characteristics an AI-infused system .

As stated above, the most common and frequently used (by every individual) AI-infused system is Siri in the mobile devices. Siri exemplifies most of the characteristics of AI-infused system mentioned above. Siri uses natural dialogues to assist humans. Siri is Apple's own digital voice assistant to help users to perform different tasks effectively. Siri helps you stay connected hands free and makes calls or send texts while you are driving or your hands are full. But all these characteristics are possible only when you get connected with Siri. And to connect with Siri, to open it up when you want, is one of the most frequent problems due to accent recognition. It is out of users' expectations and very irritating. Expectations impact how accepting end-users are of the technologies they use (Kochelnik et al. 2019).

5. Human-AI interaction design.

Both the authors (Amershi & Kocielnik, 2019) discuss the imperfections of AI and propose principles, guidelines and other sufficient strategies for user interfaces and interactions for applications that enable AI interfaces. And how technology should be designed for specific human-AI interaction scenarios.

Amershi et al. 2019 argues AI-infused system as an unpredictable system that is inconsistent, disruptive, confusing, offensive and even dangerous to humans. She says that "the AI-infused system violates established usability guidelines of traditional user interface". Those inconsistent and unpredictable behaviours confuse users and lead to unwanted problems. To establish the certainty in AI-infused systems, Amershi et al. 2019 did a HCI test to develop the new guidelines through multiple iterations of evaluation and testing the AI-infused systems such as navigation, which also satisfies the principle of usability for human AI interaction. Other recommendations so as not to mislead and confuse users. How to automatically adopt and personalised interfaces is the main concern of her article.

Similarly, Kocielnik discusses the imperfections of AI-infused systems by answering the questions like; why end-users are not satisfied with the existing AI? How "expectations impact accepting end-users are of the technologies they use". Alike Amershi, Kocielnik says that users do not expect their applications to behave inconsistently and imperfectly which leads to disappointment to the users on modern technology. To address this imperfection of AI, the author has done some contribution on human-AI

interaction through his studies. Contributions are meant to recover the errors like accuracy indicator of the system, users' able to control functionality according to his preferences, satisfaction and acceptance of imperfections, of an AI-infused system.

Two design guidelines in Amershi et al. 2019 are :

1. **G13, which is learn from user behaviour.** "Personalise the user's experience by learning from their actions over time."

I think this feature applies in some extent but not totally. Siri has been updated in 2018 which include predictive guidance and recommendations from the users' latest visit(site /place). For example if you ask Siri: where is the nearest hospital? it shows you the nearest from your current location. But for Siri to do so, the location service should be on. The other problem is, it suggest you many options instead of directly taking to the destination. I think this function can be improved in Siri. Siri could remember the location you have already been but it seems like it still does not totally personalise your locations. Another problem is understanding words with non-native accent. Siri doesn't have a personalised voice addition. As we understood from our one interview that people with more knowledge on technology find it easier to understand the changes while other with less knowledge find it harder. Some people blame technology for not understanding their accent, while other blame themselves for not being able to match the voice Siri is familiar with. This accent problem can be solved by personalising the accent according to user.

2. **G18: Notify users about changes.**

This means the AI-infused system capable of informing users about its updates or new additional features. In case of Siri it is quite applicable. The new version of Siri allows user to understand what the new feature does. They provide you a tutorial before you want to update it in your mobile device. And iPhone notifies you about the new features that requires your explicit attention. So i think this feature has added more value to the use of Siri and added consistency. But Siri's pop up notification is based on the iPhone setting. For those who are not familiar with the device can still find it difficult to follow up new updates in Siri.

6. Chatbots / conversational user interfaces.

As we know chatbot does not have a long history, they have only been around for decades. Despite its short history, it has taken a speed since last few years and the reason for this is “sudden renewed interest in chatbots include massive advances in artificial intelligence and a major usage shift from online social networks to mobile messaging applications such as facebook, twitter”(Følstad, 2017). It has been used for both commercial and non-profit purposes. Chatbots is the future of technology which is preferred for many activities. Beside the rapid growth in the development in bots filed, it has many challenges and failures. Along with the popularity, the rapid development and uptake of chatbots have challenges like implications of new technology, good interaction with human and so on. Chatbots need to be able to communicate naturally regardless of age, gender, race, language and preferences(Følstad, 2017) without creating a bias across gender, age and societal status. Due to the hidden underlying service, the interaction depends on the users input, there is a challenge in designing natural language interface that support uptake of digital technologies and services across groups that are less tech-savvy. This conversations as object of design clearly represents a challenge to the field of HCI.

Luger and Sellen mentions that most of the research today is focused in technical perspective. Both Følstad & Brandtzæg and Luger & Sellen, argues that the developers should focus on seeing design(explaining to the user) to the understanding design, where the users interface is understood and adapted to strengthen the Human-AI interaction. The conversation now is based on the messenger, but the future interactions can be voice based in natural language as one talks to his friend or with mother at home. “ The future era of chatbots and natural language user interfaces, content and services do not differentiate by their user interfaces but their convenience in accessing the context of conversational threads”(Følstad & Brandtzæg). However, misinterpretation of conversational is possible in dialogues , understanding the conversational process between chatbots and natural language user interface based on the input by user and the output provided to AI-infused systems(chatbot), shouldn't break down. Thus, the design of

chatbots and conversational user interfaces can be another challenge and the possible solution can be providing the massive volume of user data to chatbot.

6.1. Guidelines in Amershi et al.2019

G1:Make clear what the system can do“Help the user understand what the AI system is capable of doing”

G2:Make clear how well the system can do what it can do: “Help the user understand how often the AI system may make mistakes”

As mentioned in Luger & Sellen, conversational agents does not make it easy to understand what they are capable of doing and participants experienced that the agents are not capable of doing what they want them to do. In this case, adherence to guideline G1 makes user easier to understand what exactly the system does. Participants could have figured out the functionalities easily and in an effective way. Similarly, while following up the topics, participants had trouble with their conversational agent. They won't have struggled and frustrated if only their CA had added the functionality or the participants previously would have known that the function is not available. We may also find and avoid bias (Følstad & Brandtzæg) that AI-infused creates. These challenges can be resolve by a strict adherence of guideline G2.

Third iteration

- *Human-Robots collaboration,*
- *Levels of automation .*

7. Human Robots collaboration:

Human Robot Interaction(HRI) is attracting and ever-growing platform in research technology. Robots were established to help humans, to minimise their complexity of task, help them emotionally and also as cognitive benefits(Philips, 2016) . Human and Robots work as a partner and therefore a robot can provide a good companionship to humans. A good interaction between human and Robots, can increase work effectiveness. Human- Animal tuning research provided researchers and designers on building a robot. People may use the appearance of animal to assign that entity initial attributes, regardless of whether or not the attributes match the animal's true characteristics and capabilities(Upham Ellis et al. 2005, as cited in Philips 2016). Due to its physical form of animals, robots provide similar emotions to human as animal provides(Philips et al. 2016). Cognitive benefits of human-animal relationship helped in forming the shape of the robots to maintain human-robot interaction and hence can work collaboratively to maximise the outcome. Collaboration is defined as “working jointly with others or together especially in an intellectual endeavour”(Nass et al. 1994). Many of this animal shaped robot work interdependently, which further helps to maximise the task performance. Few examples of human-robot collaboration as presented by Philips at el.(2016) are as follows:

- 1) Big Dog Robot, a military robot also known as cargo robot. This robot helps in carrying goods. Specially used by soldiers to carry heavy loads from one place to another and this multiplies the human physical capabilities. This robots are interdependent to humans and have to collaborate with humans to complete the task as human load the weight on it and robot itself transfer to another place in rough or uncertain terrain(Philips, 2016).
- 2) NAO -a humanoid robot. It has a physical form of animal which provides emotional benefits of human-robot relationship. This was introduced by French robotic company with the purpose of using it to care-taking

behaviours in children(Philips, 2016). NAO is now used as an assistant by companies and healthcare centres to welcome, inform and entertain visitors(SoftBank Robotics). It helps to promote positive behaviours in students and monitor their progress. This robot is fully programmable with graphical user interface in python, and due to its cognitive cloud computing services this robot can interact continuously based on their real time analysis results(SoftBank Robotics). He can reply to various questions but get distracted or doesn't response in some case when he doesn't get eye contact.

8. Levels of automation:

I see automation as ,the degree to which a task is performed automatically without the involvement of operators. This is an approach to involve human interaction with automation of technology, which helps to increase the System Awareness of the system(Endsley, 2011). The capacity of a robot to make decisions is based on the information provided and the level of work it has to perform. The interaction of human-robot also depends on the level of automation. People can faster respond to system failures in case of intermediate level of automation rather than operating under full automation(Endsley, 2011).

1) Big Dog Robot: Given the task performance i think this robot lies at level 5; “Computer completely carries out singular or sets of task commanded by human”(Endsley, 2014). Humans gives the instruction once and the rest is done by robot itself. The decisions are made by robot itself during/under the task. The advantage of this kind of automation is human still have control of system. Human can adjust the system according to the condition and minimise biological/natural hinderance. Humans are still actively interacting with the robot and hence the failures made by robot can be detected quickly and required corrections can be made sooner or later. As i have seen in the video(Boston Dynamics), the Big Dog, while walking in the slippery roads, manages to stand up even after falling down. They can detect problems and direct themselves in other way. Which i think is an advantage, where robots can take smaller decisions and complete the task alone. They can however complete the task but this



can also be the disadvantage. This one directional task performing ability makes robot less reliable, ineffective and and less accuracy. If more human interaction and collaboration has been involved in this robot: level 1 “humans take all decisions”, the advantages would be, human have full control and decides everything, which gives the human an opportunity to choose when and what the machine/device are going to do according to situation.

2) NAO: As seen in different videos and producers’ website (SoftBank robots), this robot seems to be highly automated. This is maximum level of automation: level 12 “Computers carries out all aspects of task with no human intervention possible”(Endsey, 2014). It runs from the supplied database, which can take control of things by itself. Monitoring and information presentation is done by robot, generates options, makes decisions and implement them according to the situation. Since this is a highest level of automation, the advantage is, it does not need human help to complete the task. It is completely self dependent. But in some cases it can take wrong decisions which has social bias, morally wrong and disturbs social norms and values. Which is a disadvantage of this robot. To avoid this we can decrease the level of automation to “Blended decision making” where computer generates recommend options and selects best but human must consent before making the decision by the robot. Driving robots in this level of automation, helps to avoid negative consequences in the society.

References:

(Iteration 1)

1. Turing, Alan. 1950. Computing Machinery and Intelligence.
2. Jeffrey Mishlove, Conversations On the Leading Edge of Knowledge and Discovery
3. The universe belong to marvel, 2019, <https://www.goodworklabs.com/machine-learning-avengers-endgame/>
4. The wired guide to robots, <https://www.wired.com/story/wired-guide-to-robots/>
5. Oxford English Dictionary. Definition of 'robot'..Retrieved November 27, 2016.
6. Cambridge dictionary, <https://dictionary.cambridge.org/dictionary/english/robot>
7. NDA, 2014. What is universal design, <http://universaldesign.ie/What-is-Universal-Design/>
8. Kocielnik, R., Amershi, S., & Bennett, P. N. (2019). Will You Accept an Imperfect AI?: Exploring Designs for Adjusting End-user Expectations of AI Systems. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems
9. Pew Research center, 2018. Artificial intelligence and the future of human, <https://www.pewresearch.org/internet/2018/12/10/artificial-intelligence-and-the-future-of-humans/>
10. Definition of AI
 - 10.1.Special Report: Artificial intelligence apps come of age.) . Accessed 26.sep.2019 <https://searchenterprisetarget.com/definition/AI-Artificial-Intelligence>
 - 10.2.<https://www.britannica.com/technology/artificial-intelligence>
 - 10.3.Amazon, accessed 27. sep. 2019 (<https://aws.amazon.com/machine-learning/what-is-ai/>)
3. Mallonee, Laura (March 29, 2018).
"Photographing a Robot Isn't Just Point and Shoot]". accessed 27.09.19
4. Universal desig , nda: accessed 27.09.19
<http://universaldesign.ie/What-is-Universal-Design/>
5. Pwe research centre, Artificial intelligence and the future of humans, 2018 accessed 27.09.19
(<https://www.pewinternet.org/2018/12/10/artificial-intelligence-and-the-future-of-humans/>)

(Iteration 2)

1. Amershi, S., Weld, D., Vorvoreanu, M., Fourney, A., Nushi, B., Collisson, P., Suh, J., Iqbal, S., Bennett, P., Inkpen, K., Teevan, J., Kikin-Gil, R., Horvitz, E., 2019. Guidelines for Human-AI Interaction, in: CHI 2019. ACM.
2. Følstad, A., Brandtzæg, P.B., 2017. Chatbots and the new world of HCI, interactions 24, 38–42.
3. Kocielnik, R., Amershi, S., Bennett, P.N., 2019. Will You Accept an Imperfect AI?: Exploring Designs for Adjusting End-user Expectations of AI Systems, in: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI '19. Presented at the the 2019 CHI Conference.

4. Luger, E., Sellen, A., 2016. "Like Having a Really bad PA": The Gulf between User Expectation and Experience of Conversational Agents, in: Proceedings of CHI 2016 Conference on Human Factors in Computing Systems (pp. 5286-5297).
5. Guidelines for infusing artificial intelligence to products (<https://uxdesign.cc/guidelines-for-infusing-artificial-intelligence-to-products-bbbcf7b928f7>)
6. <https://www.uio.no/studier/emner/matnat/ifi/IN5480/h19/undervisningsmateriale/interacting-with-ai-2019---module-2---session-1---handout.pdf>

(Iteration3)

Europe, S. R. (n.d.). *SoftBank Robotics* . Retrieved from <https://www.softbankrobotics.com/emea/en/industries/education-and-research>

Endsley, Mica R.. Designing for Situation Awareness: An Approach to User-Centered Design, Second Edition CRC Press. 2011 (chapter 10.5.2)

Elizabeth Phillips, Scott Ososky, Brittany Swigert, and Florian Jentsch, Human-animal teams as an analog for future human-robot teams, Proceedings of the Human Factors and Ergonomics Society Annual Meeting, Vol 56, Issue 1, (2016) pp. 1553 - 1557

Boston Dynamics. <https://www.bostondynamics.com/bigdog>

Appendix 1: Feedback

According to the feedback for first iteration, I have had unfinished sentences which gives unclear meaning/ opposite meaning. So it was hard to understand what sentences exactly mean. I have used this feedback and made changes in my second iteration. Hopefully, i have tried to make complete sentences and make it easy for the readers and for further writing.

Appendix 2:

After my second iteration, i got feedback on using a mixture of different citations format. I was using both APA and numbering. Using the feedback i changed my style of referencing to only APA. I now realised its a bit hard to change the reference form latter. I have learnt about referencing which i have tried to implement properly in iteration 3, and hopefully i will do the same in my future articles or master thesis.

