Individual assignment - Second module

1. Definitions of AI:

First definition:
In "Store Norske Leksikon", Ivar M. Liseter describes AI as a field in computer science that uses different kinds of computer tools to study intelligent behavior and use the results from the studies to construct a system that is "intelligent", meaning, that it is capable of solving problems and learn from experience. A system which is built to be intelligent often uses knowledge-based systems for collecting and sorting of knowledge, which is a central theme in intelligent behavior (Liseter, 2018).

Second definition:
John McCarthy writes that AI is the science and engineering behind making intelligent machines and especially intelligent computer programs. McCarthy also associates it with using machines to understand human intelligence, but that AI is not limited to methods that are biologically observable. He also defines intelligence as that part of the ability one have to reach a goal (McCarthy, 2007).

Third definition:
Michael C. Harris defines AI as the science behind building intelligent machines that can perform tasks as well as or better than humans can, and often tasks that are to complicated for the human brain. Harris also writes that AI isn't really about intelligence, but rather the task of solving problems, and that all solutions in AI is based on mathematics and computers (Harris, 2011).

Discuss definitions relative to discussions of AI in the course
In this course, autumn 2018, Følstad (2018) proposed this definition of AI: *"Computer systems learning and improving on the basis of large data sources",* and that AI is confined to a specific task, like self-driving cars (Følstad, 2018). The definition that is most relative to this, is the one by Ivar M. Liseter from Store Norske Leksikon. They kind of explain it in the same way, but Følstad's (2018) definition is more compact, describing it using fewer words. All the definitions also agree that AI has to do with computer programs and systems. Michael C. Harris (2011) writes about AI as intelligent machines that can perform tasks as well as or better than humans, and Følstad (2018) that AI is confined to a specific task, using the example of self-driving cars, a task that it might perform as well as or better than us.

2. Definisjoner av robotikk:

First definition:
Robotics is concerned with the study of machines that can replace humans in the execution of a task, both physical activity and decision making (Siciliano, Sciavicco & Villani, 2010).

Second definition:
Jean-Paul Laumond defines robotics as the relationship between a machine that can move where the motions are controlled by a computer, and who can interact with the real world. He also says that robots are different from automats, because motions that an automat has is mechanically determined, where computers manipulate information but don't move (Laumond, 2012).

Third definition:
Siciliano and Khatib refers to an definition from the 1980s, where robotics was defined as the science and technology of robots, which studies the intelligent connection between perception and action. In reference to that definition, they add that a robotic system has the ability to move in the environment (with wheels, legs, etc.) and to operate on objects present in the environment with, for instance, arms or artificial hands. They also have sensors that provide them with information about the surrounding environment and the state of the robot (Siciliano and Khatib, 2016).

3. Definisjoner av machine learning:

First definition:
Tidemann and Elster defines machine learning in "Store Norske Leksikon" as a specialization in artificial intelligence where they use statistical methods to teach computers how to find patterns in large amounts of data. The machine is learning instead of being programmed.They also explain how machine learning is different from AI, in a way that AI have rule-based models and ML is based on data-driven models. Rule-based models holds rules that are programmed by humans before they are used, while data-driven models are not (Tidemann and Elster, 2018).

Second definition:
Jordan and Mitchell defines machine learning as the question of how to build computers that can improve themselves automatically through experience (Jordan and Mitchell, 2015).

Third definition:
Daniel Faggella combines different definitions from multiple researches to define what machine learning is. He ends up with defining machine learning as the science of getting computers to and act like humans do, and improve their learning over time automatically by

feeding them with data and information from observations and interactions from the real world (Faggella, 2018).

Discuss definitions relative to discussions of Machine Learning in the course.
As I understand from the course, machine learning is a way of working using programs to make the AI more intelligent, and within this is deep learning, a form of machine learning. Machine learning becomes deep learning when it has several neurons, creating a deep learning neural network (Goodwin, 2018). Relative to the definitions above, Tidemann and Elster (2018) writes that the machine is learning instead of being programmed, which maybe can be seen as a way of working. All the definition is agreeing on that machine learning has to do with learning and evolving automatically by itself.

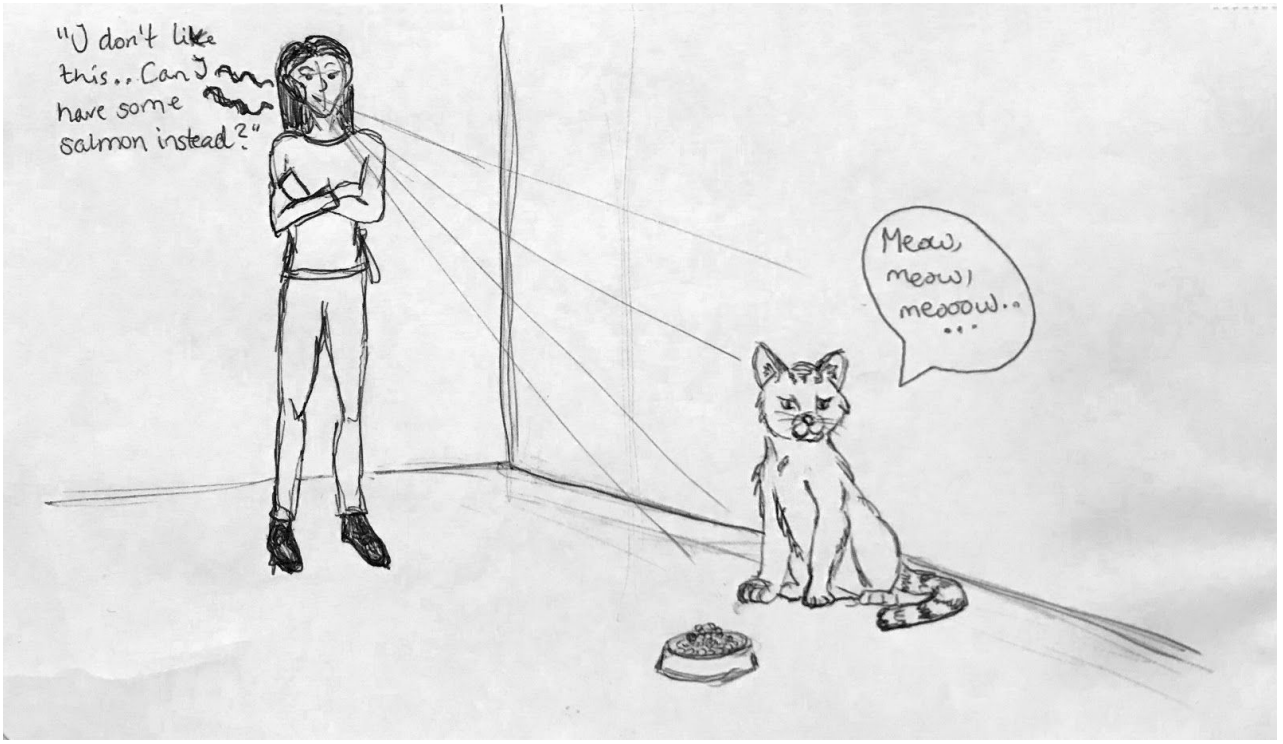
4. The relationship between robotics and AI as I understand it:
I understand the relationship between robotics and AI like something physical and psychological/ cognitive. The physical part is the robot and its moveable parts like arms and wheels, etc., which can be used to interact and perform a task. I see the cognitive as its AI, the robots brain, which make it act and understand, and who learns and remembers these actions, where the information is perceived through sensors, similar to a human eyes and ears.

5. My own definition of AI defined and explained:
As mentioned in the previous assignment, I understand AI as something psychological/ cognitive, and specially because it's about intelligence and knowledge. Much like a human human brain, it learns and evolves over time through interaction in the real-world and through perceiving information from it. In reference to Tidemann and Elster's definition of machine learning and the difference between AI and ML (see assignment 3), I think that, if it's based on rule-based models (Tidemann and Elster, 2018), it can't do everything yet, but rather solve and learn from tasks that it has been programmed to do.

Expand on this text to explain the relation between AI and Machine Learning:
As I understand, AI is more of an overall thing, that uses machine learning to evolve itself. And according to Tidemann and Elster's definition (2018), AI is based on rules that are programmed in advance, and ML is data-driven, learning and remembers through this program.

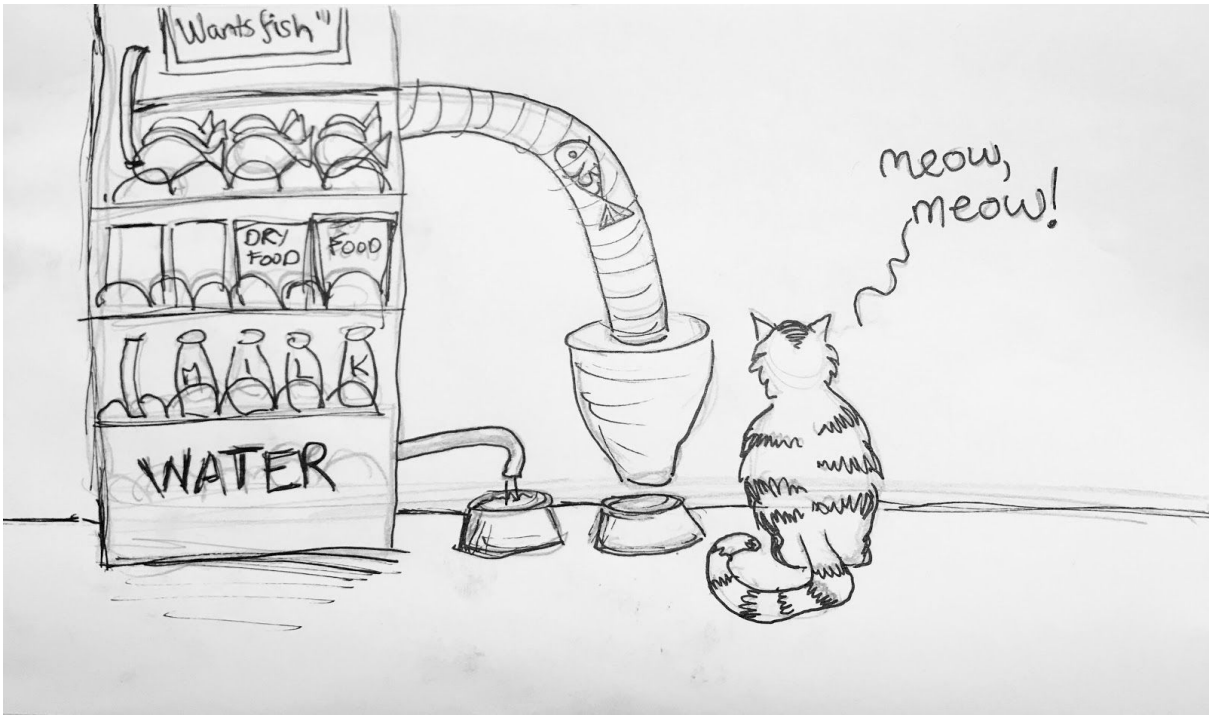
6: Drawing of an interaction with AI:
I have made a drawing of an human interacting with a device that lets her understand what the cat is meowing about. I imagine that the device could understand every animal, and that it would be really useful for both pet owners and vets. The drawing is showing a cat that is

not happy with the food the owner gave him, and asks/meows if he could have some salmon



Summarize key characteristics of interaction design for AI-based systems:
Følstad (2018) proposes a tentative definition for AI-based interactive systems: *"Interactive systems where important components are powered by AI. These systems are typically set up for learning and improvement on the basis of large datasets and gathering of new data".*
According to this, he sets three principles to think about when designing AI-based interactive systems, *learn, improve* and *fuelled by large data sets* (Følstad, 2018). *Learn* is about explaining the dynamic character in the system and show the capabilities to the user interacting with it, and think about designing for change. It is also important to be clear on the limitations (Følstad, 2018). *Improve* is about learning from mistakes, which are inevitable (Følstad, 2018). *Fuelled by large data sets* is about feeding the system/program with new data and then accommodate the users and make them benefit from the data. The users must get something in return for sharing data. Data gathering takes place through interaction (Følstad, 2018).

Sketch a user interface illustrating one or more of these characteristics.
I've decided to continue the previous drawing from this assignment, to sketch a new based on the principle *fuelled by large data sets.* This sketch is showing the cat interacting with a AI-based system which is connected to a fridge and a special food bowl. The cat can meow to the bowl what it would like to eat. So the fridge can translate cat-language and understands and learns what different types of food looks like.



7: **Read the article: "On the Subject of Objects: Four Views on Object Perception and Tool Use" by Tarja Susi / Tom Ziemke. Write in your own words one page about the different perspectives on the human relationship with tools.**

In the article by Tarja Susi and Tom Ziemke, we are presented with four different aspects of the relationship and interaction between object and subject, and how a subject perceives an object; Uexküll's *functional tone*, Heidegger's *equipment*, Gibson's *affordance* and Kirsh's *entry point*.

Functional tone - Uexküll
Uexküll is examining the question about how we come to see what things are for, and asks the question: *"How do we know that a chair is for sitting or a cup is for drinking?"*. Uexküll sees an object as something neutral that only becomes meaningful when an subject interacts with it, and sees an subject as an animal who lives in its own subjective universe (Umwelt). When there's a relationship between subject and object, he sees them as a closed unit, and in this closed unit, the object assumes/ understand a *functional tone.* Which functional tone depends on the subjects current mood (Susi and Ziemke, 2005). The object gives the subject understanding of what it is and how to use it, and can be perceived different by/ in other Umwelts.

Equipment - Heidegger
In Heidegger's view, the subject-object relation can only be understood in terms of being-in-the-world and he wanted to explain what it means for something to exist (Susi and

Ziemke, 2005). To be and exist, one has to relate oneself to being with other beings (Susi and Ziemke, 2005). Heidegger then divide beings in to categories, being-human (subjects) and non-human being, and then divide non-human beings into two sub-categories, Zuhandenheit (readiness-at-hand) and Vorhandenheit (presence-at-hand) (Susi and Ziemke, 2005). He sees the non-human beings as tools or other things that we might encounter in our everyday lives, and here use the word *equipment* (Susi and Ziemke, 2005). To understand the objects function it has to be used by an subject.

Affordance - Gibson
Gibson's view sounds similar to Heidegger's in a way that he also sees the subject as an animal, but different because he states that it has its own niche in the physical environment (Susi and Ziemke, 2005). In Gibson's view, what animals perceive of the environment is ambient light which reflects on surfaces that makes information available to the animal (Susi and Ziemke, 2005), information about the *affordances* or objects in the environment. The needs of the animal might change, but the affordances do not and are always there to be perceived (Susi and Ziemke, 2005).

Entry point - Kirsh
Kirsh use the term *entry points* about environmental structures that invites people to enter an information space, and they can be subjective or objective (Susi and Ziemke, 2005). He sees the environment as a workplace or office where things like notebooks and folders are cues in the environment (entry points) that invites us to take in/ understand information about how to use it.

8. In detail, one of the perspectives: Entry point - Kirsh
I've selected Kirsh's perspective, *entry points.* As explained in the previous assignment, entry points are things in the environment, specifically work places like offices, that invites us to do something and gives us information about how to to use it, similar to affordances. In Kirsh's view, entry points are personal and people have different preferences when it comes to numbers of entry points (Susi and Ziemke, 2005). He use an example of *neats* and *scruffies,* where neats keeps their desk tidy and organized, and scruffies the opposite, but where both provides entry points with information about what needs to be done (Susi and Ziemke, 2005). He also states that entry points have different characteristics that affect the way people react to them, like *intrusiveness* (how much attention it attracts)*, visibility, importance* and *relevance* (Susi and Ziemke, 2005).

9. Select one other article from module 1, and write with your own words what this article is about.
I have selected the article "Ironies of automation" by Lisanne Bainbridge from 1982. In the article, she discuss different ways of how automation of industrial processes may cause more problems than fixing them for the human operators, and also sees the irony in this (Bainbridge, 1982). The aim of automation is to replace the humans role in control,

planning and problem solving (Bainbridge, 1982), but in most cases, the new industrial systems being developed still needs monitoring by humans in case of failure in the system. And because of this automation, the operators might become lazy and may not detect failure as easily as when they did it manually themselves, and in addition to this the system has alarms that let them know about detected failures (Bainbridge, 1982). Bainbridge also points out that later generations of operators of the automated systems cannot be expected to have the same skills as an former manual operator (Bainbridge, 1982).

10. Select one documentary or a fictional film, book or game: Describe with your own word how interaction with AI is portrayed in this work:
I've chosen the machines from the video game "Horizon Zero Dawn". The narrative is set to the future where humans live together with machines, where the machines are more like wild animals rather than pets. The machines has learned to perceive the humans as enemies that should be destroyed. They understand the difference between a human and other machines, and humans and real animals (like rabbits and foxes). They are also very sensitive to noise and movements, and will do a search by scanning the area if they think they heard something and a human is nearby.

11. Describe what you understand by autonomy; both human autonomy and machine autonomy.
In reference to what The European Group on Ethics in Science and New Technology states in their statement "Artificial intelligence, robotics and autonomous systems", I understand *human autonomy* as the freedom one has to set one's own standards, goals and purposes in life (The European Group on Ethics in Science and New Technology, 2018). In relation to this, I understand *machine autonomy* as the ability a machine have to operate on its own.

12. When was the term "AI" first coined? Please make a reference.
According to Michael C. Harris, it was the mathematician John McCarthy, together with other creative thinkers (engineers, psychologists, etc.) who first used the term "artificial intelligence" when they were brought together at a conference in 1956 (Harris, 2011).

13. One question for the article "What we talk about when we talk about context" by Paul Dourish:
If we can't design a system with defined requirements that fits a specific context, but rather a system that evolves as the user interacts with it in their desired environment and context, could we develop just <u>one</u> system that could adapt to everything?

14. Articulate one question for any other article in the curriculum.
I've selected the article "Ironies of automation" by Lisanne Bainbridge from 1982, and articulated the question: "Why do we continue to spend money and time on making new

automated systems when it still needs monitoring by humans or replace the human completely?

15. Read the article: "Using Artificial Intelligence to Augment Human Intelligence" by Carter & Nielsen. Summarize in your own words the articles discussion of different views on computers, and on how AI may augment human intelligence.

The article by Carter & Nielsen (2017) is about how we can use artificial intelligence to augment human intelligence and shows different examples of how this can be done. They describe a new field they named *Artificial intelligence augmentation (AIA)* (Carter & Nielsen, 2017).

They begin with asking the question "*What are computers for?"* and states that different visions of what computers are started to develop in the 1950s (Carter & Nielsen, 2017). In 1962, Douglas Engelbart suggested that computers could be used for augmenting human intelligence and said that it was *"real-time interactive systems,[...] that humans could work with to support and expand their own problem-solving process"*(Carter & Nielsen, 2017). This vision of intelligence augmentation (IA) influenced others like Steve Jobs and Alan Kay, and inspired many others of the idea of using computers for support and problem-solving in areas like digital music, data visualization and HCI (Carter & Nielsen, 2017).

IA usually focus on building systems that put humans and machines to work together, while AI focus on complete outsourcing where the machines does the job for the humans, completing them as good as or better than humans (Carter & Nielsen, 2017).

As an example of how we can use AIA, they're using what they call *generative interfaces*, which is interfaces that can be used to explore and visualize generative machine learning models (Carter & Nielsen, 2017). The first example shows a tool that creates fonts based on interaction with buttons to do modifications like bold, italic and condensed, using machine learning (Carter & Nielsen, 2017). The second example is showing how machine learning can be used to augment human creativity, using iGAN by Zhu et al. (Carter & Nielsen, 2017). iGAN is a generative model trained using 50 thousand images of shows, and then use this to build an interface that lets a user interact by sketching the shape of a shoe (Carter & Nielsen, 2017). They also discuss if these interfaces can inhibit creativity.

Carter and Nielsen (2017) also writes about two models of computation, the *cognitive outsourcing model* and the *cognitive transformation model.* The first model is based on the conception that computers are used for problem-solving and AI is often viewed as an oracle, that is able to solve large problems better than humans (Carter & Nielsen, 2017). The second model is based on the conception of expanding the range of our thoughts, changing the way we usually think (Carter & Nielsen, 2017). Cognitive outsourcing is

important, but cognitive transformation offers a deeper model of IA, where computers are tools for changing and expanding the human thought itself (Carter & Nielsen, 2017).

Referanser

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