IN5480 Lecture notes 19 September 2019

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Note: This document will be revised for legibility and clarity. Please do not hesitate to send feedback about the document, info about errors, suggestions for improvement and so forth. I hope to revise and improve this text iteratively (of course without extending it too much - or adding new sections), in the same way as you will do with your individual assignment and the group assignment.

Today, the theme is AI and Universal design. Before we go into this subject matter, we will do the following:
1. Presentation of articles - anyone?
2. Brief round with the groups - and the upcoming work with the wonder documents.
3. Questions regarding the individual assignment?
4. Questions regarding the peer review process?
5. Reference system - anyone?
6. Possibly something about self-driving busses/el scooter from TØI/Espen?

Interaction with AI and Universal Design

Inclusion and Universal Design are important concerns when working with any systems, also for AI systems. In what way does the system we are working with exclude users - and in what ways does it exclude?

There are many ways to talk about ethics when developing systems, testing systems and deploying systems. Both on the individual, micro-level, organizational or meso-level and the macro level - the society. Inclusion, discrimination and fairness are often high on the agenda when discussing ethics; such as in this FATE framework (this is from the book Interaction Design; beyond human computer interaction by by Sharp Rogers and Preece (5th edition)):

Fairness: Is it fair, data handled fair, without discrimination?
Accountability: Is it correct, valid?
Transparency: Is it visible to the user what is going on, how decisions are made?
Explainability: Explanations, is it possible to understand by us?

Another framework is proposed by Jutta Treviranus; presented in her thesis: The three dimensions of inclusive design: A design framework for a digitally transformed and complexly connected society. The three dimensions of the framework are:

1.Recognise, respect, and design for human uniqueness and variability.
2.Use inclusive, open & transparent processes, and co-design with people who have a diversity of perspectives, including people that can’t use or have difficulty using the current designs.
3. Realise that you are designing in a complex adaptive system.

Here in Norway, and in Europe, we have a long history of working with fairness and inclusion; both of the built environment, of products and services. As more and more environments, products and services are digital - or in part digital, ICT and inclusion become increasingly important.

The umbrella term here in Norway is “Universell Utforming” or in short UU. Universal Design (UD) is the english word for this. In the USA the terms Inclusive Design (ID) is used, design for all - and accessible design.

Universal Design

UD is about inclusion of all. An aim when making any new systems or functionality is that the “new” systems is not creating new barriers for users, and the barriers that already exist shall be reduced. It is operationalized for certain technologies today, such as web technologies and app technologies. We all know the WCAG 2.0/2.1, (Web Content Accessibility Guidelines) standard by WAI (Web Accessibility Initiative) at the W3C (World Wide Web consortium), that are used as guidelines for ensuring accessibility of services on the net. The four principles are:

1. Perceivable: Information and user interface components must be presentable to users in ways they can perceive.
2. Operable. User interface components and navigation must be operable.
3. Understandable: Information and the operation of user interface must be understandable.
4. Robust: Content must be robust enough that it can be interpreted by a wide variety of user agents, including assistive technologies.

These guidelines are used during the design and evaluation of systems to ensure that systems are available to as many users as possible, without special adaptation or aid “hjelpemidler”, in as many contexts as possible.

UCD (user-centred Design), HCI, HRI and PD have long before these guidelines, and even the term Universal Design, been concerned with the human side of computing, and work for inclusion of the user group or population in question.

A new EU directive about inclusion is the Web Accessibility Directive (WAD). You can read more about this at DIFI (Direktoratet for forvaltning og IKT). New requirements for enterprises are that they provide an accessibility declaration and enable functionality for user feedback.

The work within UD is often about making sure that people and groups with physical, cognitive or motor disabilities (blind, deaf, wheelchair users) etc are included and not excluded. However, the idea - and ideals behind UD is broader. For example, situational disability (being pregnant, drunk, power outage/pitch dark) etc happens for “all”, i.e. And of course old age, where body functions and cognitive capacities get reduced. Very often, there is a social model of disability and ability at the core of discussion, where disability is

something that is created in the meeting between citizen and the society (stairs make you disabled in a wheelchair for example).

Interestingly, within developing AI technologies - current and previous research projects have often focused on inclusion and universal design. The current MECS project here at IFI is one such example, where we investigate the possible use of robots at home for the elderly living independently at home. A group that potentially can stay longer at home with some help from various (AI) technologies such as “robots” moving around in the home.

Other examples of this:

Speech synthesis and speech recognition. Audio books for visually impaired.

Remote control: In order to help out with motor impairments.

Video conference: Used by visually impaired for assistance.

Eye tracking/detection: Used as input for motor impaired users.

So one part of “AI” and “inclusion” is the positive side - where AI technologies are applied and used to include people and users who are else excluded.

What is peculiar with AI and UD? On one side, there are tremendous opportunities for including more people, even all. On the other side, there are tremendous opportunities to exclude people when statistics and numbers are crunched about people. AI and UD is like a double edged sword, or a dilemma that we will look into one here.

Human centered AI, statistics and probability

“If you are unique (and aren’t we all), numbers are not our friends” (Trevanius) is one statement that needs some explanations. Numbers are for course potentially very useful for many different purposes within sciences - as well as in everyday life. A meeting starts at 12:15! Or this is 2103 gram, whereas this is 2108 0 gram. However, since we are all “unique”, there are some challenges of including all the “uniqueness”.

Jutta Trevanius explain further this “uniquness”: “.....to recognise the uniqueness of each individual. We are each an irreducible and evolving complex adaptive system of characteristics and needs. This uniqueness and wild, organic diversity has been inconvenient when it comes to designing products, communication, environments, or policies. It defies mass production, mass marketing, mass communication, mass education, as well as simple and straightforward public policies.” Even within one individual, there are idiosyncrasies and differences from situation to situation; after all we are doing a bit different talking and acting here in this lecture for example compared to 3 am Sunday morning at a celebration.

When developing systems in general, very often we tend to design for the “majority”, where limited resources are applied to reach a broad population. The 80/20 principle, or the Pareto

Principle, where 20 % of the resources is used to reach 80 % effect is well documented in various disciplines.

This is not an inclusive process; since potentially 20 % (or so) of the population is left out. Another possibility is to aim from the start to reach 100 %, and as a process continuously ask “is anybody left out with this solution?”, and if so address it. This is at the core of Universal Design. However, this is a challenge when it comes to working with the “average” and modelling probability.

For the argument here, we will only invoke everyday, basic statistics about the “data” that is the “input” for machine learning algorithms.

Here we come into some basic statistics:

Distribution. Data about a population has a distribution. Often we mean probability distribution when talking about distributions. The most common is normal distribution (other names Bell curve (looks like a bell) giving a Gauss Curve), Binomial distribution (two outcomes, true and false) and Uniform distribution (throw one dice many times). In probability theory, the normal distribution is a common continuous probability distribution. Normal distributions are often used in the natural sciences. It is also used in social sciences and humanities.

Representations. Data is about something, and often represented by numbers in computers. It is a lot happening from the “real world” to the representation of the real world, or representing aspect of the real world. How happy are you on a scale from 0 to 10? Let's say you answer 7. This number 7 represents the level of happiness for you (when you answered the question, at that particular place, and at that particular time, in that particular situation). Or, a face recognition system determines by a visual representation of your face that you are 3.27 on this happiness scale.

Average (gjennomsnitt) can be the mean, median, and mode. The "mean" is the "average" we are used to, where we add up all the numbers and then divide by the number of numbers. In the list of numbers, the "median" is the "middle" value. You list the numbers in numerical order from smallest to largest in order to find the median. The value that occurs most often is called the “mode”.

Standard deviation is a number that tell how measurements for a group are spread out from the average (mean). A high standard deviation means that the numbers are more spread out. A low standard deviation means that most of the numbers are close to the average.

Outliers: This are data points that differs significantly from other data points in a data set about a population.

Working with statistics and probability calculations are very valuable for production processes and manufacturing for example. There are some challenges when working to with

inclusive design however. Two of the challenge are the notion of the “average” and the notion of the “Normal” in Normal distribution. This may foster comparison of what is above or below the average, as well as what is not-normal or even ab-normal.

"Lies, Damn Lies and Statistics" is the name of episode 21 in the first season of NBC drama *The West Wing.* Many people have used this phrase before, what does it mean? One interpretation is that the use of statistics can be done in many different ways, also for misleading and even lying.

n=1 is another way of saying that each human or user of a system is unique. This is then a challenge when one system is to be developed for a population of n=3.800.000 users!. What are the challenges?

When modelled in statistical models, human traits (exercise, mood, shape, reasoning, navigation activites etc.) get measured and represented in numbers. Outcomes of this is very average, standard deviation - and outliers. How to work with this dilemma?

There is no “final solution” to be found here about inclusion and AI. However it is about critically asking questions during development of systems, and bringing in a variety of users!! Another way is to get to know, and work with boh the WCAG principles and the WAD actively. And of course to be enthusiastic about the users, diversity and not only the technologies in question.

TODO: Include this...
From Jutta: Start:
Since I first became aware of the potential threats of AI with respect to outliers, the issue has been amplified by the press and numerous public efforts have emerged. Cathy O’Neil’s book Weapons of Math Destruction (O'Neil, 2017) served to raise alarms globally. Sufiya Ujoma Noble(2018) and Virginia Eubanks (2018) powerfully framed the role of AI in amplifying and demonising poverty and automating racial bias. All three authors highlight the systemic vicious cycles of discrimination experienced by individuals sorted, filtered, and processed using machine intelligence.Increasing awareness of the threats posed were reflected in the

European Union privacy regulations in the form of the General Data Protection Regulation (enacted in 2016 and taking effect in 2018). The right to explanation pertains to algorithms that guide machine decisions. The Microsoft Inclusive Design team, once alerted to the issues by a variety of scholars, convened several meetings and design sessions that attempted to capture and communicate the types of bias that can occur with artificial intelligence. Five forms of bias in AI were identified: 1.dataset bias (similar to sampling bias), 2.associations bias, 3.automation bias, 4.interaction bias, and 5.confirmation bias (Chou et al., 2017).
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