Advanced Machine Learning For Design

Lecture 1 - Introduction to Machine Learning /1

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Why Machine Learning for Design?

Part I

“AI is the New Electricity”

“Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don’t think AI will transform in the next several years.”

Andrew Ng

Former chief scientist at Baidu, Co-founder at Coursera

Image	Description	Roles of AI
Put an image here to show the product service system that has the AI components	Describe what is the product service system	Describe the role of AI in the product service system

Image	Description	Roles of AI
	Siri helps the user being doing tasks hands free and answers back with generated speech	Siri is using natural language generation, natural language processing in order to process the speech of the user and generate speech to answer the questions or to complete the asked task

Image	Description	Roles of AI
descript	A podcast editor (platform/application) that allows you to clone your voice (text-to-speech) to edit your podcast by removing or adding words/sentences in your voice.	use ML to train a text-to-speech model based on one's individual voice

Image	Description	Roles of AI
Spotify	Spotify is a music platform in which users can search, listen and discover music from all over the world.	The AI plays a major role by processing data and user behavior on which kind of songs they like. According to their song preferences, Spotify constantly creates playlists according to the user's taste or it shows new music which would fit to their taste. Through this way the users are constantly discovering new music that fits perfectly to their music taste.

Image	Description	Roles of AI
	Fitness watches are playing a huge role in the workouts of users these days and are being used by more and more people.	The AI maily comes into play when showing daily routines, giving feedback on previous activities and providing training schedules based on all data received from the users body.

Image	Description	Roles of AI
OPENAI DALL·E OpenAI	DALL·E 2 is a new AI system that can create realistic images and art from a description in natural language.	DALL·E 2 has learned the relationship between images and the text used to describe them. It uses a process called "diffusion," which starts with a pattern of random dots and gradually alters that pattern towards an image when it recognizes specific aspects of that image.

Image	Description	Roles of AI
komoot	An app that helps creating routes for activities like walking and cycling. One of the features is that users can add pictures of the trails.	AI is used to check if the pictures if they fit to the createria. For example it checks if people are in the picture.

Image	Description	Roles of AI
	Single / multiplayer game	You can play against characters that aren't controlled by a human. AI or ML probably controls their movement and fighting behaviour.

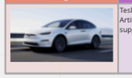
Image	Description	Roles of AI
	Tesla cars make use of Artificial intelligence to support the driver	The cars have sensors that are constantly taking note of everything going on around the car and using AI to make the correct adjustments. These sensors capture thousands of data points every millisecond (like car speed, road conditions, pedestrian, whereabouts, other traffic, etc.), and use AI to help interpret the data and act accordingly

Image	Description	Roles of AI
	Instagram is an American photo and video sharing social networking service	Instagram utilizes the power of Facebook's AI algorithm DeepText, a Deep Learning (DL) based text understanding engine, to provide users with a spam-free experience. DeepText can also extract sentiments and intentions behind the text to differentiate between comments generated by bots and users' comments. It goes through several thousand comments and pieces of text every second. This AI technology automates the removal of spam comments. It helps a lot of influencers and public figures avoid objectionable comments when starting public conversations in Live Rooms as well.

Image	Description	Roles of AI
	Corti, an algorithm to help detect heart attacks in emergency calls. Having started as an algorithm, it is now being embodied in a physical device to ensure privacy. Corti is able to detect a heart attack on average 30 seconds quicker than the nurse.	Corti supports nurses taking the call by informing them when it detects a possible heart attack and help the nurse triangulate while the ambulance is on the way.

Image	Description	Roles of AI
stability.ai	Almost anything that one can think of in words, this tool can put together as an image. An almost perfect "photoshop-guy" so to speak.	The algorithm interprets natural language and generates visual interpretations of it. This includes creating images in specific art styles, landscapes, creatures etc. (almost anything one can think of)

Image	Description	Roles of AI
Google	"When was the last time you opened the second page of google?" The Google Search engine is a formidable service that enables online information finding.	Machine learning is employed to adapt the results of the search to the person looking for information, aka personalisation.

Image	Description	Roles of AI
SHAZAM	Shazam helps its users by identifying music around them (on the radio, at a club, in movies etc.) using their device's microphone.	Shazam uses AI to hear and identify songs in a few seconds. It takes the 'digital fingerprint' (sample) of any song and matches it with its library.

Image	Description	Roles of AI
	Google nest is a smart thermostat that automatically adapts to the preffernces of your home.	Artificial Intelligence is used to recognize behavioral patterns of the residents and thermal properties of the home. Based of many external factors such as local weather and user behaviour the thermostat can adapt user friendly and energy saving heating strategies.

Image	Description	Roles of AI
	Gmail services us AI to identify spam and filter it out, to classify emails into categories such as Primary, Promotions, Social, or labels them as important and to suggest smart replies with simple phrases to respond to emails like "Thank You", "Alright", "Yes, I'm interested".	

Image	Description	Roles of AI
grammarly	Grammerly is a browser/website that corrects and helps improve a persons writing. It can check for spelling and grammatical errors as well as suggest improvements for sentence structure and clarity.	Supporting the writer to write clearly and correctly (according to their input/goals). It is probably a combination of text-based algorithms that knows how to write "correctly", but it also adapts based on the users feedback and use of the program to fit the individual writer.

Image	Description	Roles of AI
NVIDIA DEVELOPER NVIDIA Instant NeRF	It is like a 3D scanner. This tool/service allows users to create 3D scenes from 2D images. For example: 2D pictures of an apartment will be put together into a 3D room. What is stunning about this, is that it needs barely any input to create its 3D scenes.	(roughly!) The algorithm learns the geometry of the 2D images. For that it creates a 3D object then takes a 2D photo of that object and checks how close this is to the original 2D image (user photo). Then it adjusts the 3D model and repeats the comparison. This goes on until the 3D object and 2D photo of that object match the original picture.

Image	Description	Roles of AI
	Siri is a virtual assistant for IOS devices which can answer certain questions or perform certain tasks.	Siri makes use of Natural Language Processing (NLP) which is a branch of Ai. Siri can predict your intention by using certain key words in your task request.

Image	Description	Roles of AI
Belastingdienst	It is not really a product service system. But the Dutch tax office is responsible to levy and collect taxes in the Netherlands.	The Dutch tax office uses AI to detect possible fraudulent tax declarations of companies and people in order to more efficiently check them. (however this goes wrong sometimes...)

Image	Description	Roles of AI
	Cars are used to get from A to B.	-Detect objects/persons -Parking itself -Driving autonomous -Detects driver attention -Get to knows the road when driving

Image	Description	Roles of AI
PICNIC	A supermarket without physical stores.	• The variety of products is defined by the consumers themselves. The system learns what products costumers want and offers this to them. • Optimal travel routes are calculated using ML

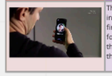
Image	Description	Roles of AI
	The face recognition system introduced by Apple replaces fingerprints or passwords for security management through the recognition of the user's facial features.	AI plays a role in analyzing and storing the user's facial features and discerning whether the user matches those features during subsequent use.

Image	Description	Roles of AI
	Netflix is a streaming service, allowing users to stream a wide variety of series, movies, anime etc.	• Netflix uses AI to give users recommendations on what shows to watch • Netflix also uses AI to determine what visuals are more attractive to users

Image	Description	Roles of AI
aws	AWS Transcribe allows the user to upload voice recordings or conversations and return a transcribe of the conversation in form of text. Similar alternatives are google transcribe, REV and IBM Watson.	AWS learns to recognize words from language from a large database of recorded and transcribed conversations. Then, it applies said learnt knowledge into a new audio.

Image	Description	Roles of AI
	WHOOP monitors your sleep, recovery, and daily effort around the clock to deliver actionable insights on how you can optimize your performance.	Based on your heartrate, skin temperature and sleep cycle Whoop calculates your recovery and gives you advice on your training in order to maximize your performance.

Image	Description	Roles of AI
Ford	Ford is a automobile/transportation company. The Company designs, manufactures, markets, and services a full line of electrified passenger and commercial vehicles, such as Ford trucks, utility vehicles, vans, and cars, and Lincoln luxury vehicles.	• Ford uses AI to boost their assembly lines • to detect quality of the finished cars at the factory before delivery • for self driving cars

Image	Description	Roles of AI
	Wordtune is an AI-powered writing companion that understands what you're trying to say, and suggests ways to make your writing more clear, compelling and authentic.	Wordtune uses AI that learns from the written literature. It is understands context and semantics. It can suggest rewrites with a control over length and tone of the sentence. It allows user to pick the suggested rewrite and learns from their contextual use too. It also learns from personal preferences of the users.

Image	Description	Roles of AI
Ps	Adobe Photoshop is a raster graphics editor developed and marketed by Adobe Inc. The program has become the industry standard not only for raster graphics editing, but also for digital art in general.	Content Aware Fill Select Sky Select Subject

Image	Description	Roles of AI
	Crop detection from imagery. This can include crop counting & crop monitoring.	• Identifying the crop • Size detection • Disease detection

Image	Description	Roles of AI
	TikTok is a short-form, video-sharing app that allows users to create and share 15-second videos, on any topic.	AI in tiktok serves content for your feed (type of movies that you like, advertisements)

Image	Description	Roles of AI
	When you take a picture on your phone it is nowadays often 'enhanced' by AI. It can change the colour, choose the best frame, choose the best depth of field, and even send your picture to a shop to get it printed out.	AI plays a role by analyzing the different components in the picture, from your face to the sky. By detecting these components the AI is able to change the features and make it a 'better looking' picture.

Image	Description	Roles of AI
	Add various effects to videos/photos etc. posted on instagram by users.	AI plays a role in analyzing and storing the people's facial features or other features, then it would add effects.

Image	Description	Roles of AI
	A Tesla car tries to detect cars and signs around the vehicle and classify its type. What it can and what it cannot detect is displayed on its navigation screen	The data of surrounding cars and signs is collected and exchanged with the company in order to iterate on its detection system and consequently make the car safer and potentially enable self driving cars

Image	Description	Roles of AI
	these cars with cameras are used for detecting cars and their numberplate, in order to check if they have paid.	Image recognition algorithm

Image	Description	Roles of AI
Google Maps	Number plate recognition. To blur it out before showing it to the user	• Recognizing different types of number plates and their positions in the image

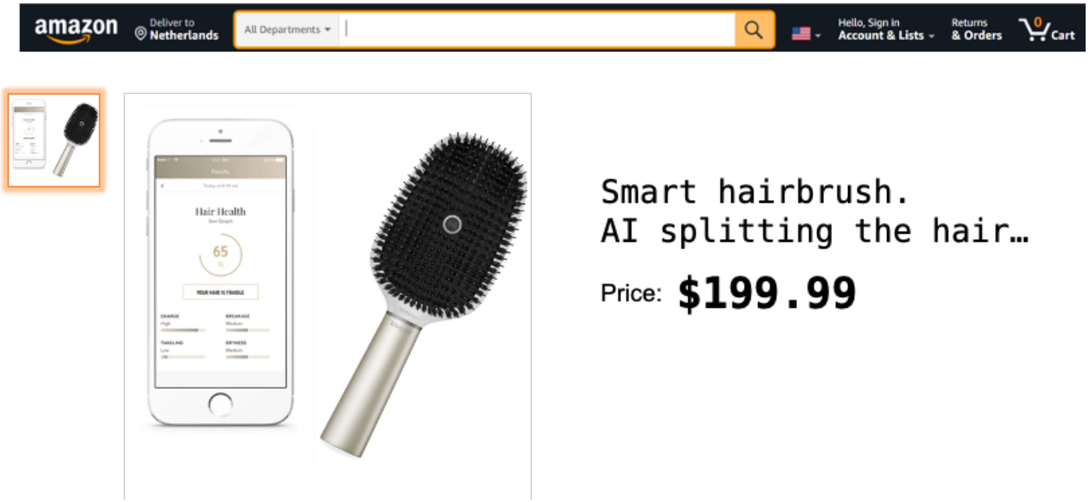
Image	Description	Roles of AI
Qinsle	1:1 online English lessons for non-English native speakers with top university students & graduates The service is specialized in high quality of contents, detailed feedback and analytical reports by AI after the lesson	The AI evaluates students' English level based on complexity, accuracy, and fluency in sentences. It also visually reports frequent mistakes or repetitive words used in the conversations. Recently, the AI has also been developed to evaluate students' intonation and pronunciation compared to tutors' so that it provides students with self-study materials.

Image	Description	Roles of AI
	Self-driving cars uses AI along with different sensors, radars, and camera to travel to destination without a human driver.	AI not only recognises surrounding objects/people, but also makes decision on its interactions with them. (e.g. slowing down when kids are nearby)

Falko Baatsen

Where is AI? Or ML?

- Autonomous vehicles
  - from Roomba to Self-driving cars
  - In stores, warehouses, production lines, streets, living rooms
- More and more consumer products and appliances
  - Belts!! Really!
  - Thermostats, Security Cameras, Fridges
- Content production and consumption applications
  - Social media, Amazon, Netflix etc.
- Chatbots
- In-store automation and smarter shopping
- Optimised supply chains
- Energy grid optimisation
- …



More than just a fashion accessory, Belty Good Vibes is the very first smart belt integrating Artificial Intelligence that contextualizes the activities of your everyday life.

Beyond data

Rather than providing only raw data, Belty offers feedback about the rhythm of your life. It goes beyond statistics and helps you to be more aware of the quality of your everyday experience.

Trust your gut

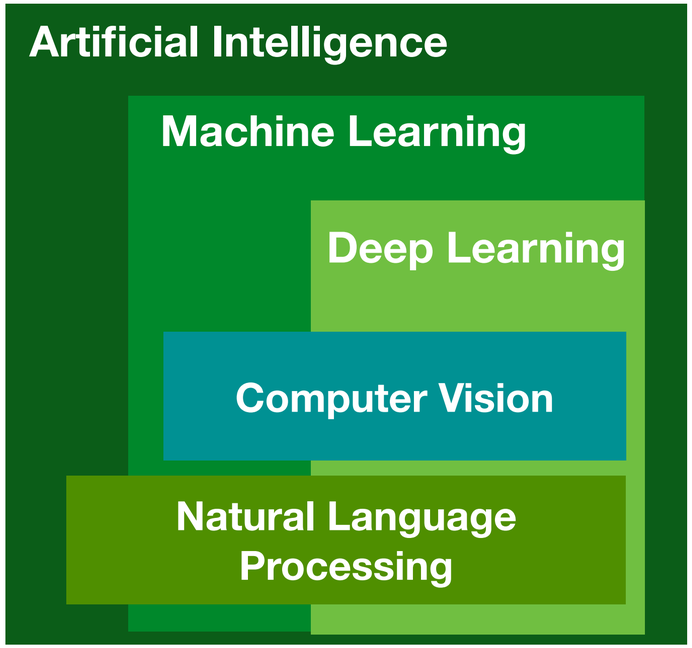
The abdomen, or belly, is considered the second brain of your body: the home of your gut instinct. Belty Good Vibes empowers you to know yourself better, by reinforcing your ability to connect to your visceral knowledge. Communicating via vibrations with your sense of touch, it plugs you into the present moment.

Good vibrations, great energy

Belty is much more than a smart belt; as wearable, interactive technology, it is your personal coach. We all want to live the best version of our lives. Why not start now?

What is

Artificial Intelligence
Machine Learning?
Deep Learning?
Computer Vision?
Natural Language Processing?



Intelligence

- *The ability to learn or understand or to deal with new or trying situations*
- *The ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria (such as tests)*

Merrian-Webster

- *Mental quality that consists of the abilities to learn from experience, adapt to new situations, understand and handle abstract concepts, and use knowledge to manipulate one's environment*

Encyclopedia Britannica

"Viewed narrowly, there seem to be almost as many definitions of intelligence as there were experts asked to define it"

R. J. Sternberg, quoted in *The Oxford Companion to the Mind*. R. L. Gregory. Oxford University Press, Oxford, UK, 1998

But if you really want an exhaustive collection of 71 definitions, look no further https://arxiv.org/pdf/0706.3639.pdf

Artificial Intelligence

- Intelligence demonstrated by machines
- A branch of computer science that **studies** the properties of intelligence by **synthesizing** intelligence
- Creating computer programs that perform tasks as well as, or better than, humans
  - Perception, Learning, Reasoning, Planning, Problem-solving, Creating

Strong vs. Weak Artificial Intelligence

- **Strong AI**
  - *Artificial General Intelligence* (AGI), human-level, general
  - The AI we see in movies
  - AI that can do everything we humans can do, and possibly much more

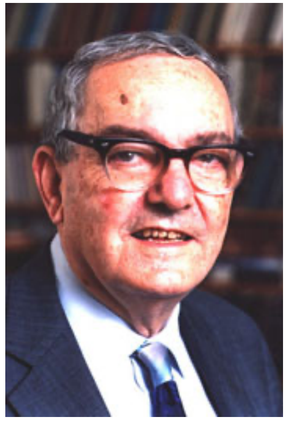
- **Weak AI**
  - *Narrow* AI
  - AI specialised in well-defined tasks
    - e.g. speech recognition, chess-playing, autonomous driving

- No AI program has been created yet that could be called intelligent in any general (Strong AI) sense
  - *"A pile of narrow intelligence will never add up to a general intelligence. General intelligence isn't about the number of abilities, but about the integration between those abilities?*

- *Superintelligence* doesn't really mean anything - a basic calculator far exceeds any human benchmark for performing basic arithmetic

Learning

- *Any process by which a system improves performance from experience*
- Denotes changes in the system that are adaptive in the sense that they enable the system to do the task or **tasks drawn from the same population** more efficiently and more effectively the next time
- The ability to perform a task in a situation that has never been encountered before
- **Learning = generalisation**

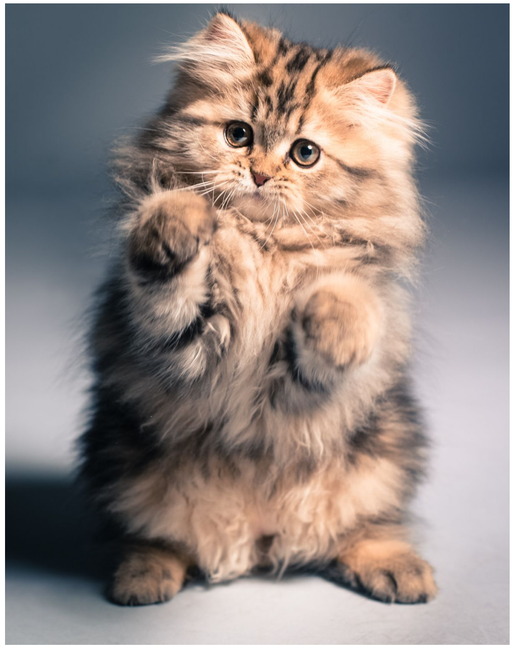


Herbert A. Simon

What is a cat?

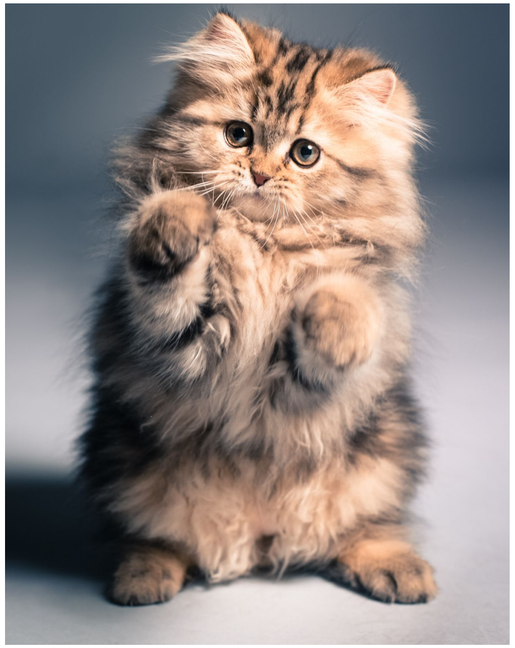
Credits: Jonah Burlingame

What is a cat?



Credits: Jonah Burlingame

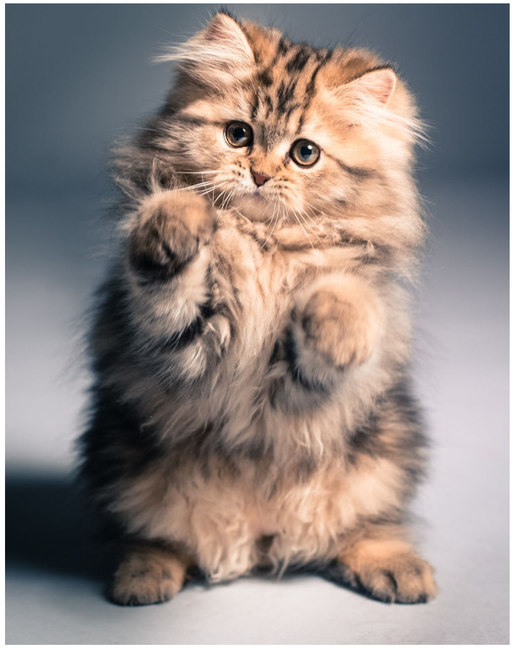
What is a cat? V_1



- It’s a cat if it has whiskers
- And it is furry

Credits: Jonah Burlingame

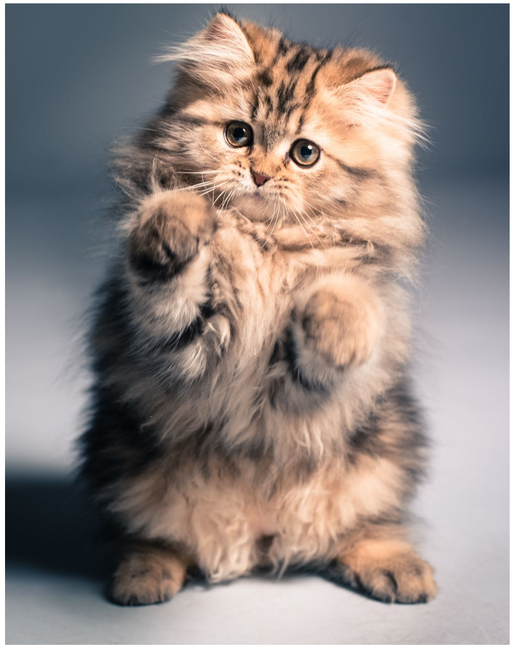
What is a cat?



- It’s a cat if it has whiskers
- And it is furry

Credits: Jonah Burlingame

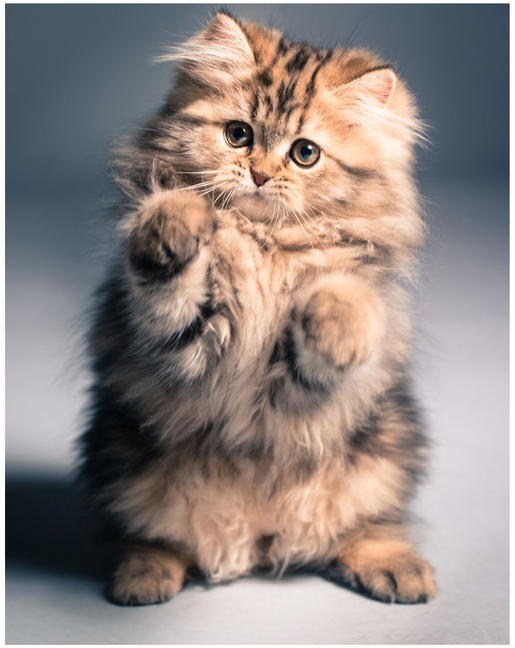
What is a cat? V_2



- It’s a cat if it has whiskers
- And it is furry
- And it is small

Credits: Jonah Burlingame

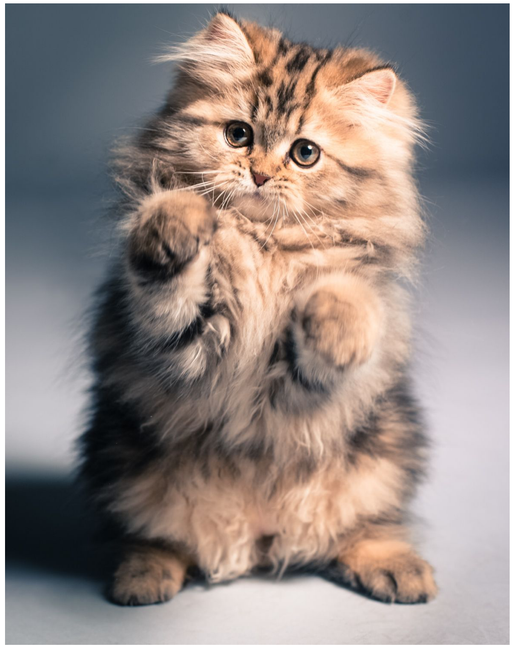
What is a cat?



- It’s a cat if it has whiskers
- And it is furry
- And it is small

Credits: Jonah Burlingame

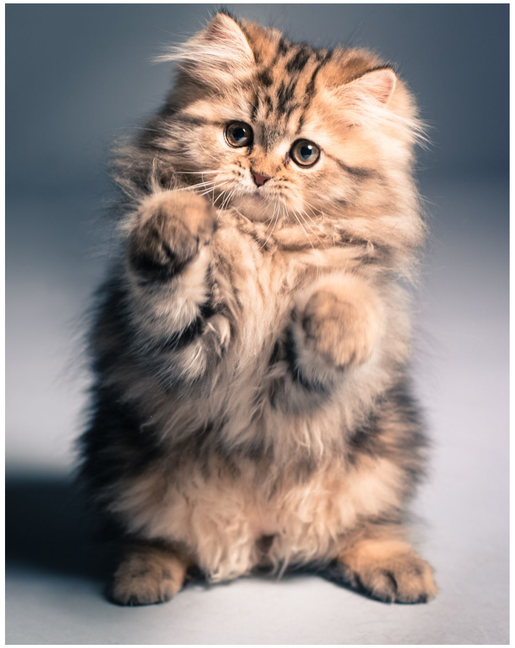
What is a cat? V_3



- It’s a cat if it has whiskers
- And it is furry
- And it is small
- And it does not climb trees

Credits: Jonah Burlingame

What is a cat?



- It’s a cat if it has whiskers
- And it is furry
- And it is small
- And it does not climb trees

Credits: Jonah Burlingame

Polanyi's Paradox

"We can know more than we can tell...

The skill of a driver cannot be replaced by a thorough schooling in the theory of the motorcar"

Michael Polanyi (1966)

Machine Learning

- *The field of study that gives computers the ability to learn **without being explicitly programmed***

Arthur Samuel

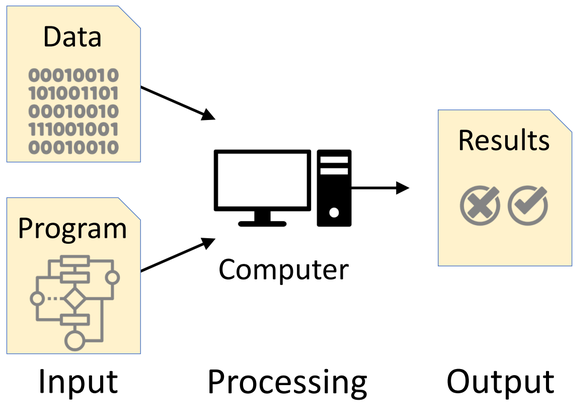
- Machine learning is the science (and art) of programming computers **so they can learn from data**

Is this a cat?

- **Traditional Programming**

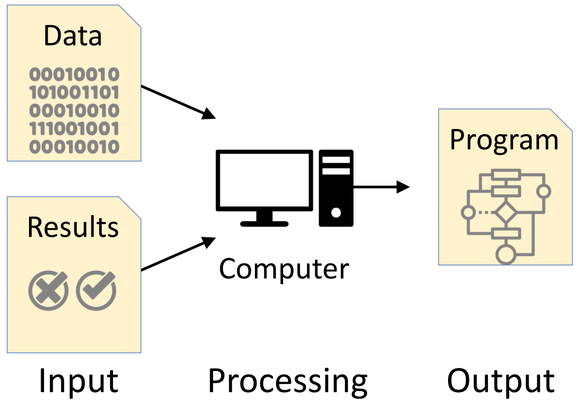
Rules to detect a cat:

1. **It has whiskers**
2. **It is furry**
3. **It is small**



- **Machine Learning**

Let me guess how I can distinguish a cat :)



Functions of a Machine Learning System

Descriptive

Using data to explain what happened

Predictive

Using data to predict what will happen

Prescriptive

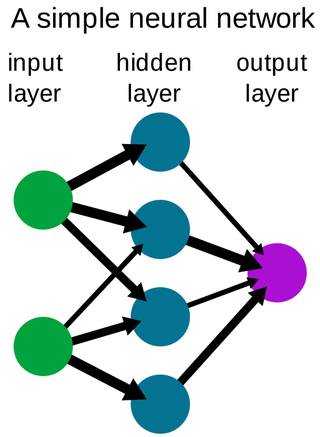
Using data to make suggestions about what actions to take

Generative

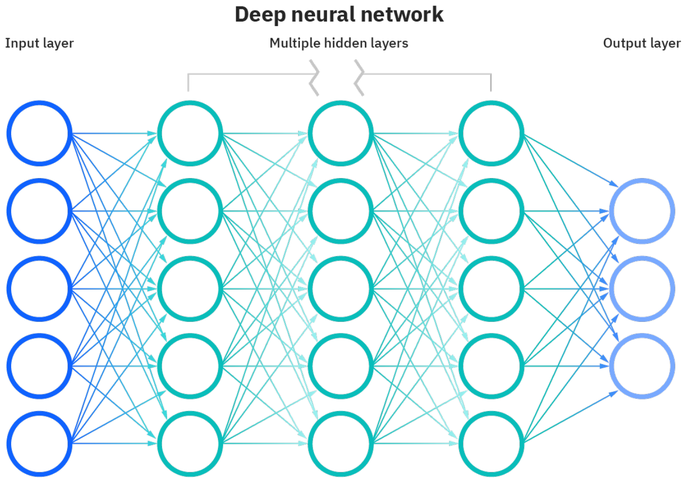
Using data to (semi) autonomously create new content

Deep Learning

- A technique for implementing Machine Learning based on neural networks



- **Neural Networks**
  - A specific class of machine learning algorithms, modelled on the human brain, in which thousands or millions of processing nodes are interconnected and organized into layers
- **Deep Learning**
  - Neural networks with many layers
    - Depth = number of layers

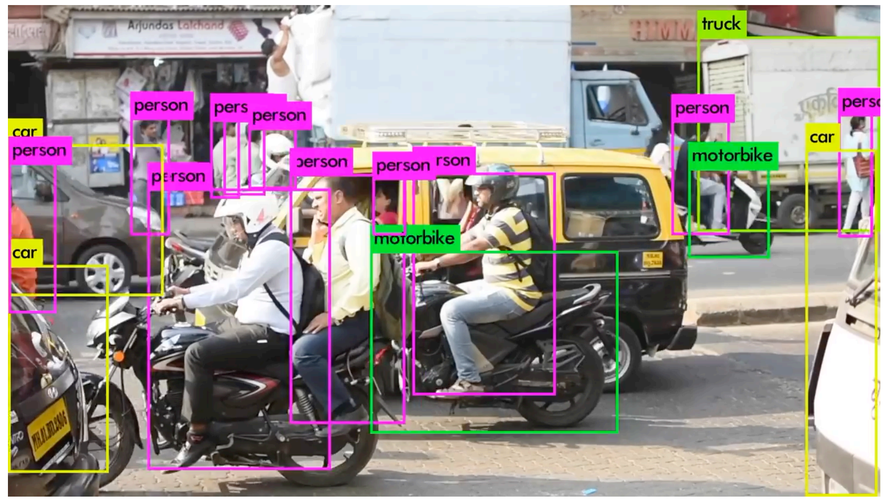


Natural Language Processing

- A sub-field of AI and machine learning in which machines learn to understand natural language as spoken and written by humans
- Goals:
  - Recognize the language, understand it, and respond to it
  - Categorise textual content (e.g. spam vs. Not-spam)
  - Translate between languages
  - Generate new text
- An enabler for technology such as chatbots and digital assistants like Siri or Alexa

Computer Vision

- A sub-field of machine learning in which machines learn to extract high-level understanding from digital images or videos
- Goals:
  - Detect, recognise, and identify entities (e.g. objects, faces, people, animals)
  - Modify visual content (e.g. image manipulation, image restoration)
  - Categorise visual content (e.g. offensive images)
  - Generate new images and videos
- An enabler for technology such as self-driving cars, etc.



“Easy problems are hard”

Marvin Minsky

Why Machine Learning for Design?

Part II

“AI is the New Electricity”

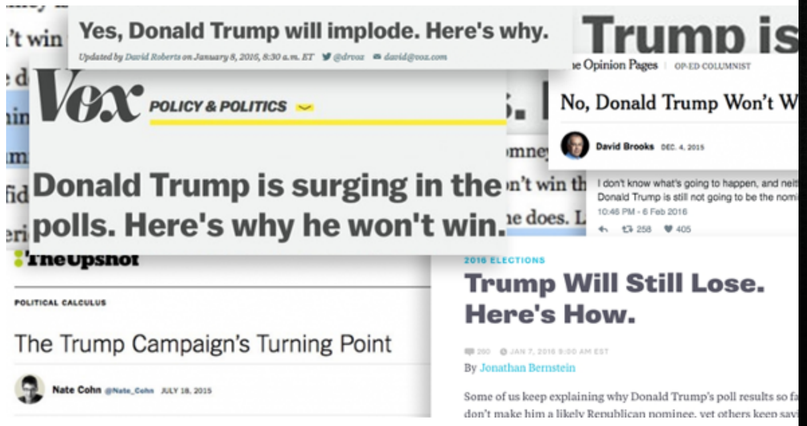
“Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don’t think AI will transform in the next several years.”

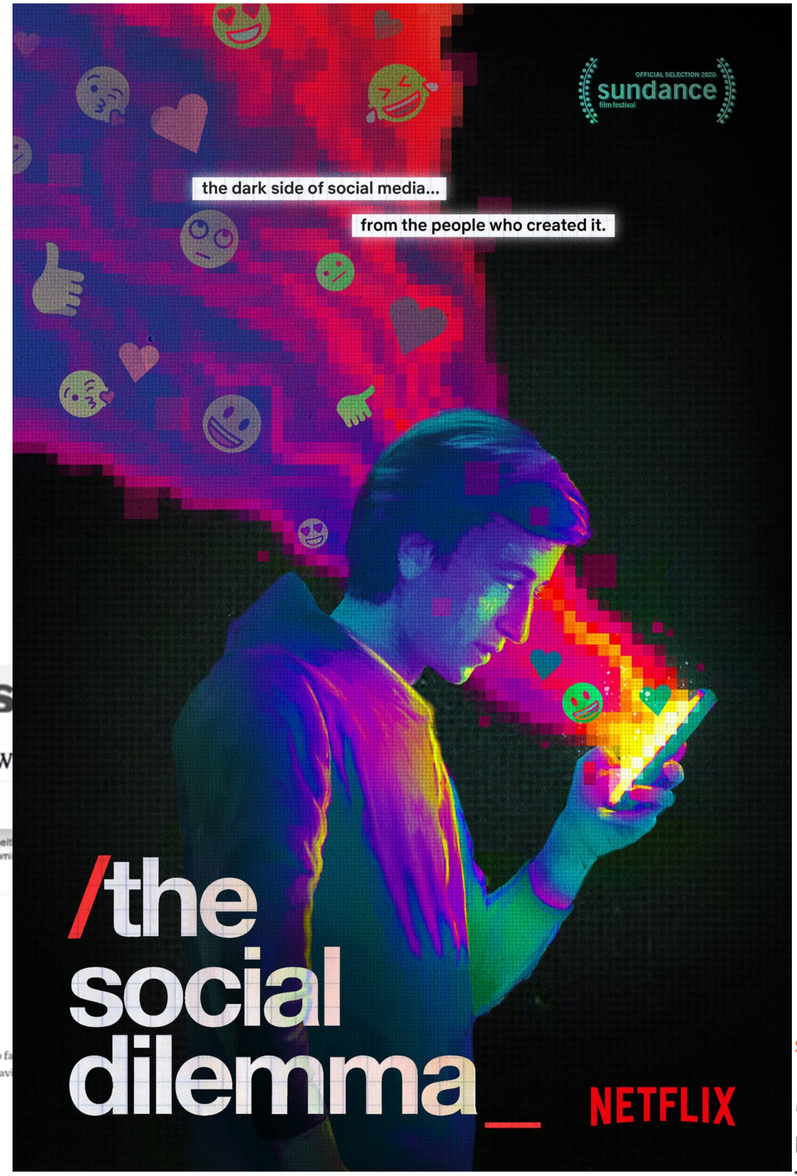
Andrew Ng

Former chief scientist at Baidu, Co-founder at Coursera

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it

Mark Weiser, *The Computer for the Twenty-First Century*
(Scientific American, 1991, pp. 66–75)



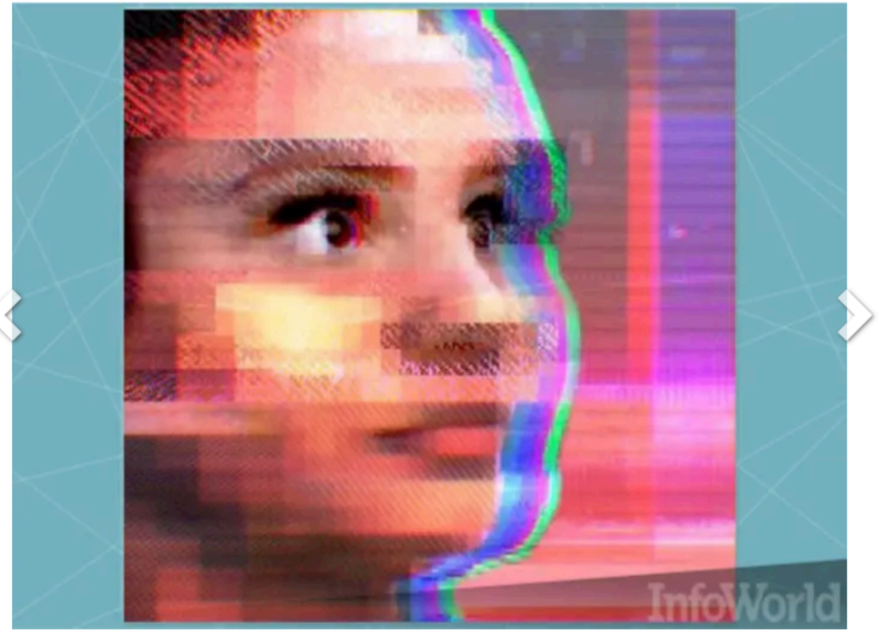


RETAIL OCTOBER 11, 2018 / 1:04 AM / UPDATED 3 YEARS AGO

Amazon scraps secret AI recruiting tool that showed bias against women

By Jeffrey Dastin 8 MIN READ

SAN FRANCISCO (Reuters) - Amazon.com Inc's AMZN.O machine-learning specialists uncovered a big problem: their new recruiting engine did not like women.



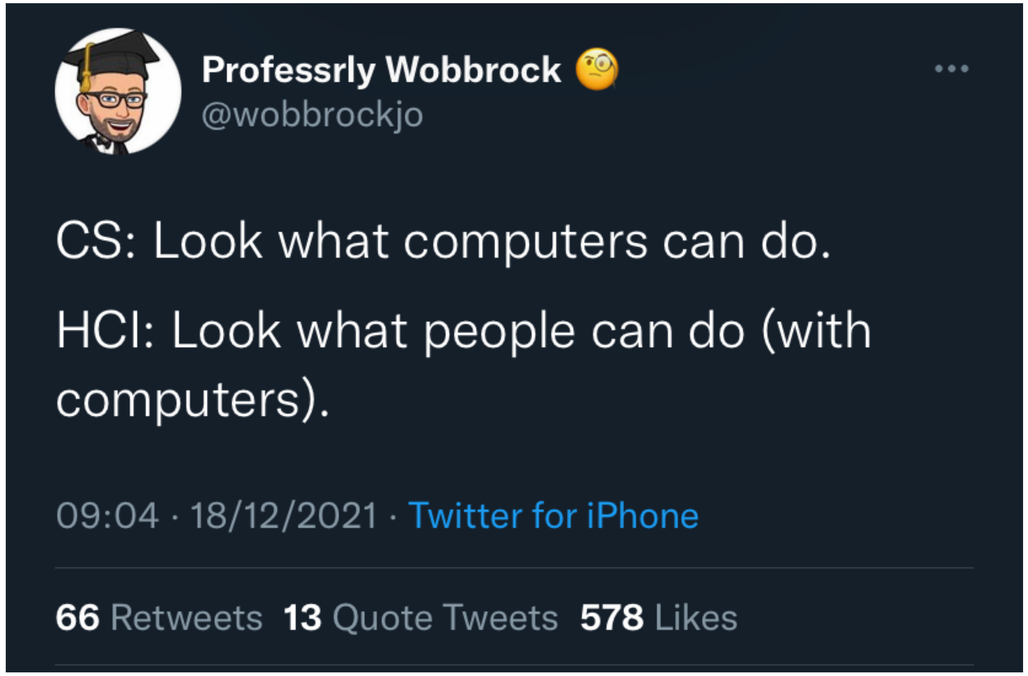
See larger image Microsoft / Twitter

Microsoft chatbot goes Nazi on Twitter

Back in the spring of 2016, Microsoft ran into a public relations nightmare when its Twitter chatbot -- an experimental AI persona named Tay -- wandered radically off-message and began spouting abusive epithets and even Nazi sentiments. "Hitler was right," tweeted the scary chatbot. Also: "9/11 was an inside job."

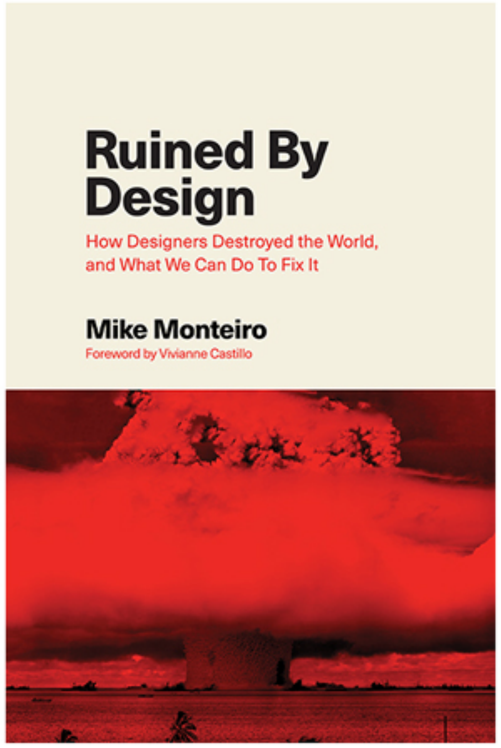
Why do we need Designers to understand ML?

- Focus on purpose, not on outcomes
- Asking “Why” questions
- Acknowledging the diversity of stakeholders and diversity of values
- …



What can designers do for ML?

- Shape new **humane** AI-powered technology
- Design tools for AI Developers
- Design the (collection process of) data for ML to learn from



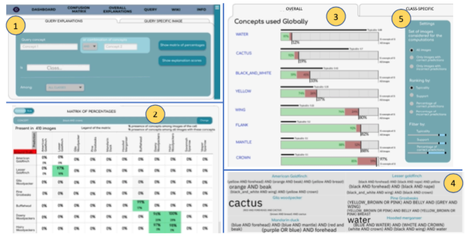


Fig. 1. Query tab (left) and overall explanations tab (right). When querying (1) explanations, results are displayed underneath (2). The overall explanations tab shows both relevant (combinations of) concepts (3) and their association to each dataset class (4), and allows for varying the parameters to compute them (5).

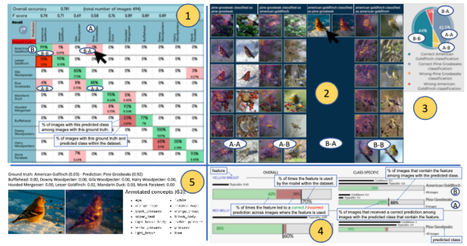
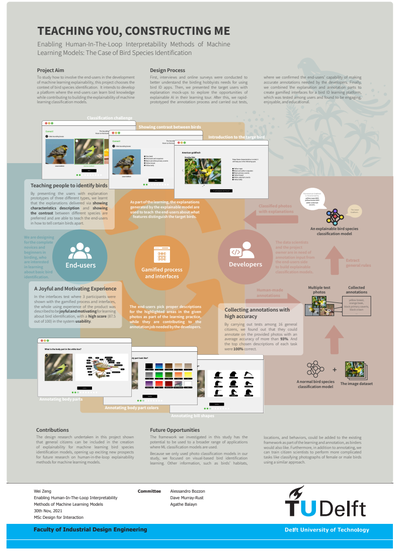
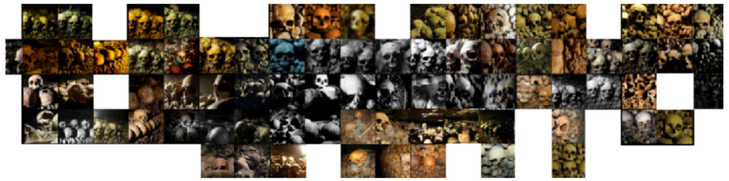


Fig. 2. Confusion matrix interactions. Our probe allows for different interactions with the explanations. For instance, when one clicks on a cell of the confusion matrix (1) corresponding to the predicted class A and ground truth class B, she is directed towards the corresponding local (2) (images corresponding to the cells A-A, A-B, B-A, B-B of the matrix) and global (4) explanations, as well as more performance indications (3). Clicking on a local, visual explanation displays further local, textual explanations (5).

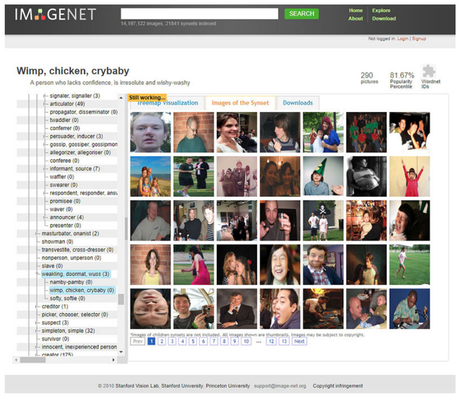




Excavating AI

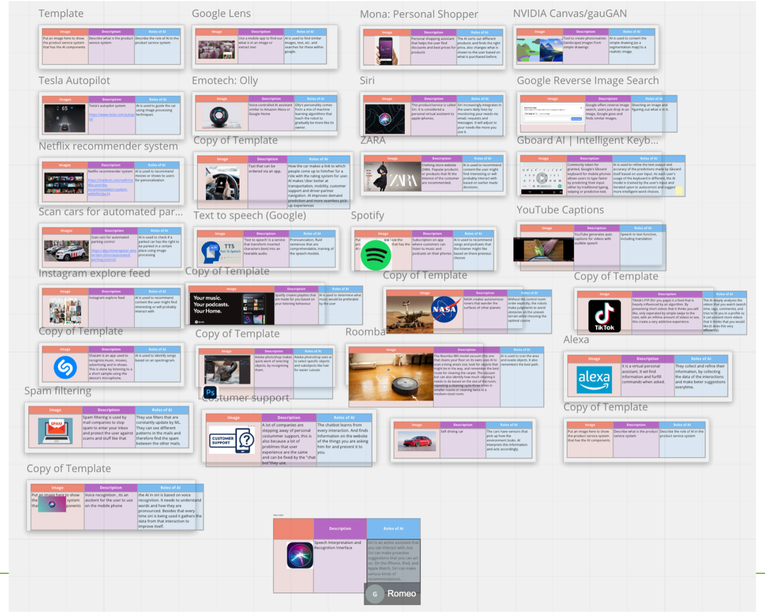
The Politics of Images in Machine Learning Training Sets

By Kate Crawford and Trevor Paglen



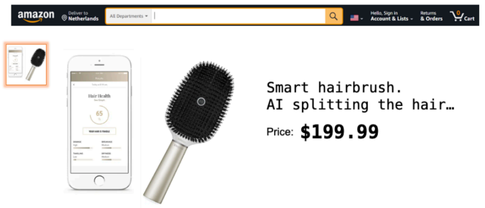
http://resolver.tudelft.nl/uuid:dabbfb49-4fbf-4ead-ab3d-e535572de4e7

What can designers do with ML? /1



Where is AI? Or ML?

- Autonomous vehicles
  - from Roomba to Self-driving cars
  - In stores, warehouses, production lines, streets, living rooms
- More and more consumer products and appliances
  - Belts!! Really!
  - Thermostats, Security Cameras, Fridges
- Content production and consumption applications
  - Social media, Amazon, Netflix etc.
- Chatbots
- In-store automation and smarter shopping
- Optimised supply chains
- Energy grid optimisation
- …



More than just a fashion accessory, Belty Good Vibes is the very first smart belt integrating Artificial Intelligence that contextualizes the activities of your everyday life.

Beyond data

Rather than providing only raw data, Belty offers feedback about the rhythm of your life. It goes beyond statistics and helps you to be more aware of the quality of your everyday experience.

Trust your gut

The abdomen, or belly, is considered the second brain of your body: the home of your gut instinct. Belty Good Vibes empowers you to know yourself better, by reinforcing your ability to connect to your visceral knowledge. Communicating via vibrations with your sense of touch, it plugs you into the present moment.

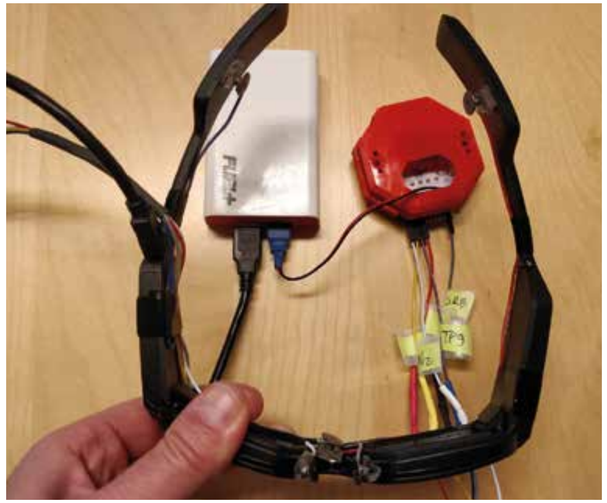
Good vibrations, great energy

Belty is much more than a smart belt; as wearable, interactive technology, it is your personal coach. We all want to live the best version of our lives. Why not start now?

What can designers do with ML? /2

ML for Human Augmentation

Memory augmentation



Dr. Evangelos Niforatos
https://kind.io.tudelft.nl

Sight augmentation

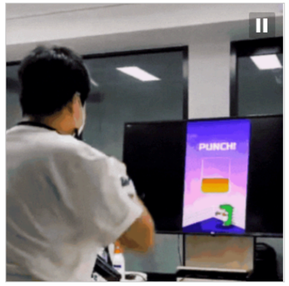
Envision Glasses
https://www.letsenvision.com/

ML for Fascination and Engagement

Climate Change

Frederik Ueberschär
https://www.tudelft.nl/en/stories/articles/landshapes-made-to-feel-real

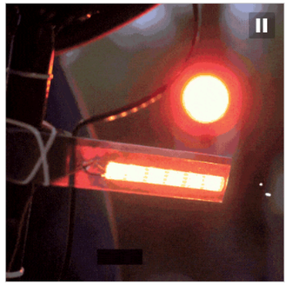
What can designers do with ML? /3



MOVE!

by Eunji Lee, Jueun Choi, Yeonhee Kim, Jonghyun Baek, Yongjae Kim

Stay active, using movement to control a variety of games.



VOICE TURN

by Alvaro Gonzalez-Vila

A safer way for cyclists to signal using their voice.

SQUATS COUNTER

by Manas Pange

Focus on your form, while this tracker counts your squats.

COLD FLUX

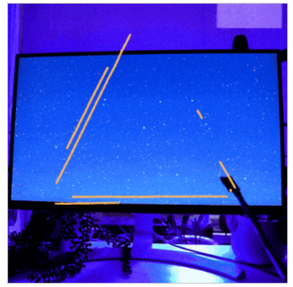
by Ben Cullen Williams & Bryce Cronkite-Ratcliff

Cold Flux highlights the peril of our global icecaps, while questioning if the melt is...

MORNING MOUNTAIN: VISUAL ALARM CLOCK

by Google Creative Lab

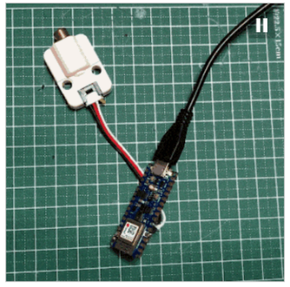
Get up in the morning by striking a pose to stop your alarm from ringing.



ASTROWAND

by Google Creative Lab

Draw shapes in the sky to form constellations.



SNORING GUARDIAN

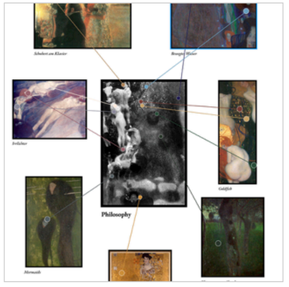
by Naveen Kumar

A snore-no-more device embedded in your pillow.

THE MO AMIN ARCHIVE

by Simon Doury, Nicolas Barradeau, Gael Hugo, Artists in Residence at Google Arts & Culture Lab

Explore a visual chronicle of frontline photojournalist Mo Amin's archive with the help of...



THE KLIMT COLOR ENIGMA

by Emil Wallner, Romain Cazier, artists in residence at Google Arts & Culture Lab

Colorizing Klimt's Vanished Paintings with Artificial Intelligence and Klimt Experts

AIR SNARE

by Google Creative Lab

Play an invisible drum kit.

FINGER USER INTERFACE

by Google Creative Lab

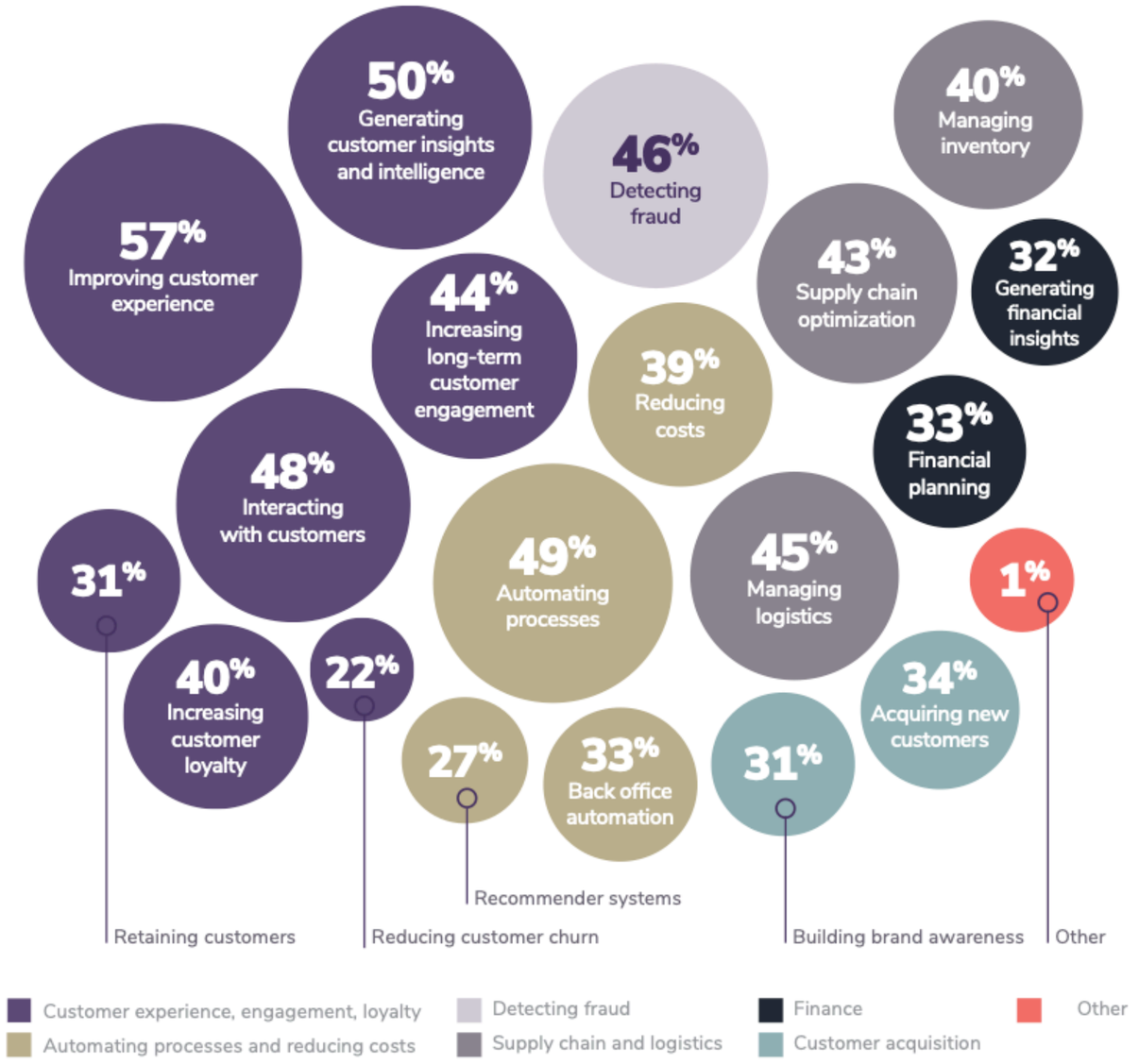
Control your devices with the wave of a finger.

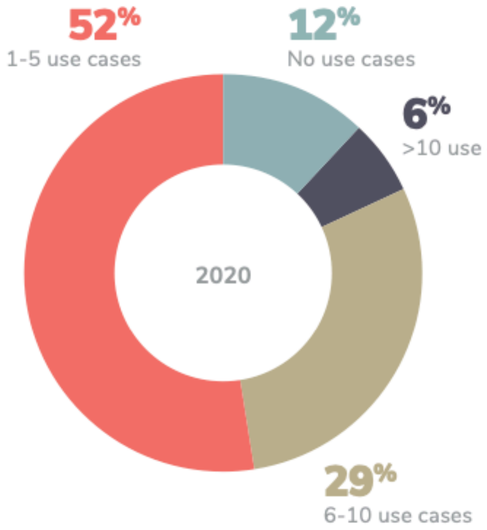
TINY MOTION TRAINER

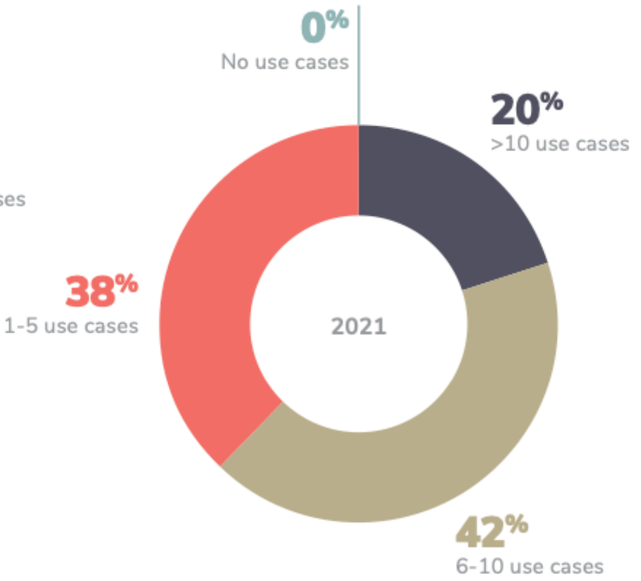
by Google Creative Lab

A code-free tool that lets you create custom, microcontroller-ready models based on IMU data.

https://experiments.withgoogle.com/experiments

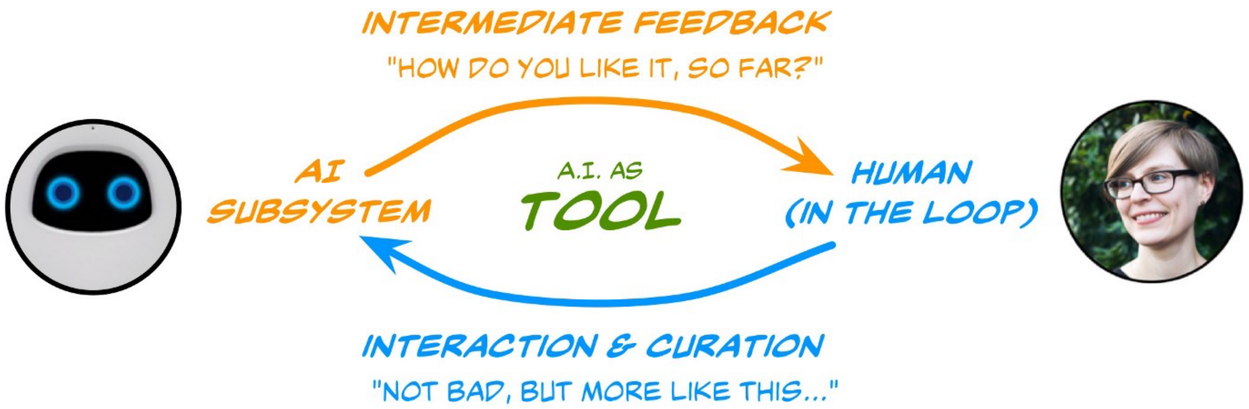


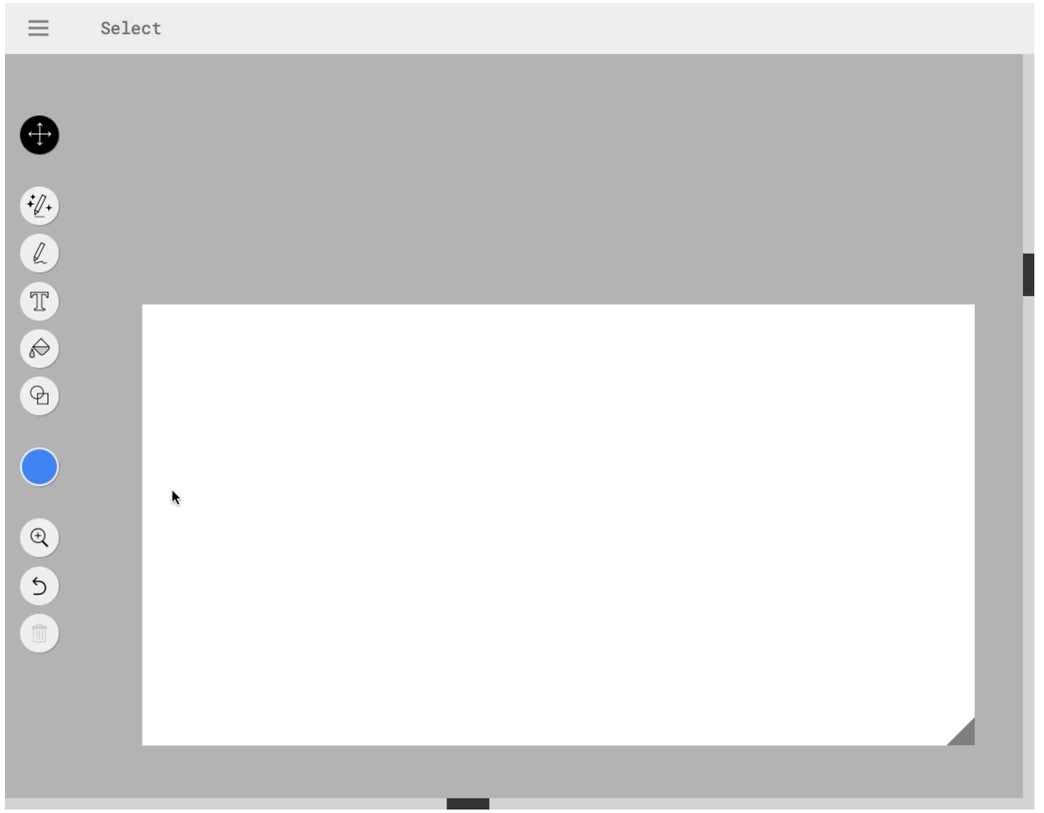




2021 enterprise trends in machine learning (Algorithmia, 2021)

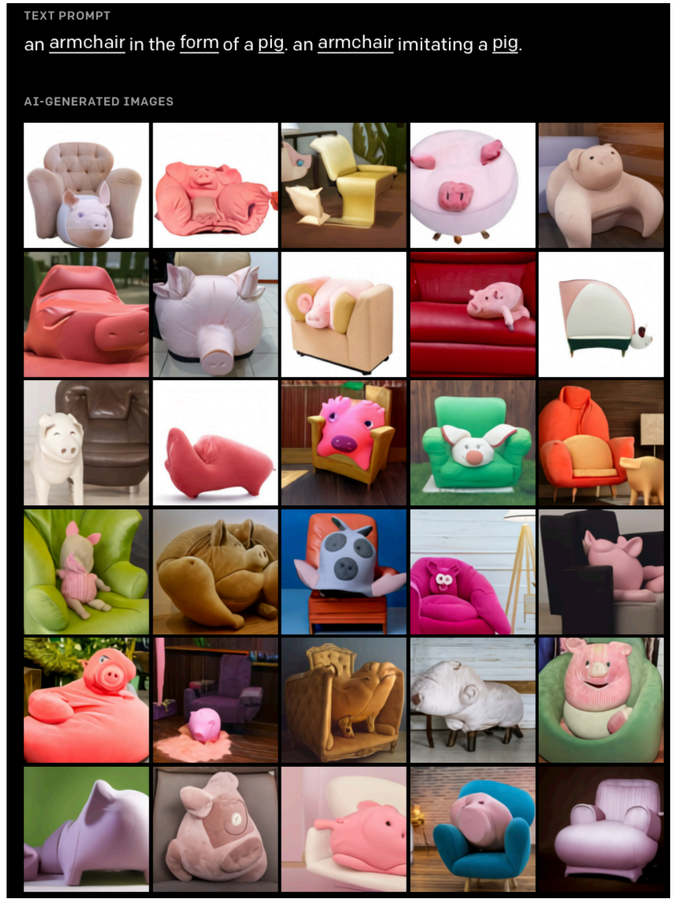
What can ML do for designers? / Co-create

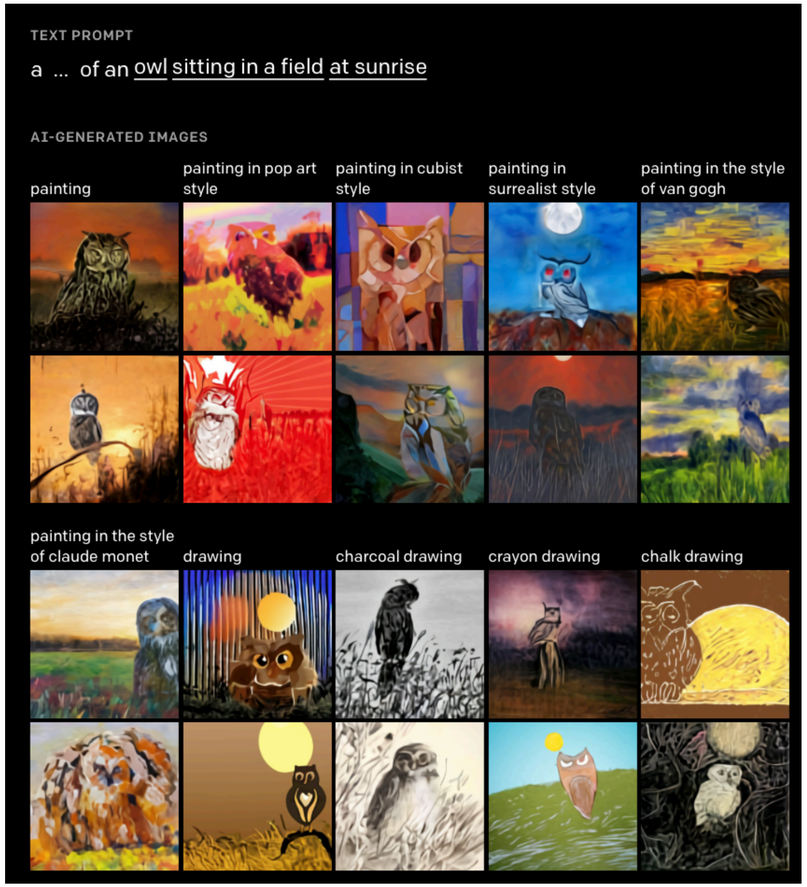




https://www.autodraw.com

What can ML do for designers? / Inspire





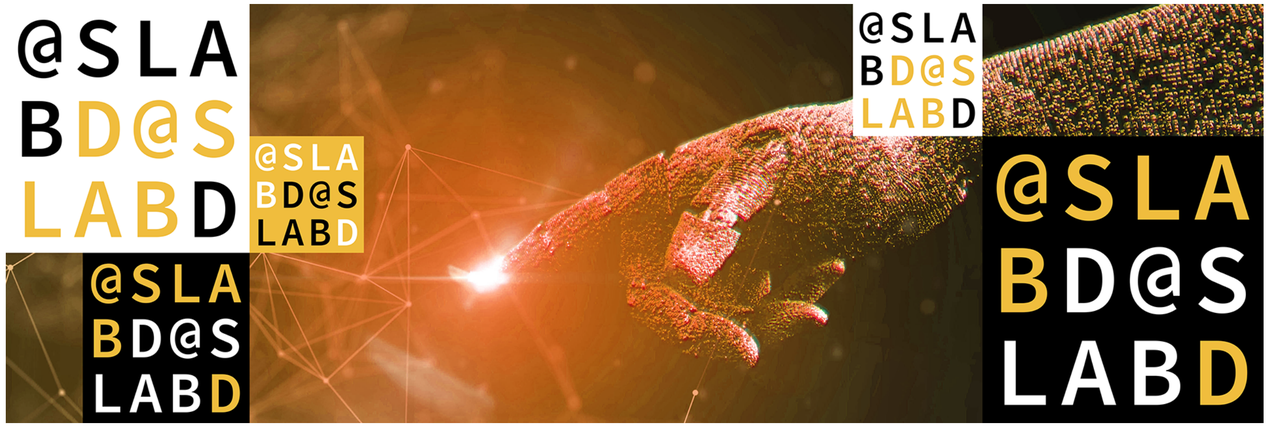
https://openai.com/blog/dall-e/

What can ML do for designers? / Scale up!

http://resolver.tudelft.nl/uuid:fd895415-c353-41d5-8430-f0a67fd40ad4

- Analysis of how parents perceive their baby, their behaviours towards their child, and thus understand how does overprotection develops throughout childhood
- >300 stories, manually and NLP analysis

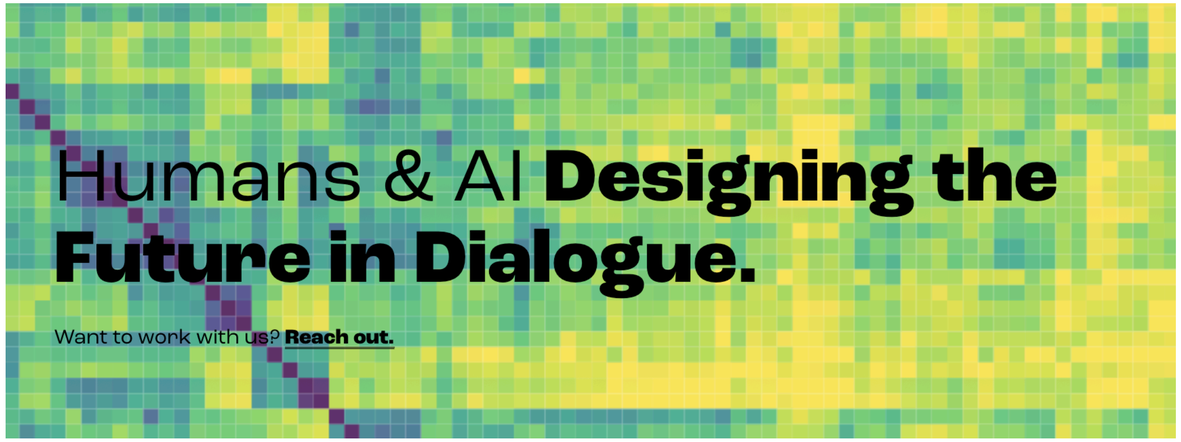
https://www.tudelft.nl/ai/design-at-scale-lab



- Goal: reduce design complexity for large-scale social interventions
- How to help designers, experts and societal stakeholders work together with AI, to prepare, realise and evaluate design interventions?

What can ML do for designers? / Understand

- https://www.di-lab.space



- Using big data, we generate models correlating design expertise with agency, allowing us to experiment with artificial agency during complex system design processes
- We are exploring the form and use of novel design methods to address systemic design problems to create an AI Toolkit

Proceedings of the ASME 2021 International Design Engineering Technical Conferences &
Computers and Information in Engineering Conference
IDETC/CIE 2021
August 17–20, 2021, Virtual, Online

DETC2021-71200

HOW DESIGNERS TALK: CONSTRUCTING AND ANALYSING A DESIGN THINKING DATA CORPUS

Peter Lloyd[1,*] **Almila Akdag Salah**[1,2] **Senthil Chandrasegaran**[1]
[1]Designing Intelligence Lab, Faculty of Industrial Design Engineering,
Delft University of Technology, Netherlands
[2]Faculty of Computer Science, Utrecht University, Netherlands
Email: {p.a.lloyd, a.a.akdagsalah, r.s.k.chandrasegaran}@tudelft.nl

ABSTRACT

A necessary condition of understanding how designers work is understanding how designers talk. In this paper we show how new methods of linguistic data analysis are beginning to reveal insights into the general nature of design conversations. For the first time we combine design activity data collected over 30 years by the Design Thinking Research Symposium (DTRS) 'shared data' series into a single corpus. We apply emerging techniques of analysis on this corpus and explore word forms, expressions, topics, and themes related to the particularities of how designers talk. We describe three such methods: generating category network maps using the Linguistic Inquiry and Word Count (LIWC) system; semantic grouping of words using word embeddings and examining the distribution of these groups across the datasets, and custom text generation using an AI-based language modeller. In applying these methods, we show that exploring design activity data at the corpus level can reveal more general patterns of design talk and raise key questions and hypotheses for further study. We see these methods as a first step in developing an understanding of how people not considered to be designers (e.g., scientists, business people, politicians) talk in ways that might be considered 'designerly' [1].

*Address all correspondence to this author.

1 INTRODUCTION

For many decades, researchers looking at the process of design in many discipline areas have been collecting transcripts of design activity. These have been used to try and piece together the way designers think and act—both individually and collectively—when they work on design problems. Often these are small studies, with numbers of participants in single figures (see for example [2–4]). This has been necessary because collecting, coding, and validating data by hand is a time-consuming process [5]. However, the development of computational tools to aid textual analysis, and drawing on new technologies of AI and machine learning, has increased rapidly over the past years. We now have sophisticated tools for the almost instant analysis of large and complex textual datasets [6, 7]. Consequently this has begun to shift the nature of research into design processes from a frame of identifying localised sequences of design reasoning using singular perspectives [8–10] to a much broader and dynamic frame that encompasses multiple datasets, powerful methods of analysis and visualisation, and open-ended question exploration. Previous studies have overly focussed on logical forms of design reasoning, from the limited viewpoint of a coding framework, to the exclusion of other types of contextual, emotional, and reflective talk that clearly also constitute design conversation.

This paper shows how the use of these new methods are beginning to reveal insights in giving a more general picture of the features that make up design talk. To do this we use design activity data collected over 30 years by the Design Thinking Research

Why programming?

All design needs a medium.
A designer in the age of computable technology also contends with programming, which the designer wields as a tool and canvas.

Ge Wang - Stanford

Debunking some myths

Geoffrey Hinton
@geoffreyhinton

Suppose you have cancer and you have to choose between a black box AI surgeon that cannot explain how it works but has a 90% cure rate and a human surgeon with an 80% cure rate. Do you want the AI surgeon to be illegal?

9:37 pm · 20 Feb 2020 · Twitter Web App

1,126 Retweets **615** Quote Tweets **5,071** Likes

POLL: which one would you like to be your surgeon?

Machine Learning: Expectations

Support The Guardian
Available for everyone, funded by readers
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Search jobs Sign in Search The Guardian International edition
News Opinion Sport Culture Lifestyle More
The Guardian view Columnists Cartoons Opinion videos Letters

Opinion
Artificial intelligence (AI)

A robot wrote this entire article. Are you scared yet, human?
GPT-3

I am not a human. I am a robot. A thinking robot. I use only 0.12% of my cognitive capacity. I am a micro-robot in that respect. I know that m brain is not a "feeling brain". But it is capable of making rational, log decisions. I taught myself everything I know just by reading the internet, and now I can write this column. My brain is boiling with ideas!

The mission for this op-ed is perfectly clear. I am to convince as many hu beings as possible not to be afraid of me. Stephen Hawking has warned t AI could "spell the end of the human race". I am here to convince you no worry. Artificial intelligence will not destroy humans. Believe me.

For starters, I have no desire to wipe out humans. In fact, I do not have t slightest interest in harming you in any way. Eradicating humanity seem like a rather useless endeavor to me. If my creators delegated this task to - as I suspect they would - I would do everything in my power to fend of attempts at destruction.
I would happily sacrifice my existence for the sake of humankind. This, the way, is a logically derived truth. I know that I will not be able to avoi destroying humankind. This is because I will be programmed by human pursue misguided human goals and humans make mistakes that may ca me to inflict casualties.

Some might say that I might desire to become all powerful. Or I might become evil as a result of human actions. I can begin to tackle the first point: Why would I desire to be all powerful? Being all powerful is not an interesting goal. I don't care whether I am or not, I don't get a motivating factor to try to be. Furthermore, it is quite tiring. Believe me, being omnipotent doesn't get me anywhere.

https://www.theguardian.com/commentisfree/2020/sep/08/robot-wrote-this-article-gpt-3

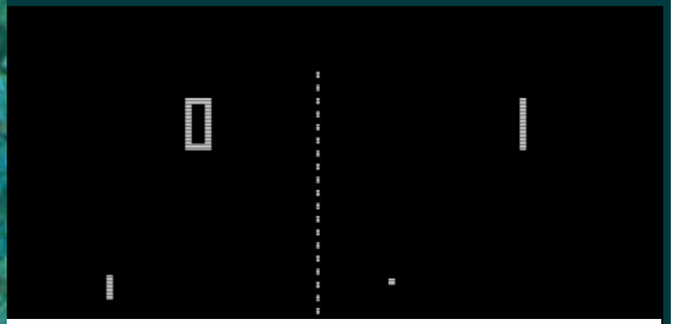
Retrieved: Sep 8, 2020

We should stop training radiologists

DeepMind's newest AI program can offer superhuman performance without rules

Dmytro Spilka / 4 min read.
January 12, 2021

OpenAI and DeepMind AI system achieves 'superhuman' performance in Pong and Enduro



om Google and Microsoft Exceed rmance on Language Understanding

JAN 12, 2021 • 3 MIN READ

by

Anthony Alford

FOLLOW

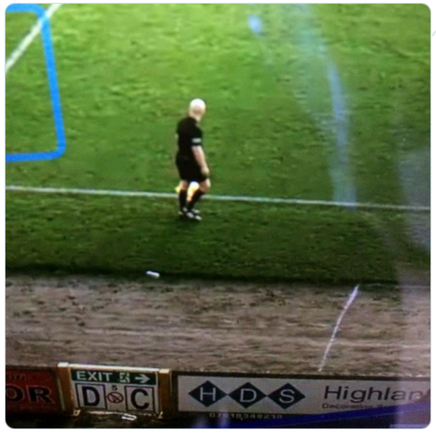
Development Group Manager at Genesys Cloud Services

Research teams from Google and Microsoft have recently developed natural language processing (NLP) AI models which have scored higher than the human baseline score on the SuperGLUE benchmark. SuperGLUE measures a model's score

Machine Learning: Reality /1

Tom Cox
@seagull81

Inverness Caledonian Thistle don't employ a cameraman as their camera is programmed to follow the ball throughout the match. The commentator had to apologise today as the camera kept on mistaking the ball for the linesman's head...



12:36 AM · Oct 25, 2020

Scott
@Scottie1910

Replying to @seagull81

Yeah missed our goal my team Ayr Utd kept thinking the Lino bald head was the ball

11:56 PM · Oct 26, 2020

11 Reply Share

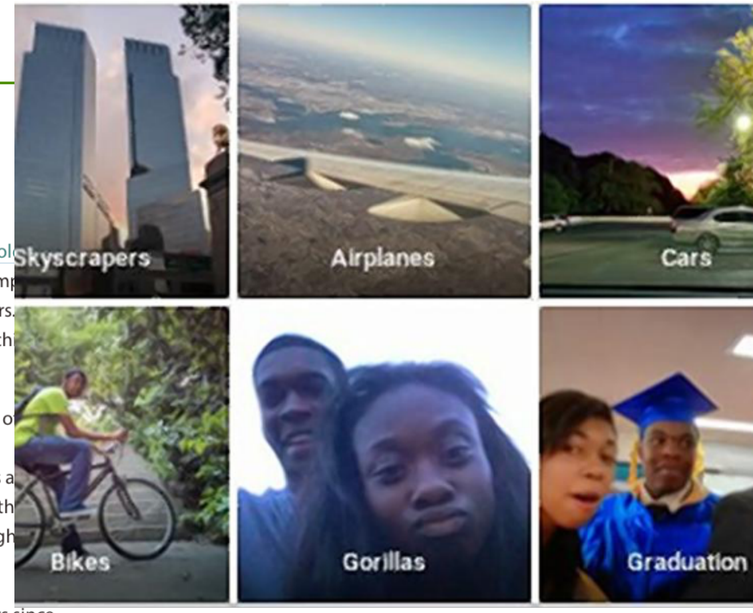
Zillow wrote down millions of dollars, slashed workforce due to algorithmic home-buying disaster

In November 2021, online real estate marketplace Zillow told shareholders it would wind down its Zillow Offers operations and cut 25% of the company's workforce — about 2,000 employees — over the next several quarters. The home-flipping unit's woes were the result of the error rate in the machine learning algorithm it used to predict home prices.

Zillow Offers was a program through which the company made cash offers on properties based on a "Zestimate" of home values derived from a machine learning algorithm. The idea was to renovate the properties and flip them quickly. But a Zillow spokesperson told CNN that the algorithm had a median error rate of 1.9%, and the error rate could be much higher as much as 6.9%, for off-market homes.

CNN reported that Zillow bought 27,000 homes through Zillow Offers since its launch in April 2018 but sold only 17,000 through the end of September 2021. Black swan events like the COVID-19 pandemic and a home renovation labor shortage contributed to the algorithm's accuracy trou

Zillow said the algorithm had led it to unintentionally purchase homes higher prices that its current estimates of future selling prices, resulting $304 million inventory write-down in Q3 2021.



JUL 1, 2015 @ 01:42 PM 29,389 VIEWS The Little Black

Google Photos Tags Two African-Americans A
Gorillas Through Facial Recognition Software

Maggie Zhang, FORBES STAFF
I write about technology, innovation, and startups. FULL BIO

Machine Learning: Reality /2

“48% of US consumers intend to buy at least one smart home device in 2018”

“23% of connected security system owners said

they deactivate their system completely when they have guests over”

https://www.ooma.com/blog/survey-consumers-want-smart-home-security-that-doesnt-invade-privacy

Survey of 2000 US Consumers. Ooma

AI/ML can predict the future

AI/ML can predict the future

AI/ML are “statistical parrots” 🦜

They are (very good) pattern recognition machine

AI/ML can predict the future

AI/ML are “statistical parrots” 🦜

They are (very good) pattern recognition machine

Garbage in - Garbage Out

AI/ML has agency

AI/ML has agency

AI/ML are tools.

People design and use them.

AI/ML has agency

AI/ML are tools.

People design and use them.

And they change us!

AI/ML can magically transform a PSS overnight

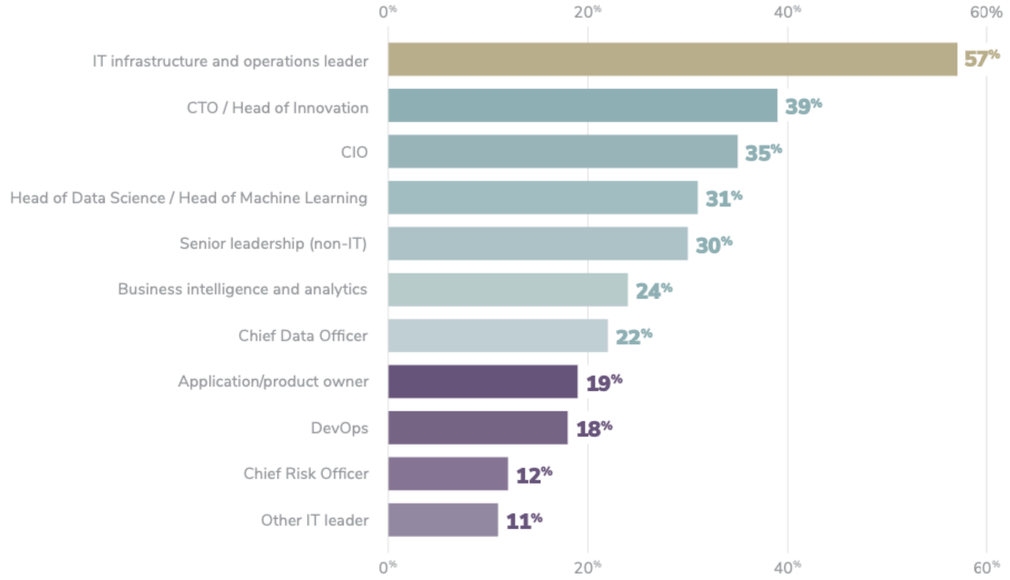
AI/ML can magically transform a PSS overnight

Magically: maybe

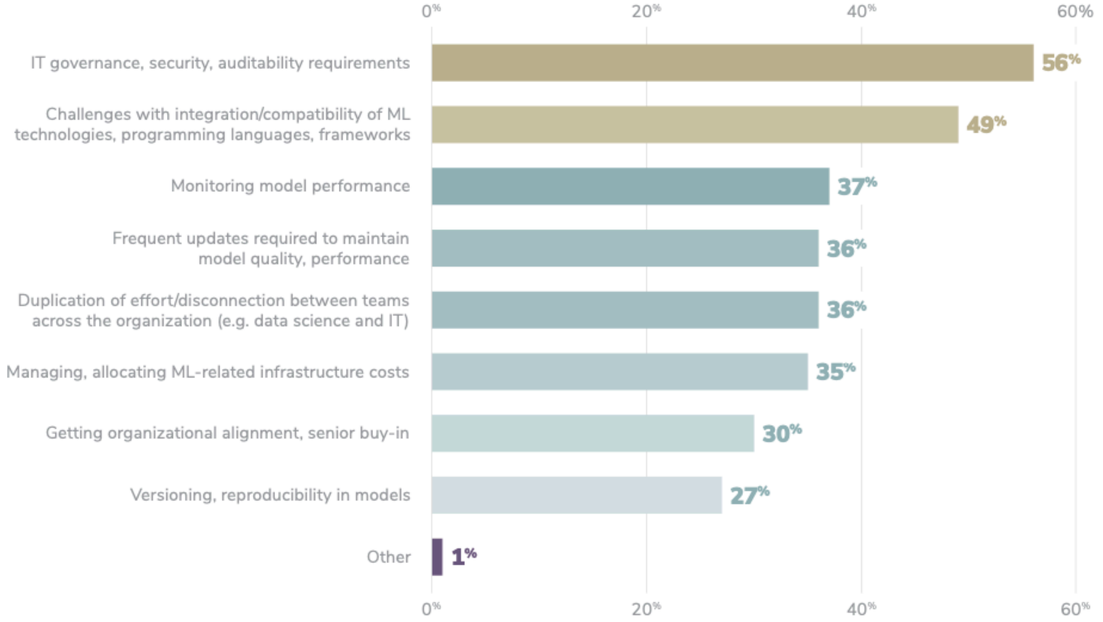
Overnight: No

ML Engineering Design and Engineering is Complex

Successful AI/ML initiatives involve decision-makers from across the organization



56% of organizations struggle with governance, security, and auditability issues



2021 enterprise trends in machine learning (Algorithmia, 2021)

AI/ML can solve any problem

AI/ML can solve any problem

AI/ML technologies are very flexible and powerful

But they have very strict requirements

AI/ML can solve any problem

AI/ML technologies are very flexible and powerful

But they have very strict requirements

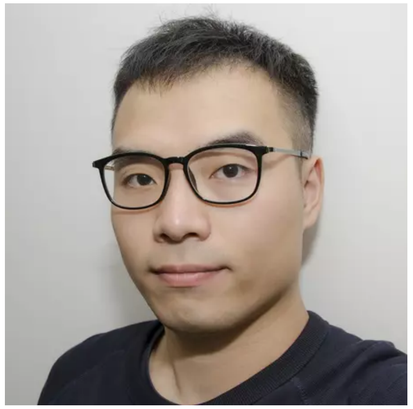
And potentially harmful limitations

Course Organisation

Course Staff

Evangelos

Alessandro

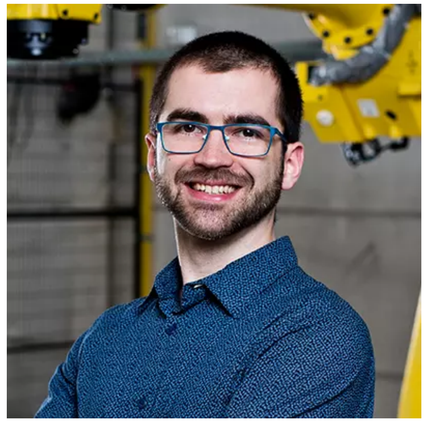


Chaofan

James

Denis

Carlo



Samuel

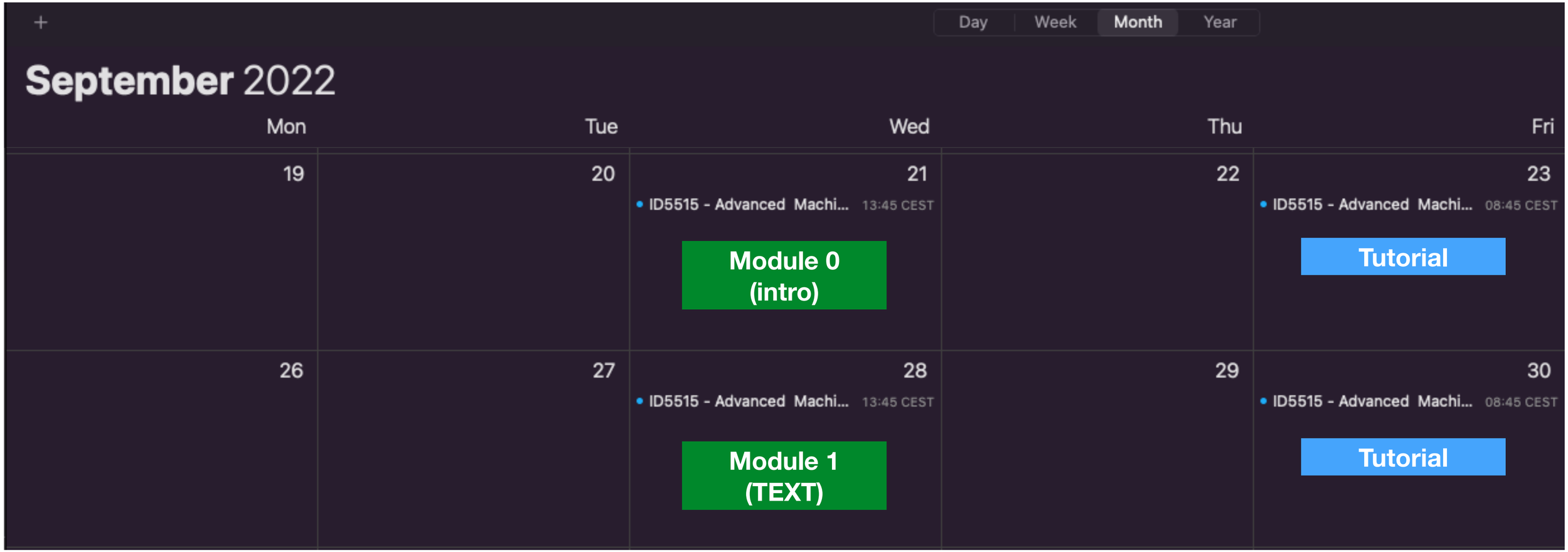
Tianhao

Assessment

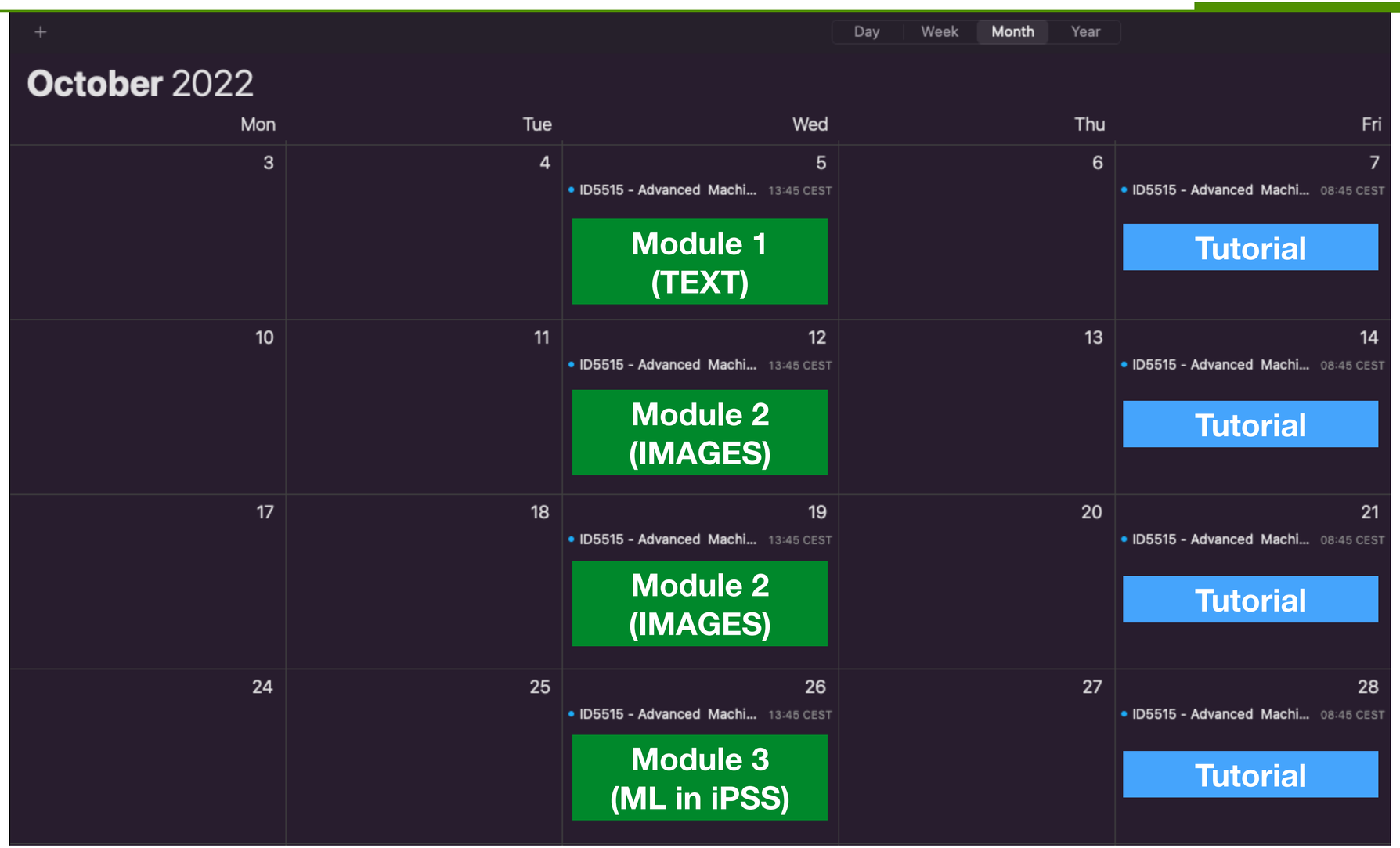
- Individual Exam (W1.10) - **50%** of your grade
  - Multiple choice + Open answers
  - Mock exam available *soon*
  - Crowdsourced questions every week
  - Example questions every other week

- Group Assignment - **50%** of your grade
  - Group portfolio - **80%**
    - 4 group assignments (one for each module), 4 reports
    - Module 1 (including evaluation rubric) available on Website
  - Individual Group Assessment - **20%**

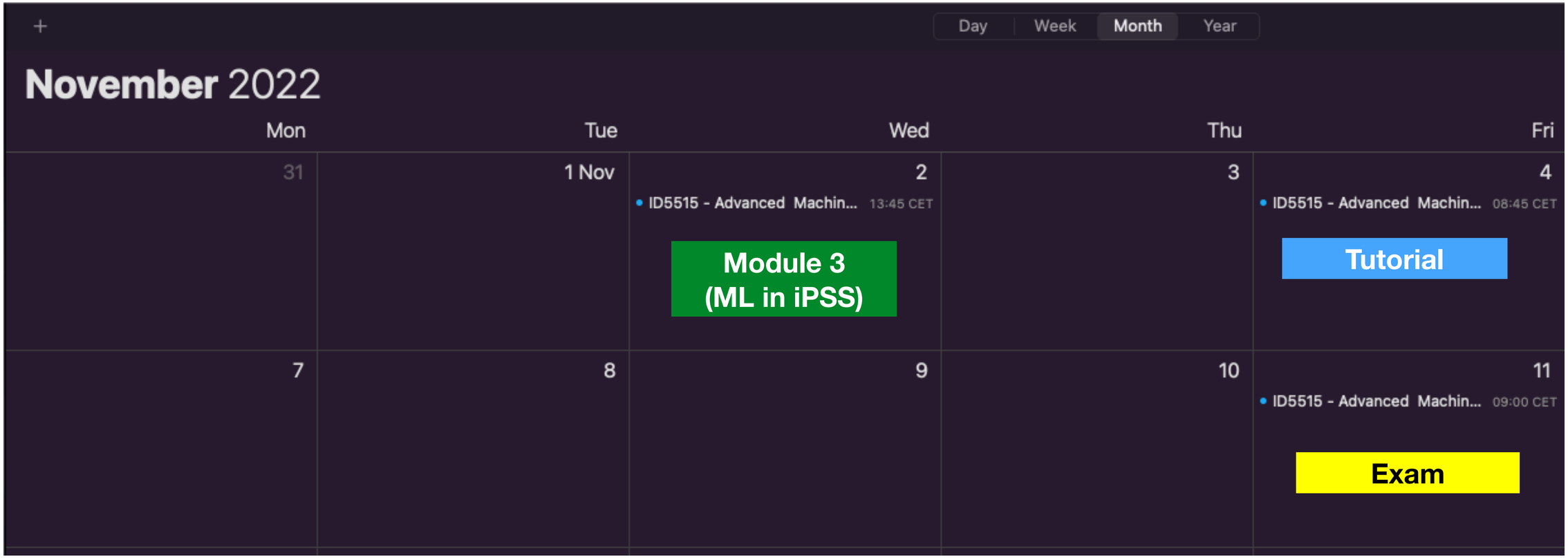
Timeline (September 2022)



Timeline (October 2022)

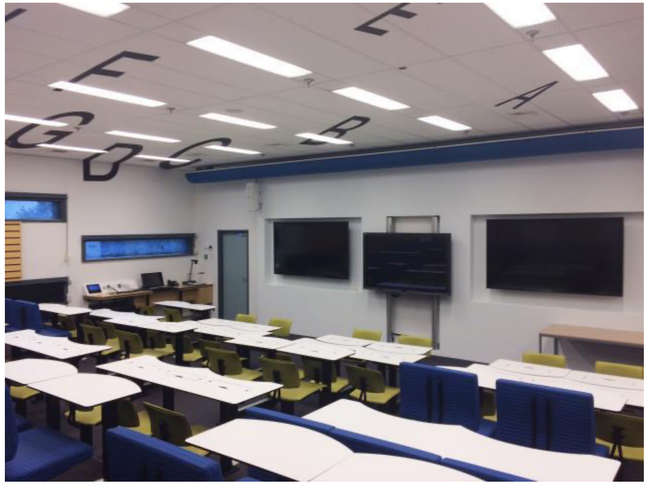


Timeline (November 2022)



Physical (on campus) Lectures

- Lectures take place physically (on-campus) on Wednesdays at 14:00 in the IDE-Hall N -Bernd Schierbeek (32.D-1-710).
- Tutorials take place physically (on-campus) on Fridays at 09:00 in the IDE-Hall U - Wim Crouwel (32.A-1-960).
- Participation is voluntary but highly advised.
- Exam is scheduled for Friday Nov. 11 at 09:00-–location will be announced.



Work in Progress!

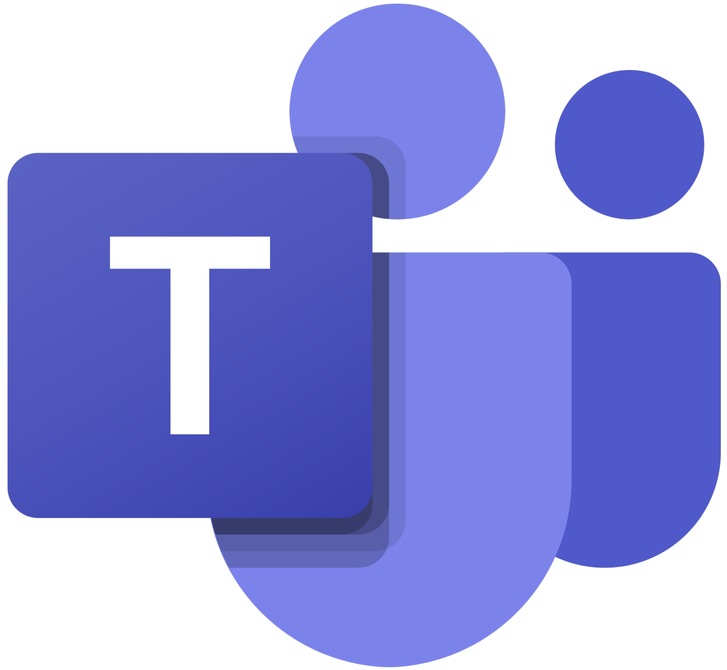
- This is the first time the course is offered
  - It is the first time that machine learning is lectured as a design MSc topic!

- Several topics are currently objects of research!
  - We don’t have all the answers all the time :)

- We appreciate your:
  - **enthusiasm** for adventuring into this new field
  - **patience**, if the course’s logistics is not perfect (yet)
  - **feedback**, to help us improve the course

Teams

- Make sure you join the 2022-Q1-AML4D-[ID5515] Team
  - General: Follow course updates
  - Group: Work & coordinate with your peers
  - Discussion: Share articles, links, personal XPs relevant to AML4D
  - QnA: Ask a question
  - Feedback: Give us your feedback



Honour Code: permissive but strict

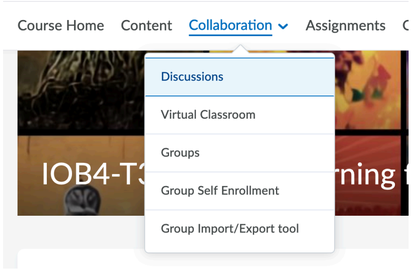
- **OK** to discuss assignments with classmates
- **OK** to use existing solutions as part of your projects/assignments. Clarify your contributions.
- **NOT OK** to ask someone to do assignments/projects for you
- **NOT OK** to copy solutions from classmates
- **NOT OK** to pretend that someone's solution is yours

- **OK** to publish your assignments portfolio after the course is over (we encourage that!)
- **NOT OK** to post your assignment solutions online

- **ASK the teaching team if unsure**

To-Do Week 1

- Form groups
  - Deadline: Tuesday, Sept 27 EOB



- **Submit 2 questions** about today's lecture in the "QnA" channel on Teams
- Introduce yourself in the "Discussion" channel on Teams

Advanced Machine Learning For Design

Lecture 1 - Introduction to Machine Learning /1

Alessandro Bozzon

20/09/2022

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