Philipp Schmitt

Machine Learning für Designer

Laborwoche
WS 2018/19

Hochschule für Gestaltung
Schwäbisch Gmünd

Philipp Schmitt

philippschmitt.com
@philippschmitt

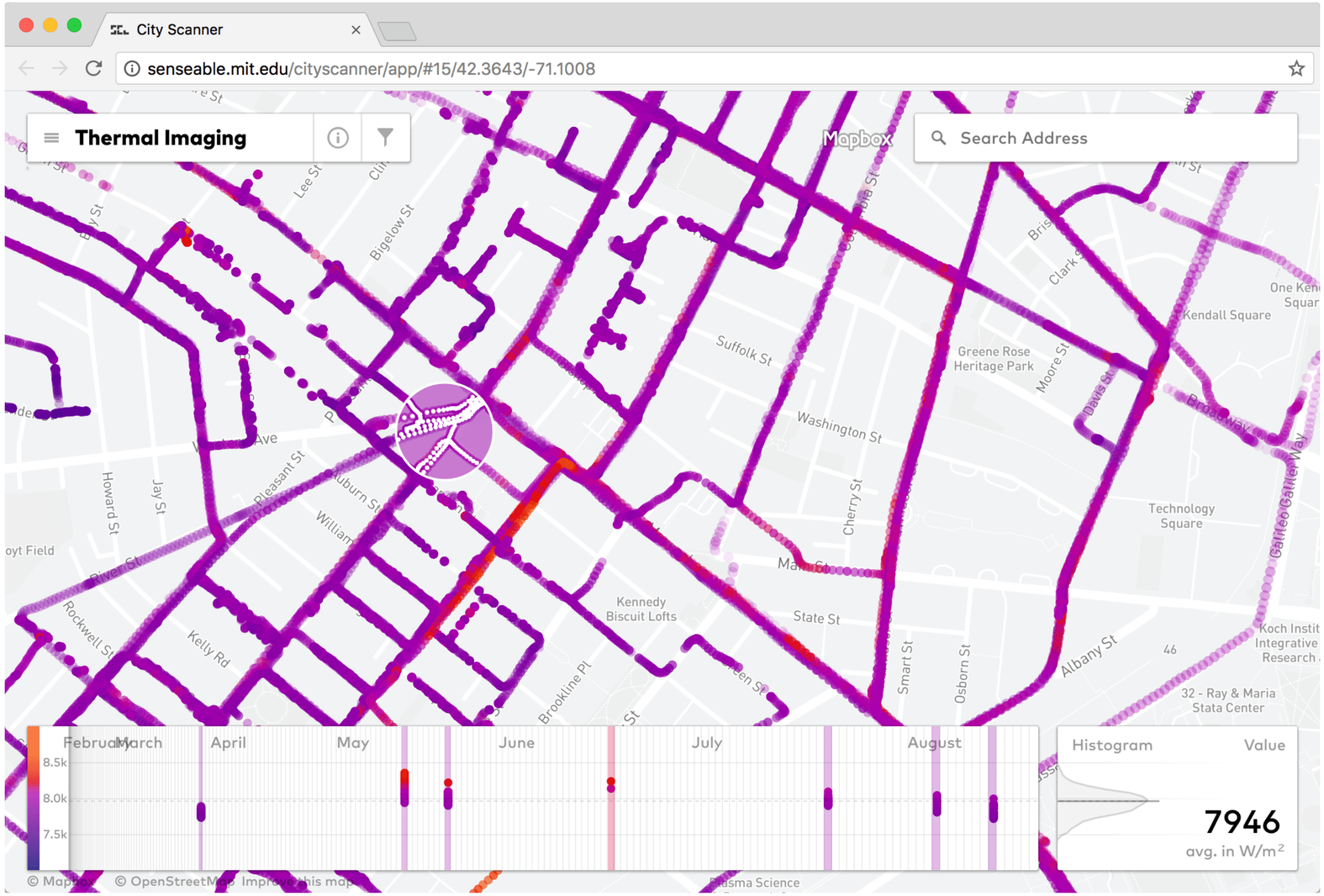
Computed Curation

philippschmitt.com/work/computed-curation

Unseen Portraits, mit Stephan Bogner

philippschmitt.com/work/unseen-portraits-2

City Scanner, MIT SENSEable City Lab

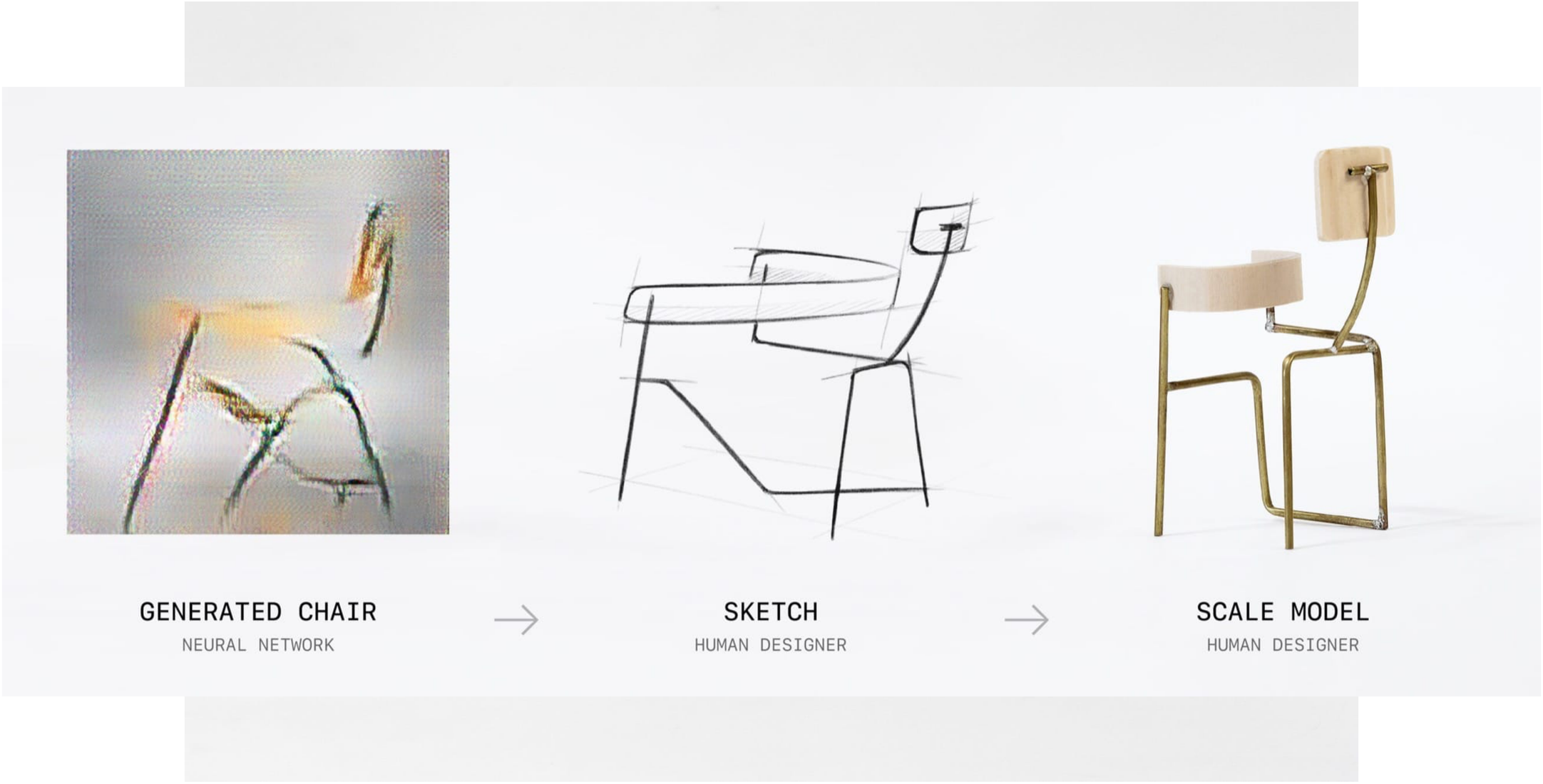


senseable.mit.edu/cityscanner

The Chair Project, mit Steffen Weiß

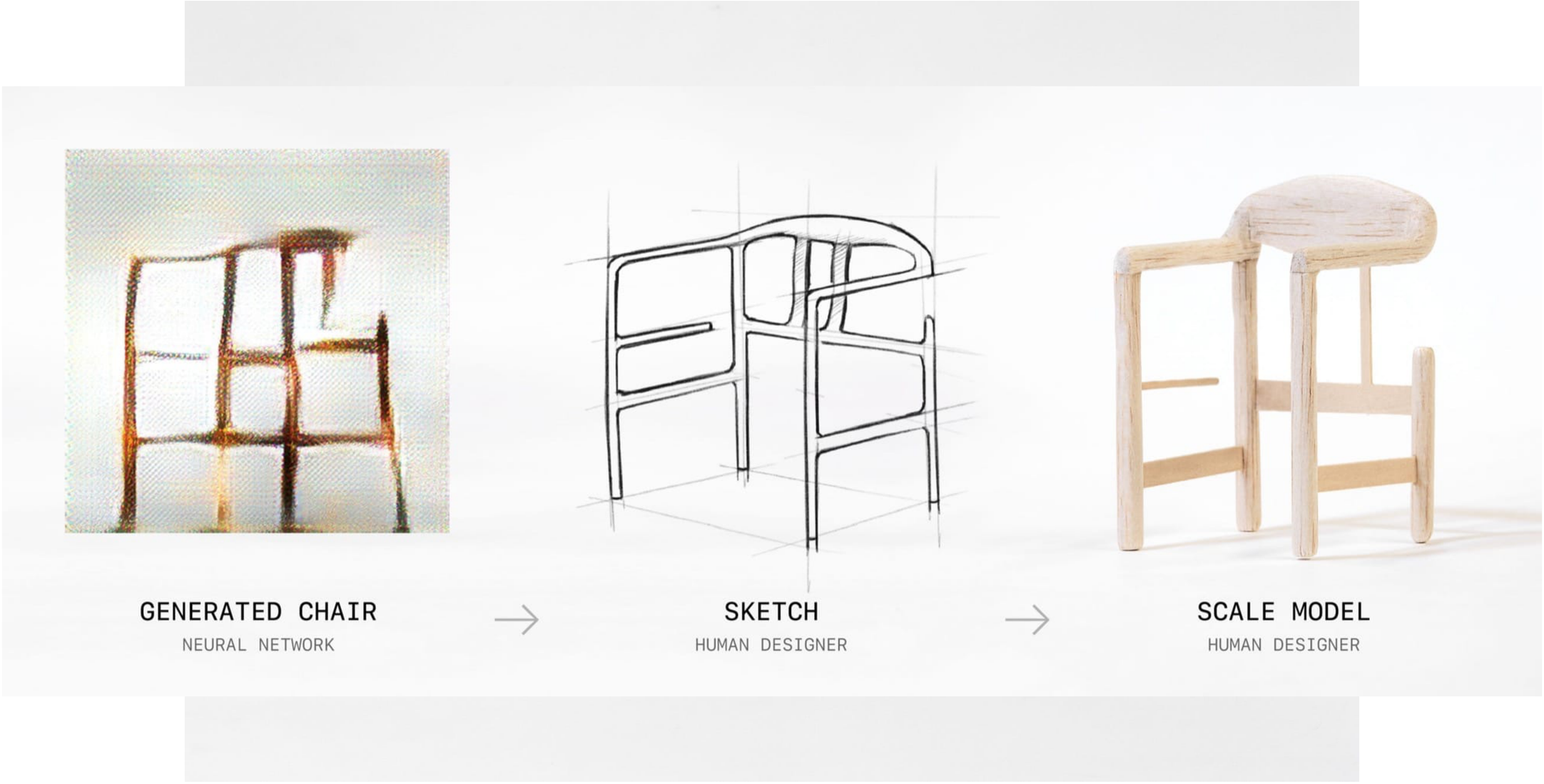
philippschmitt.com/work/chair

The Chair Project, mit Steffen Weiß



philippschmitt.com/work/chair

The Chair Project, mit Steffen Weiß



philippschmitt.com/work/chair

Wer seid ihr?

Montag	Dienstag	Mittwoch	Donnerstag	Freitag
Einführung Demo: Wekinator [Demo: Runway]	Demo: Runway [Demo: ml5.js] [Demo: t-SNE.js] [Demo: Brain.js] Projektarbeit	Projektarbeit	Projektarbeit Dokumentation	Ausstellung
Hausaufgabe Docker downloaden und installieren			Abgabe Projektbeschreibung, Namen/ Websites der Teammitglieder, sowie 3-5 Bilder per Email an mail@philippschmitt.com	

Machine Learning für Designer

Einführung

Laborwoche
WS 2018/19

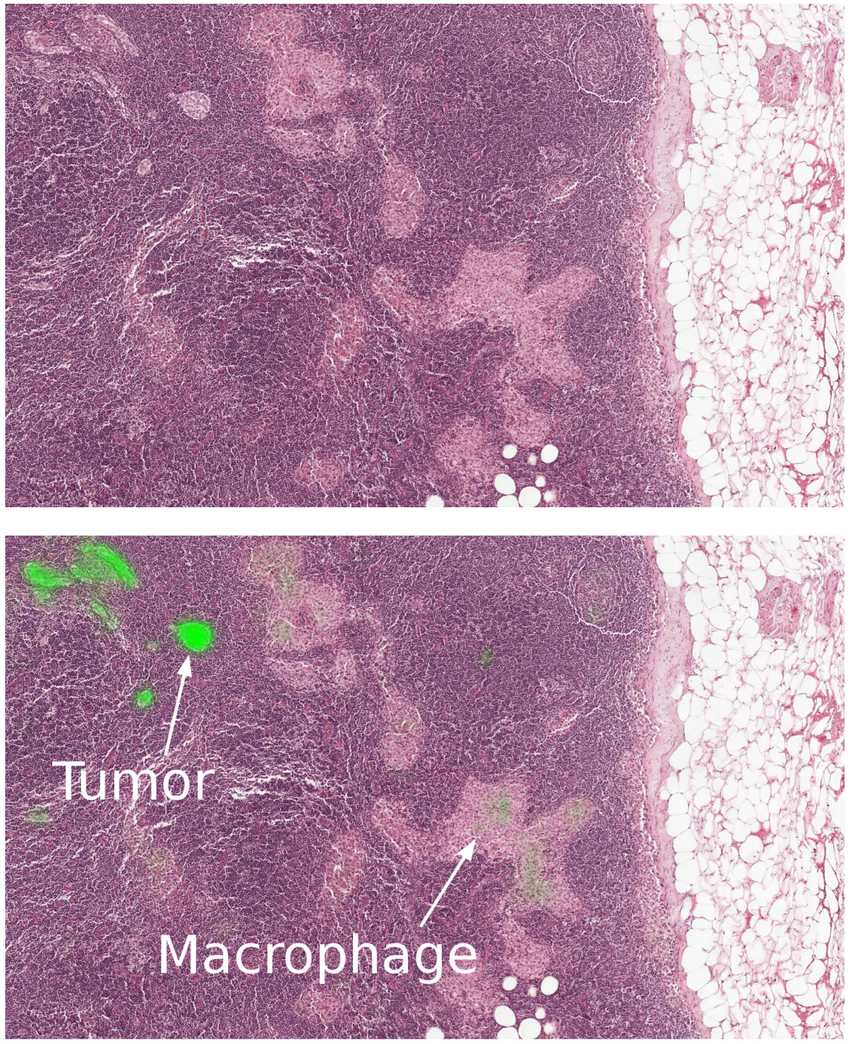
Hochschule für Gestaltung
Schwäbisch Gmünd

Beispiele für Machine Learning

Klassifizierung	Prediction / Regression	Generation
Text	Recommendation	Text
Bild	Ranking	Bild
Sprache	Verhalten	Sprache
Verhalten	Clustering	
A, B oder C ?	*51.69%*	*[1,2] → “Hallo Welt!”*

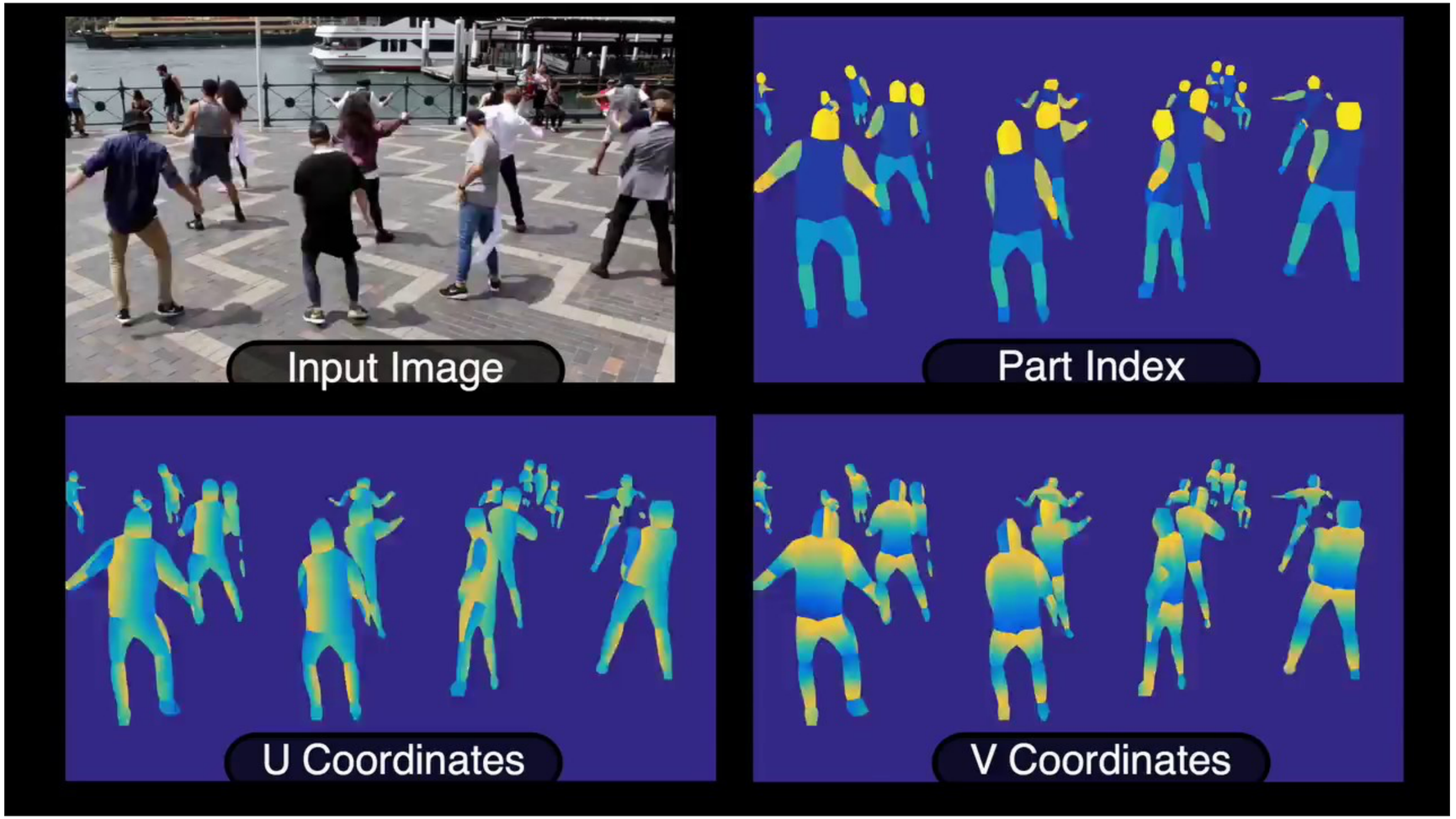
Klassifizierung: Sprache und Text

Klassifizierung: Bilder



https://ai.googleblog.com/2017/03/assisting-pathologists-in-detecting.html

Klassifizierung: Bild/Video

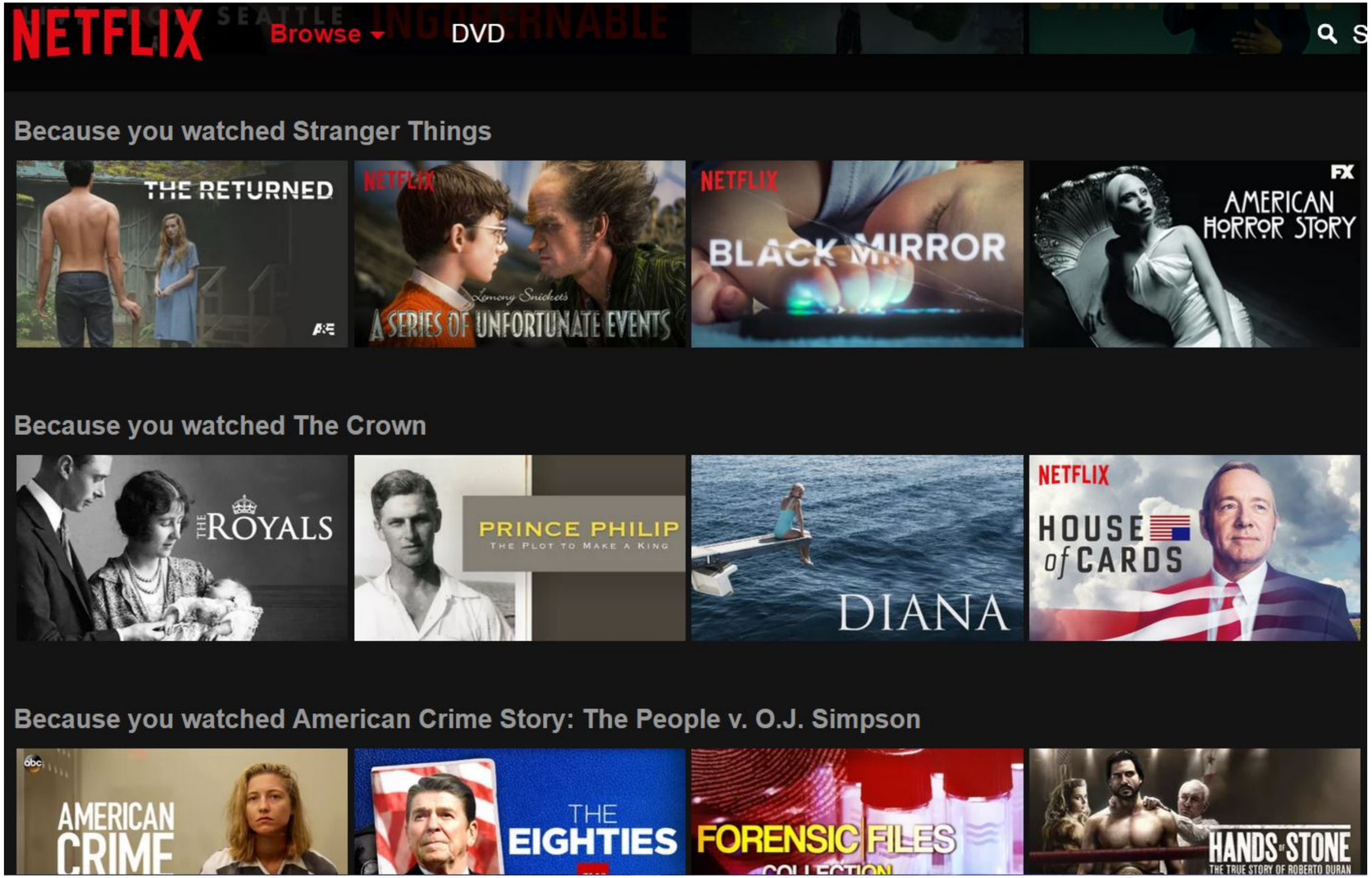


https://www.youtube.com/watch?v=Dhkd_bAwwMc

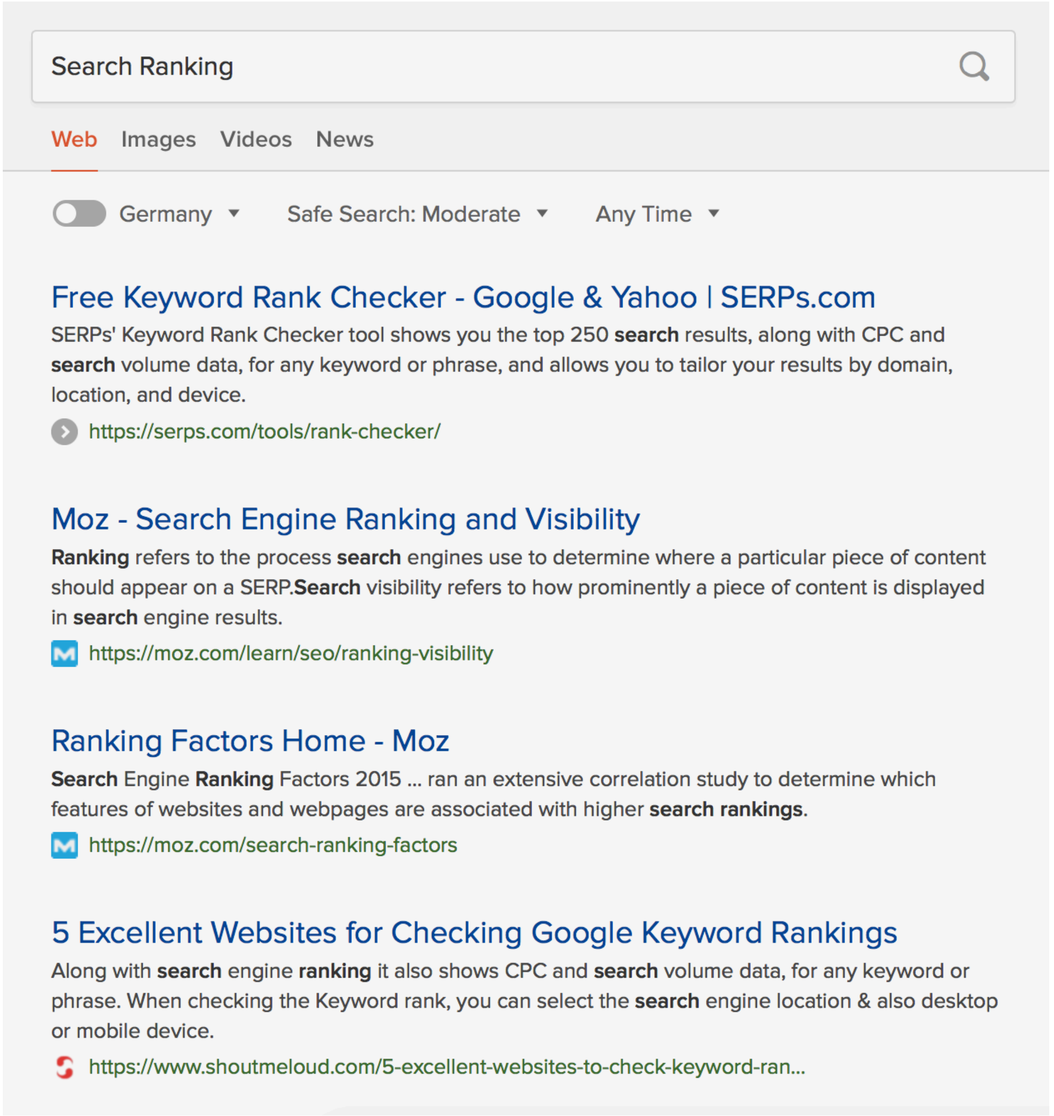
Klassifizierung: Verhalten

Bild: https://www.ibtimes.co.uk/french-criminals-implanting-stolen-pin-card-chips-into-new-forged-cards-video-1524885

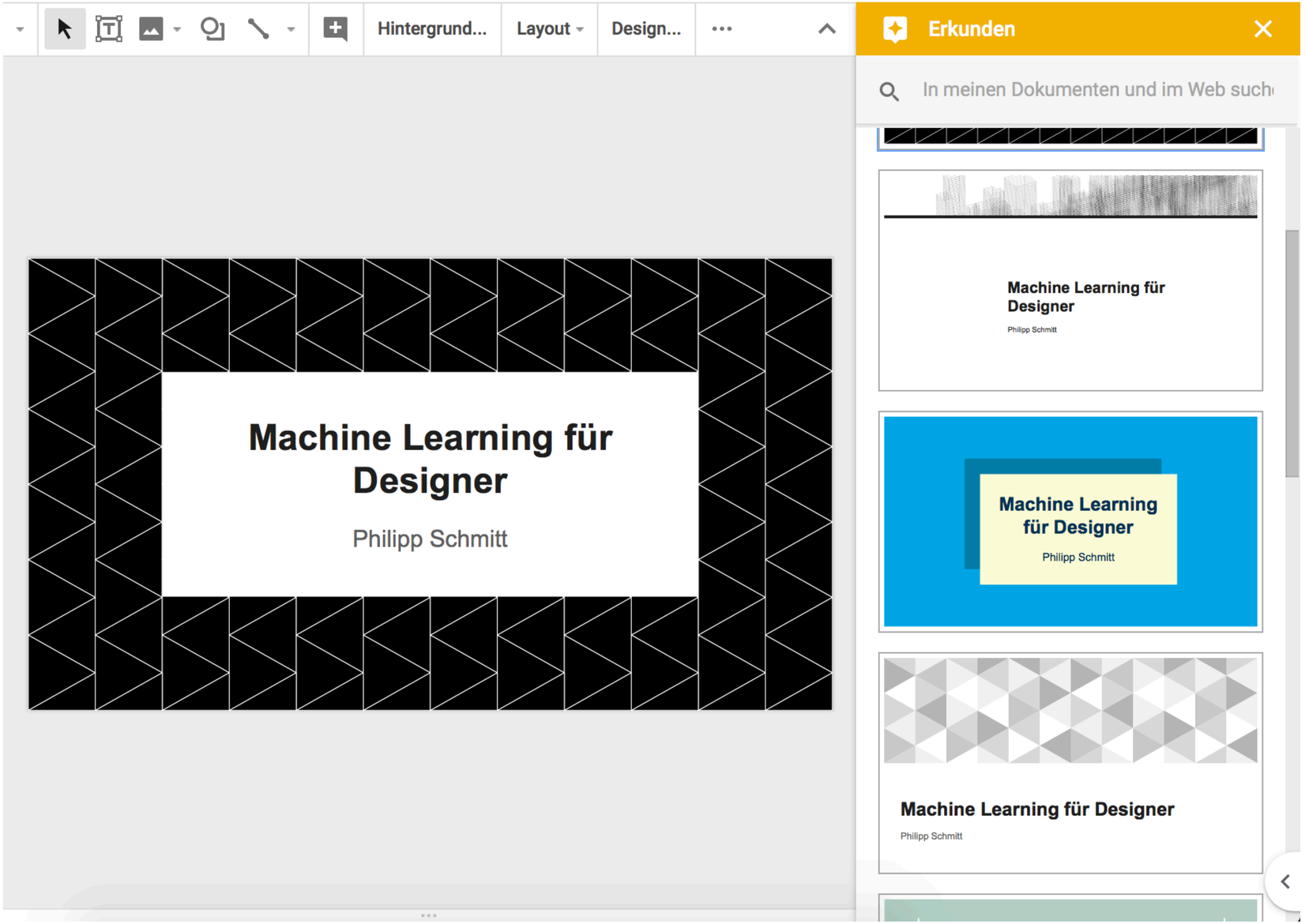
Vorhersage/Regression: Content Recommendation



Vorhersage/Regression: Ranking

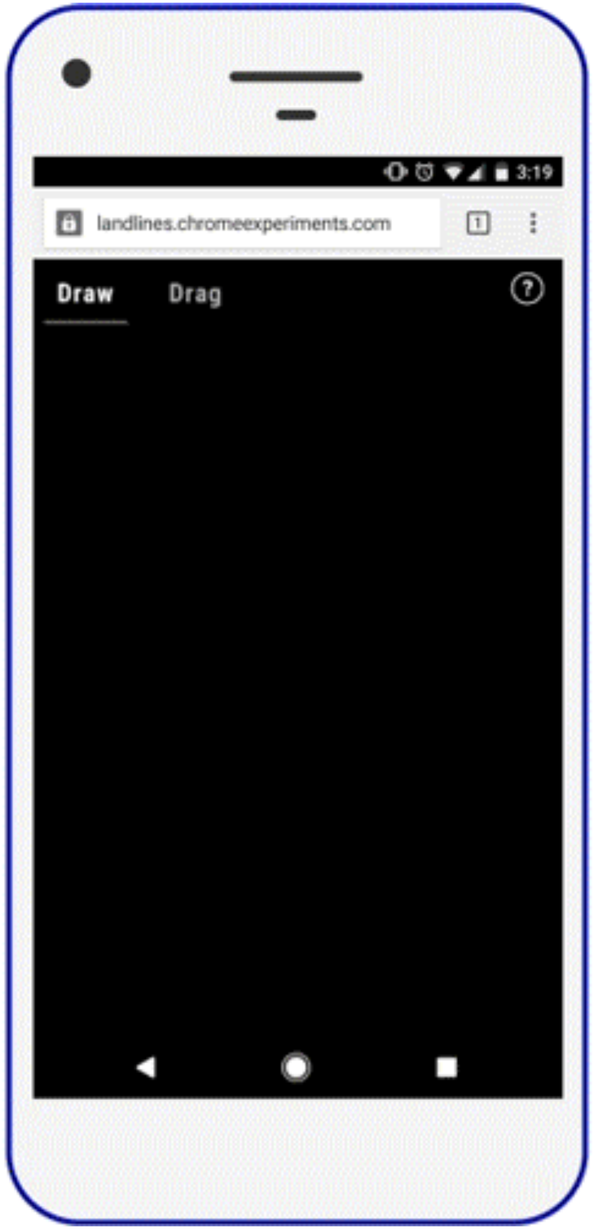


Vorhersage/Regression: Empfehlung



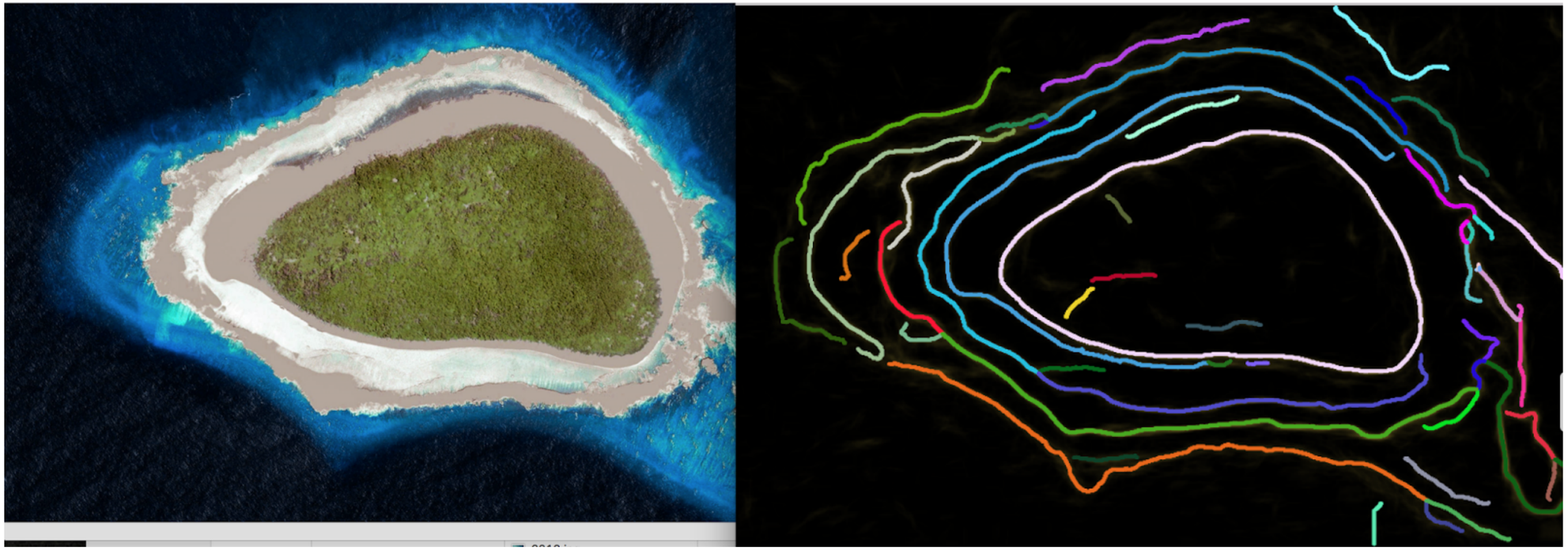
Vorhersage/Regression: Clustering

Vorhersage/Regression: Clustering



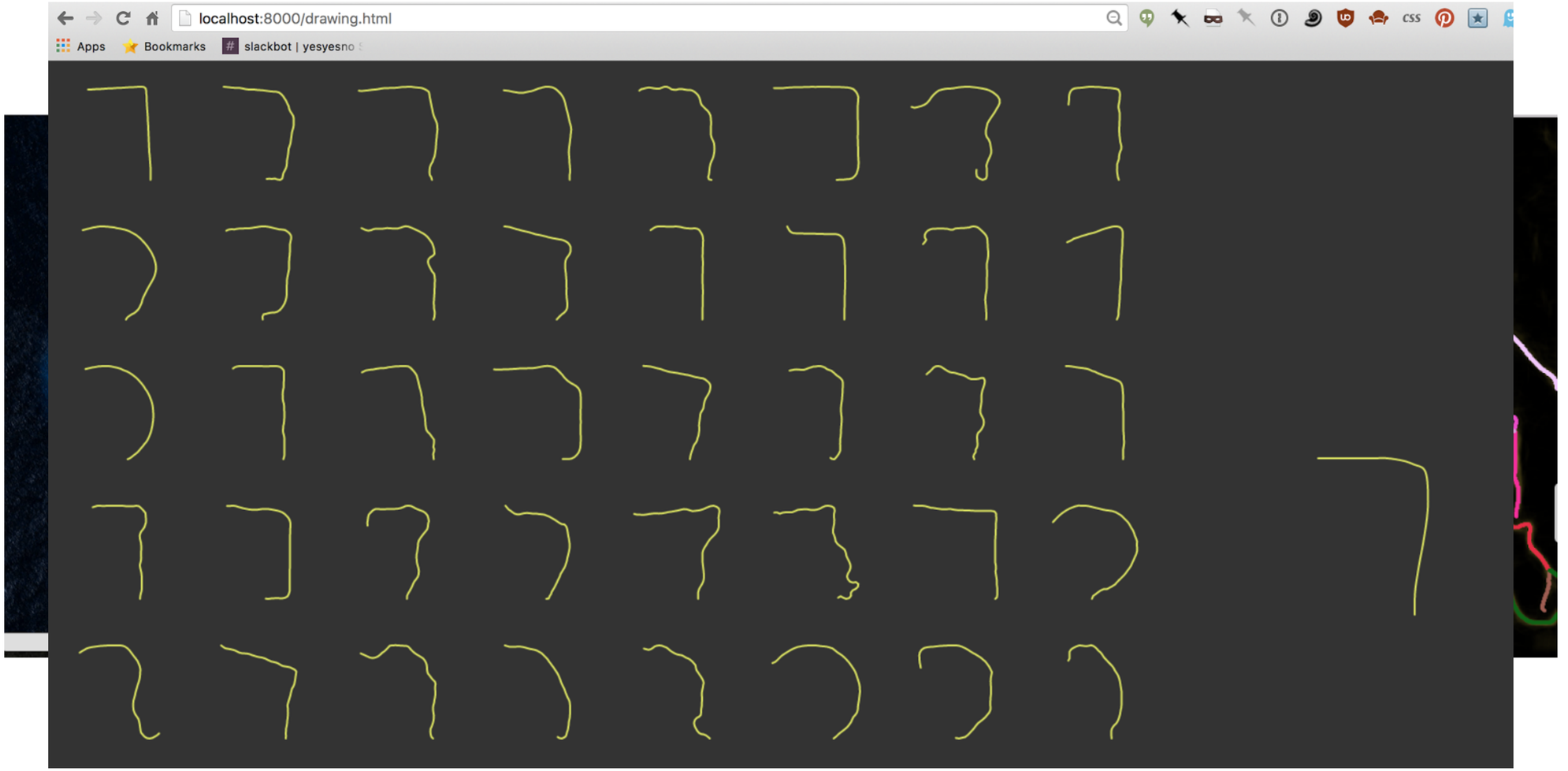
lines.chromeexperiments.com

Vorhersage/Regression: Clustering



lines.chromeexperiments.com

Vorhersage/Regression: Clustering



lines.chromeexperiments.com

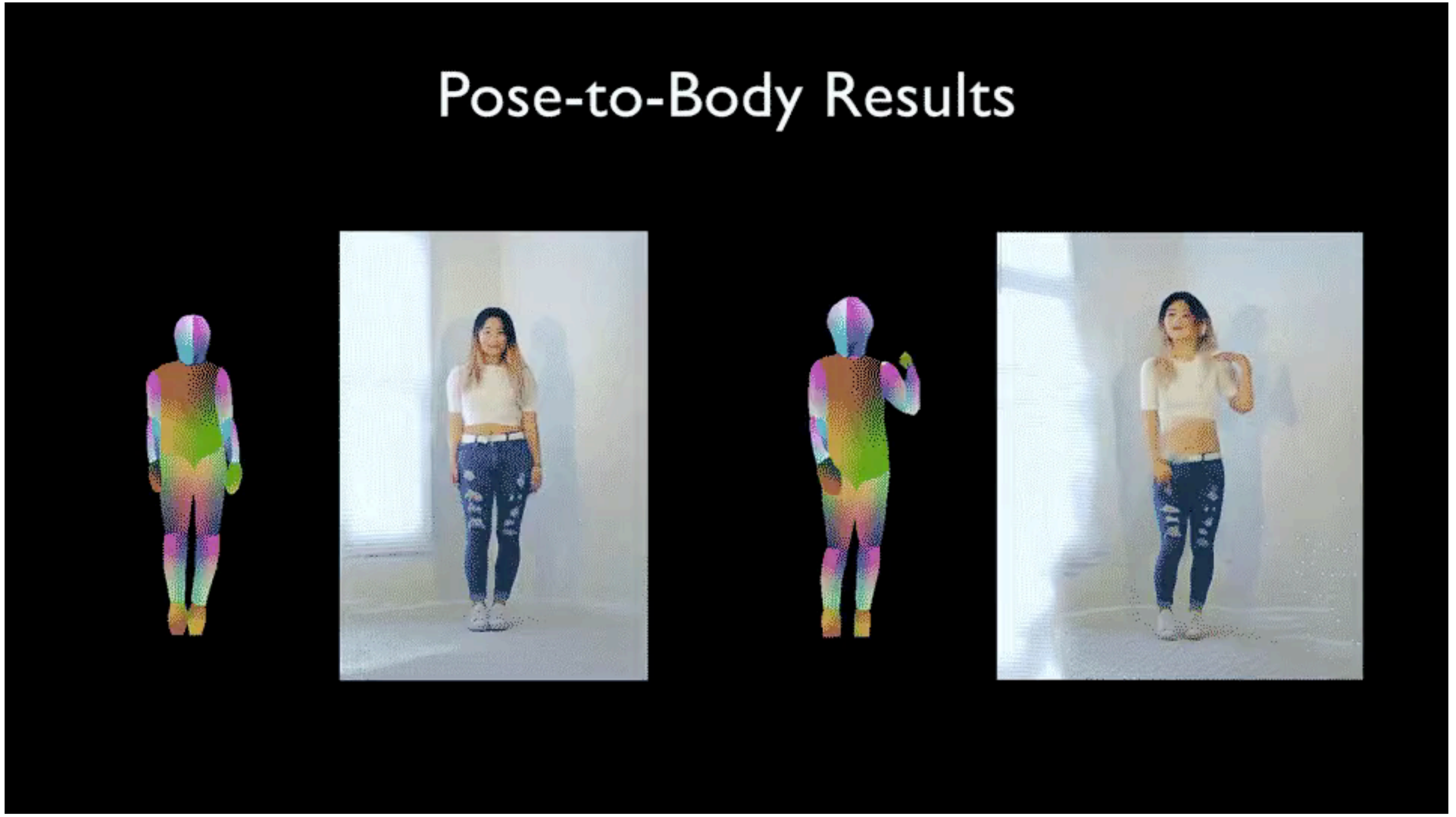
Generativ: Bild und Video

Large Scale GAN Training for High Fidelity Natural Image Synthesis
Brock et al, https://arxiv.org/abs/1809.11096

Generativ: Bild und Video

Style Transfer mit CycleGAN

Generativ: Bild und Video



github.com/NVIDIA/vid2vid

Generativ: Text und Ton

Was ist eigentlich “Machine Learning?”

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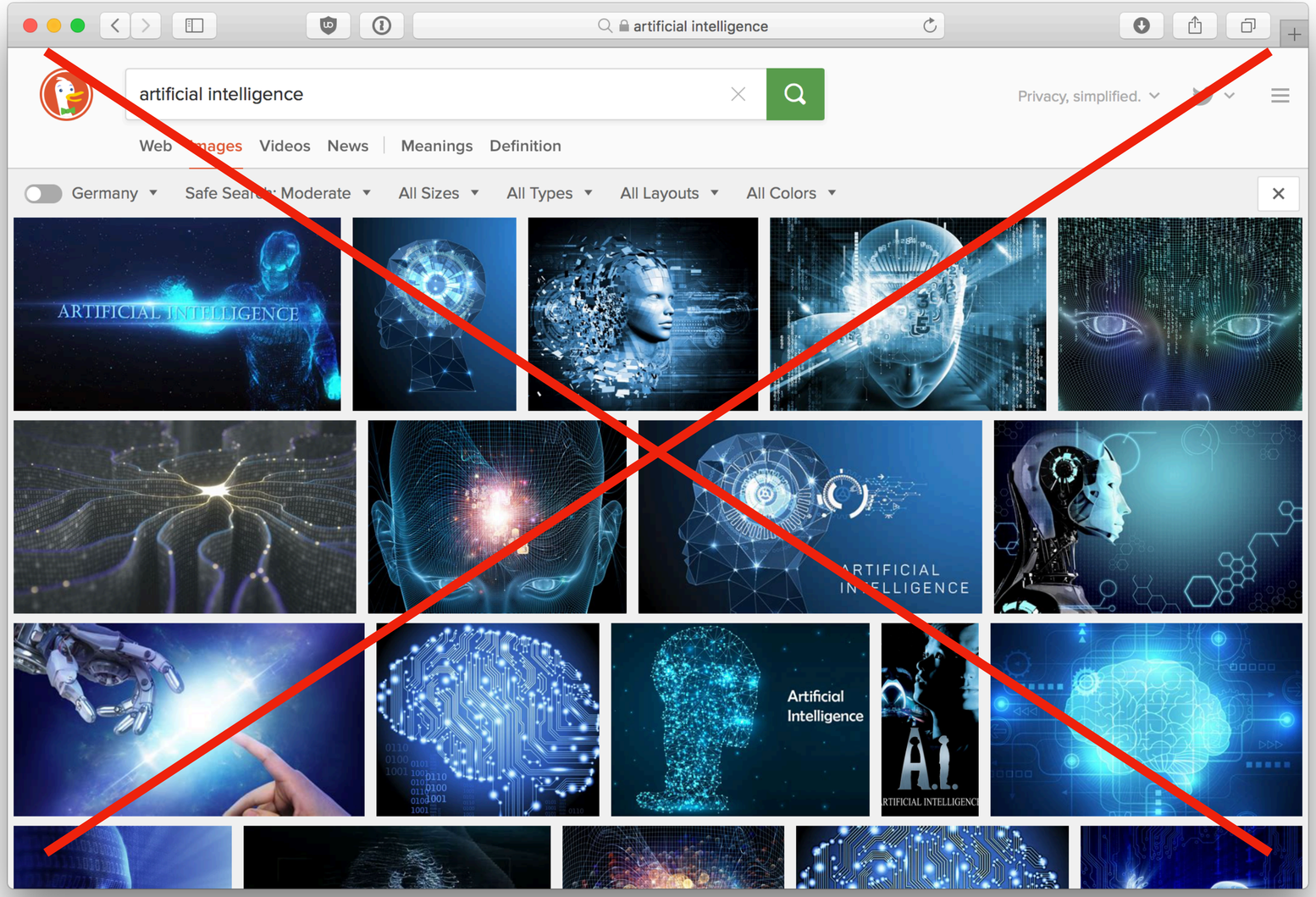


Was ist eigentlich “Machine Learning?”

Machine learning systems automatically learn programs from data

Domingos, Pedro. "A few useful things to know about machine learning.”
Communications of the ACM 55, no. 10 (2012): 78-87.

Was ist eigentlich “Machine Learning?”

Machine lea

Dear Beloved

As you read this, I don't want you to feel sorry for me, because, I believe everyone will die someday.

My Name is Alhaji Thlama Dawha, the managing director with the Nigeria National Petroleum Corporation (N.N.P.C), in Nigeria I have been diagnosed with Esophageal cancer which was discovered very late, due to my laxity in caring for my health. It has defiled all forms of medicine, and right now I have only about a few weeks to live, according to medical experts.

I have not particularly lived my life so well, as I never really cared for anyone not even myself but my Work. Though I am very rich, I was never generous, I was always hostile to people and only focus on my business as that was the only thing I cared for. But now I regret all this as I now know that there is more to life than just wanting to have or make all the money in the world.

I believe when God gives me a second chance to come to this world I would live my life a different way from how I have lived it. Now that God ! has called me, I have willed and given most of my properties and assets to my immediate and extended family members and as well as a few close friends.

Domingos, Pedro. "A few
Communications of the ACM 55, no. 10 (2012): 78-87.

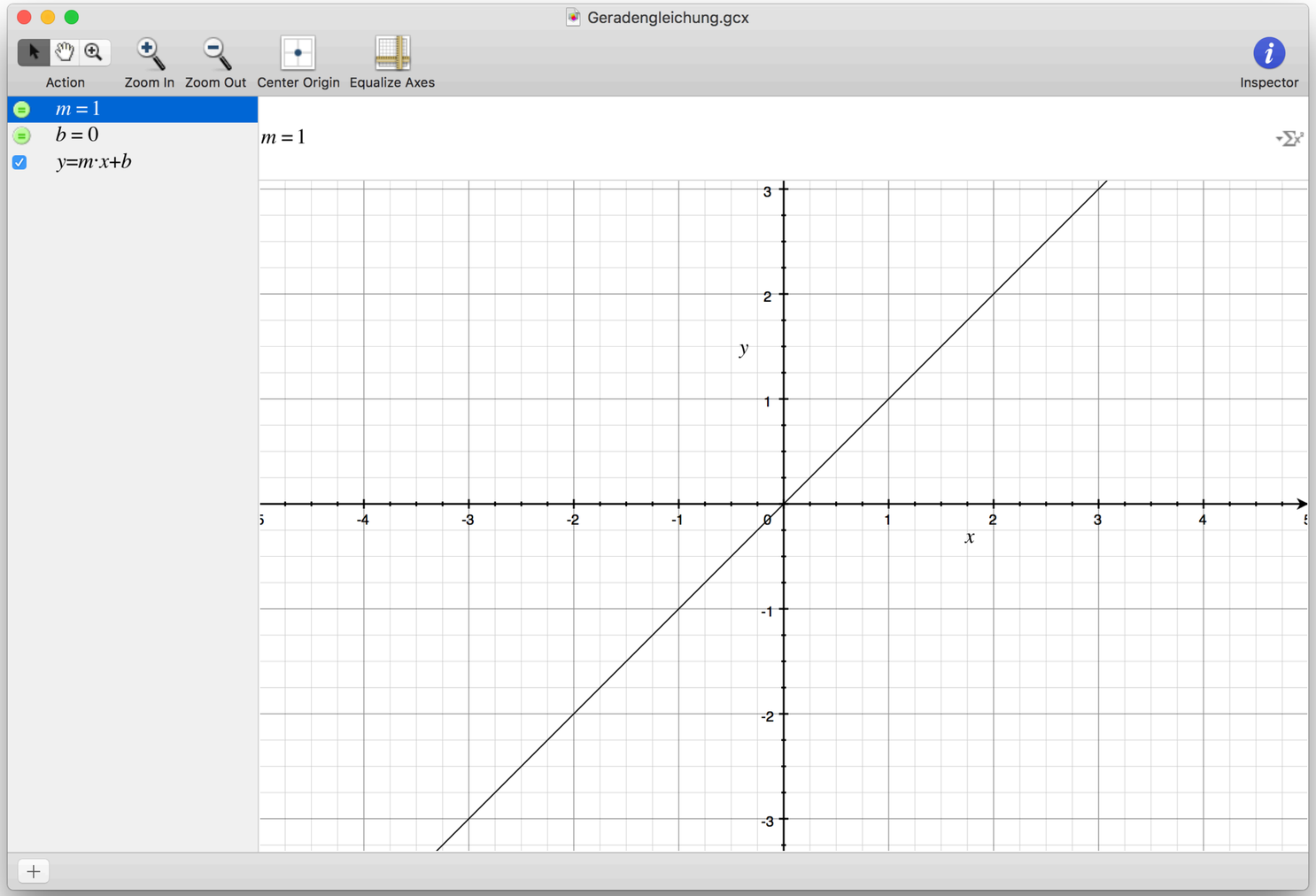
Was ist eigentlich “Machine Learning?”

Maschinelles Lernen bedeutet, dass Computer statistische Lernverfahren anwenden, um automatisch Muster in Daten zu erkennen.

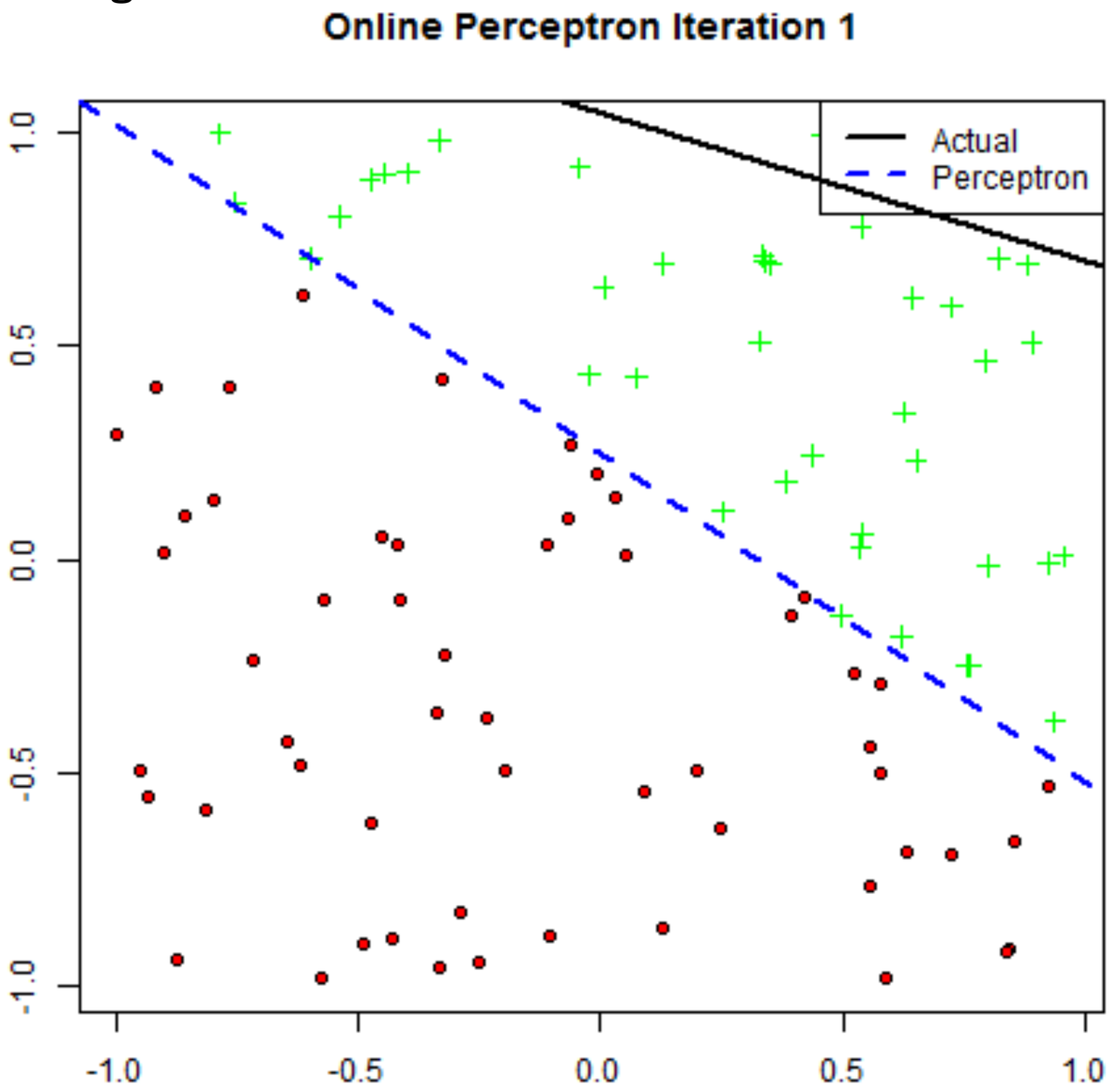
Statistisches Lernen ist im wesentlichen das Ziehen von Grenzen in Daten mit Hilfe der Mathematik

R2D3: Eine visuelle Einführung ins Maschinelle Lernen
http://www.r2d3.us/visuelle-einfuehrung-ins-maschinelle-lernen-teil-1/

Was ist eigentlich “Machine Learning?”

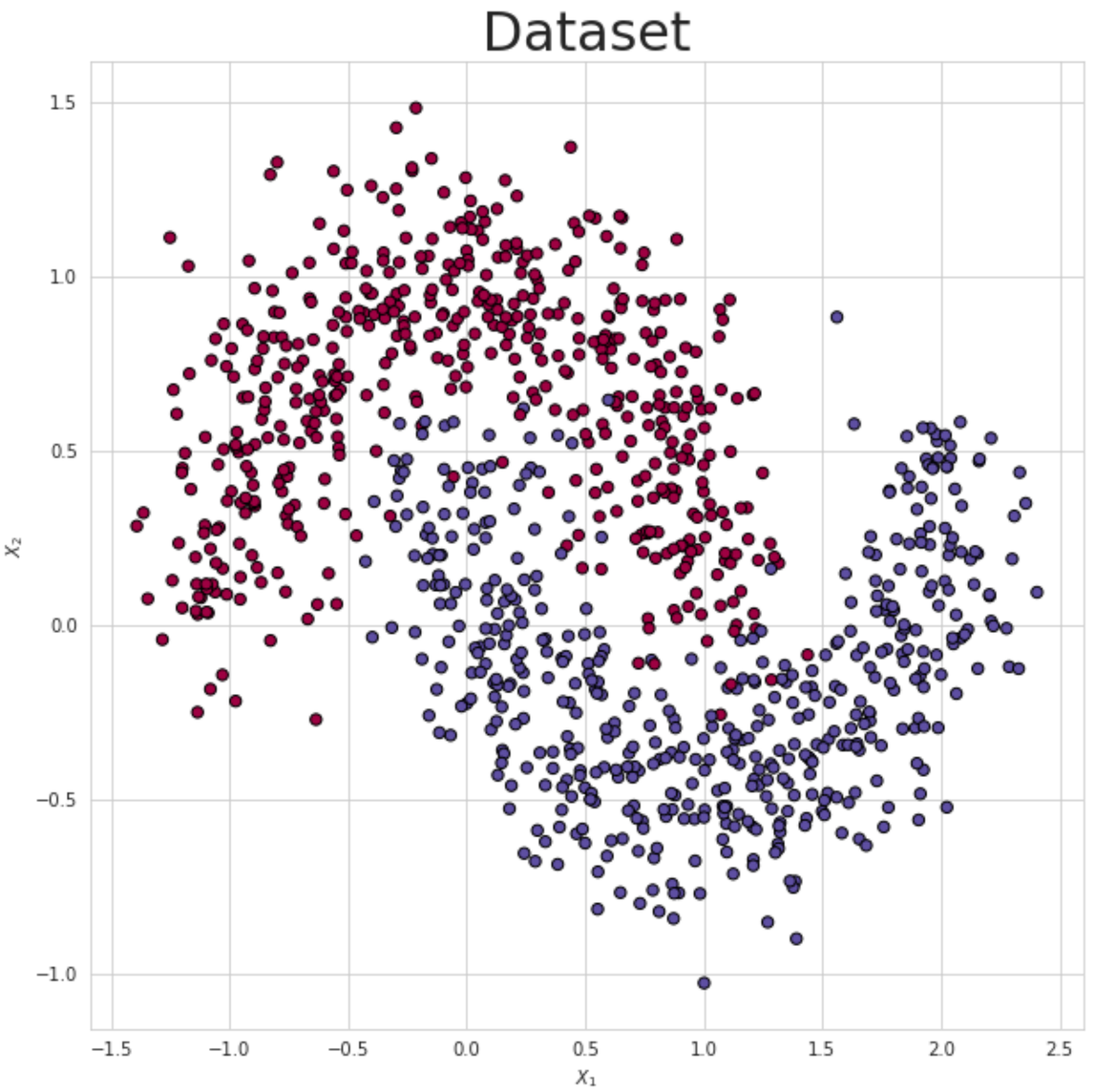


Was ist eigentlich “Machine Learning?”



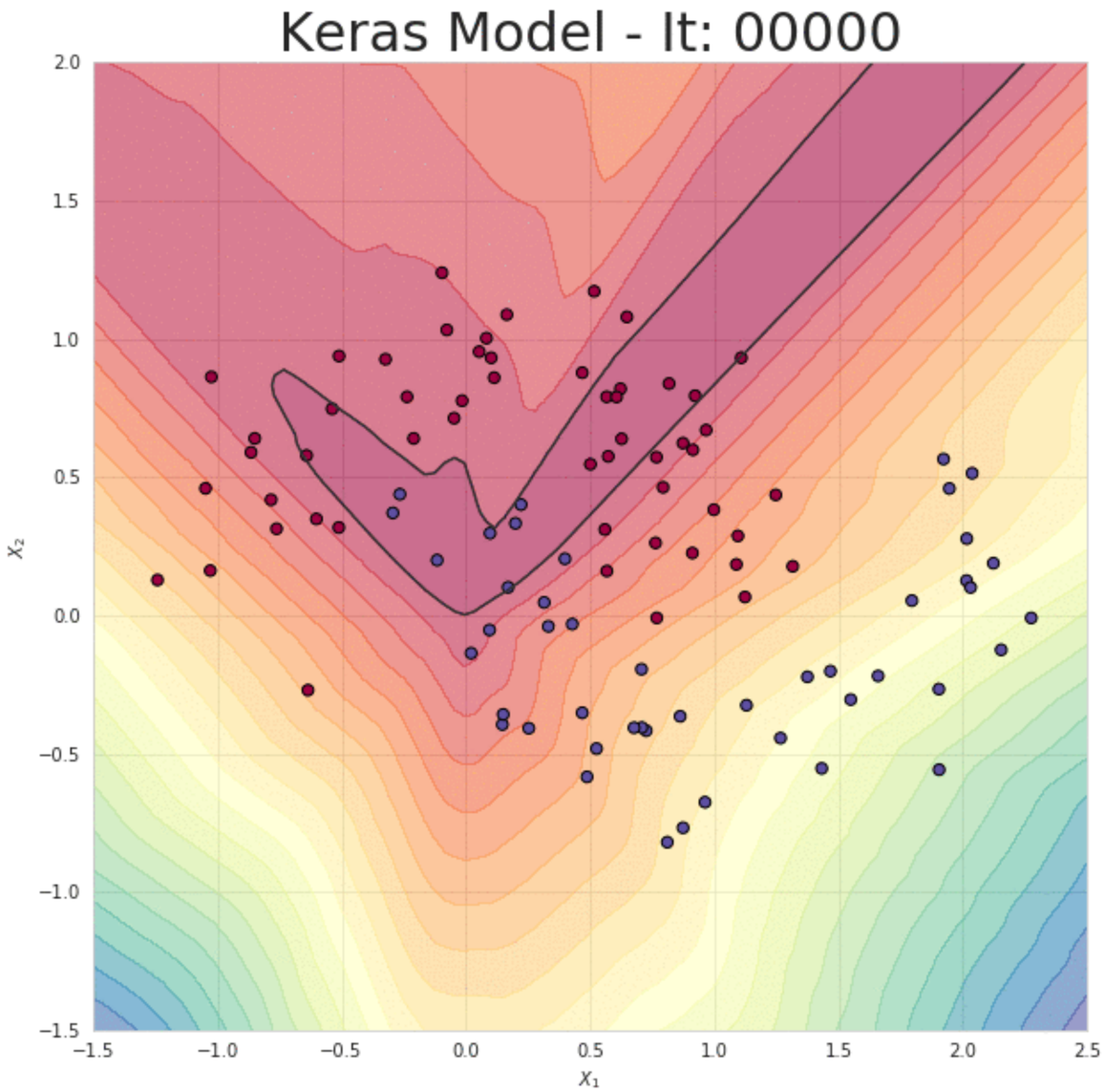
https://sandipanweb.wordpress.com/2016/07/09/convergence-of-the-gradient-descent-algorithms-stochastic-and-batch-for-the-linear-logistic-regression-and-perceptron/

Was ist eigentlich “Machine Learning?”



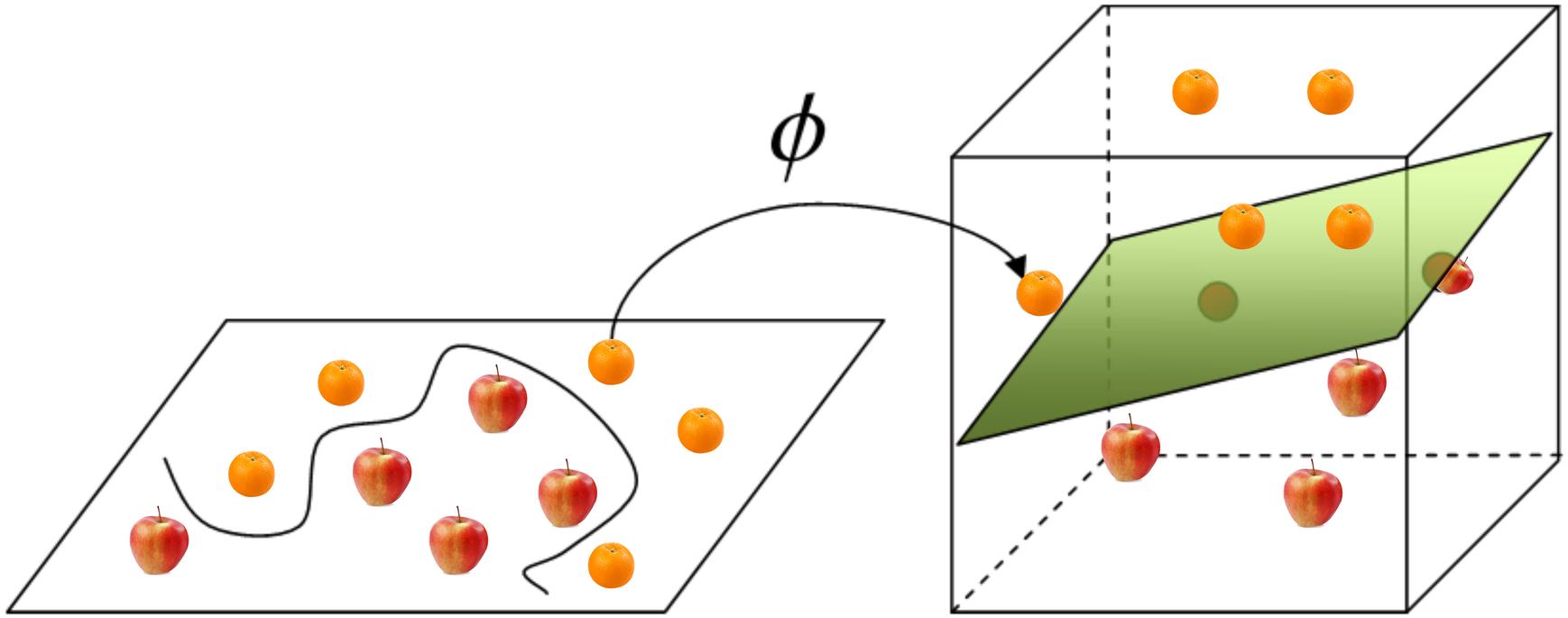
https://towardsdatascience.com/lets-code-a-neural-network-in-plain-numpy-ae7e74410795

Was ist eigentlich “Machine Learning?”



https://towardsdatascience.com/lets-code-a-neural-network-in-plain-numpy-ae7e74410795

Was ist eigentlich “Machine Learning?”



Quelle?

Arten von Machine Learning

Supervised Learning: für kategorisierte Daten (labelled data)

FARBE	FORM	GEWICHT	KATEGORIE
rot	rund	150g	Apfel
orange	rund	200g	Orange
gelb	länglich	200g	Banane
grün	rund	140g	Apfel

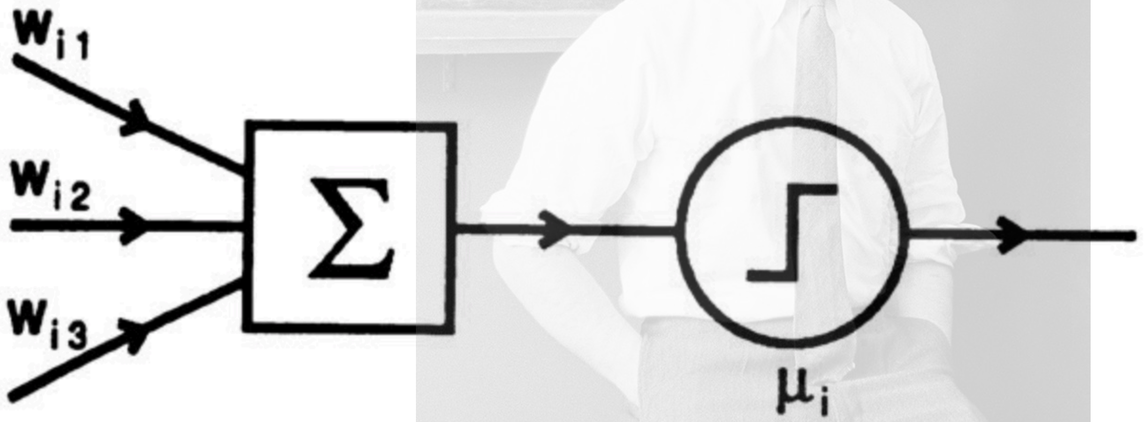
Unsupervised Learning: für nicht-kategorisierte Daten (unlabelled data)

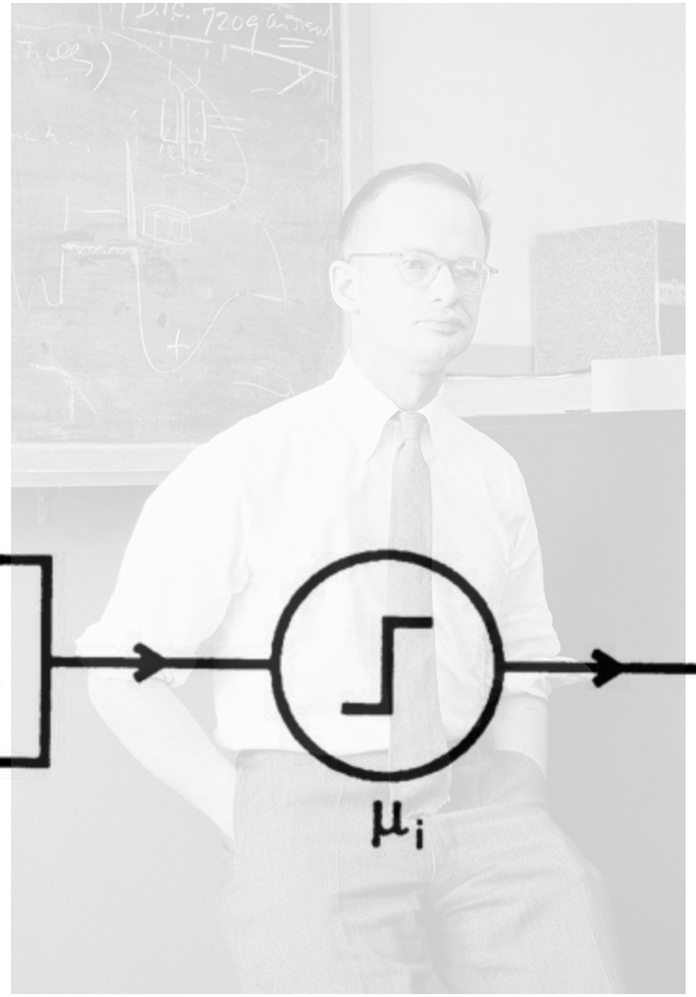
FARBE	FORM	GEWICHT
rot	rund	150g
orange	rund	200g
gelb	länglich	200g
grün	rund	140g

Reinforcement Learning: “Agent” lernt von Feedback/Umwelt

https://www.independent.co.uk/life-style/gadgets-and-tech/news/alphago-zero-go-deepmind-ai-artificial-intelligence-google-machine-learning-human-knowledge-a8009801.html

Neural Networks: Pitts/McCulloch Binary Neuron (1943)





Walter Pitts

Warren McCulloch

Interessanter Artikel: http://nautil.us/issue/21/information/the-man-who-tried-to-redeem-the-world-with-logic

Neural Networks: Frank Rosenblatt's Perceptron (1957)

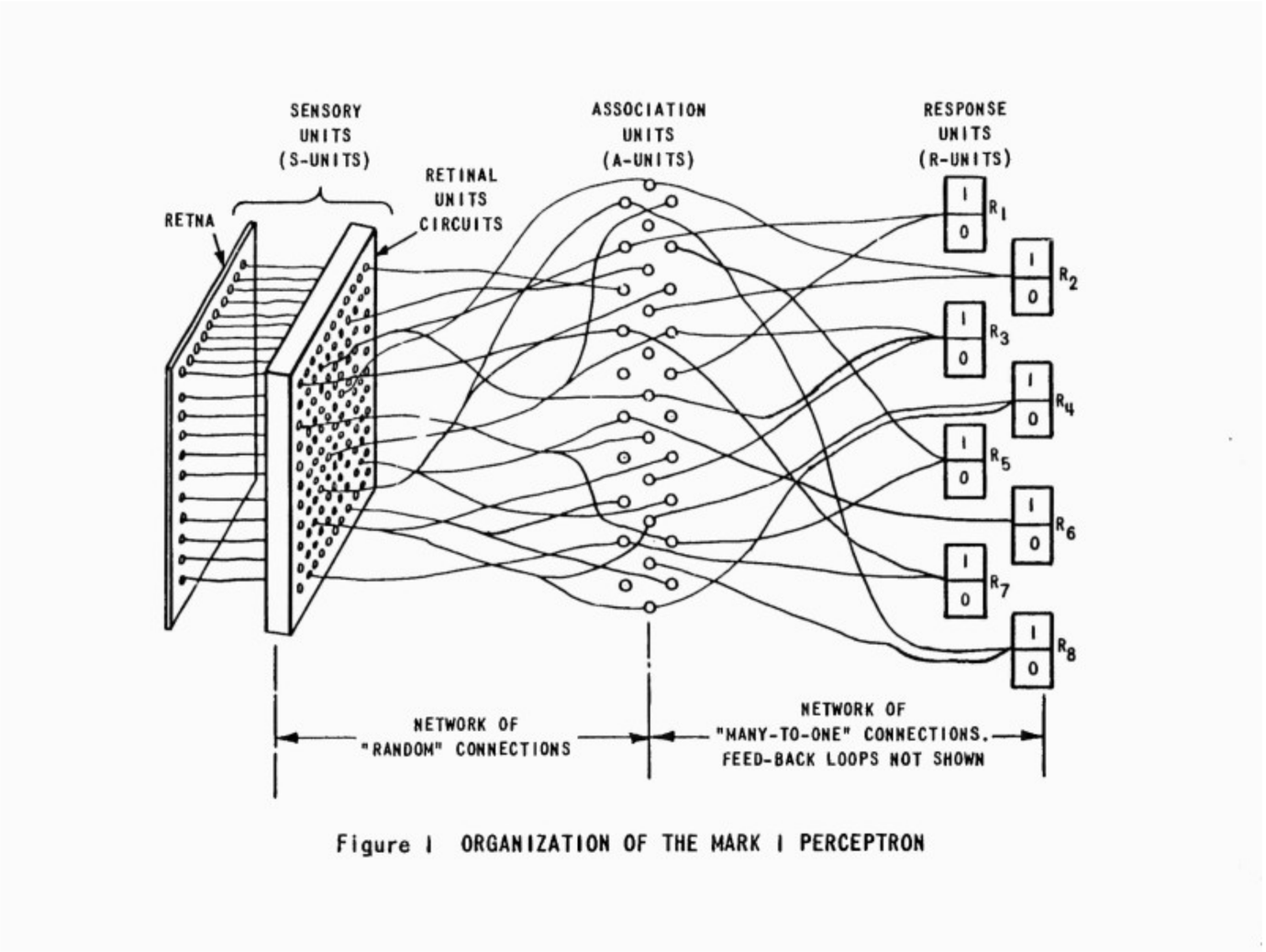
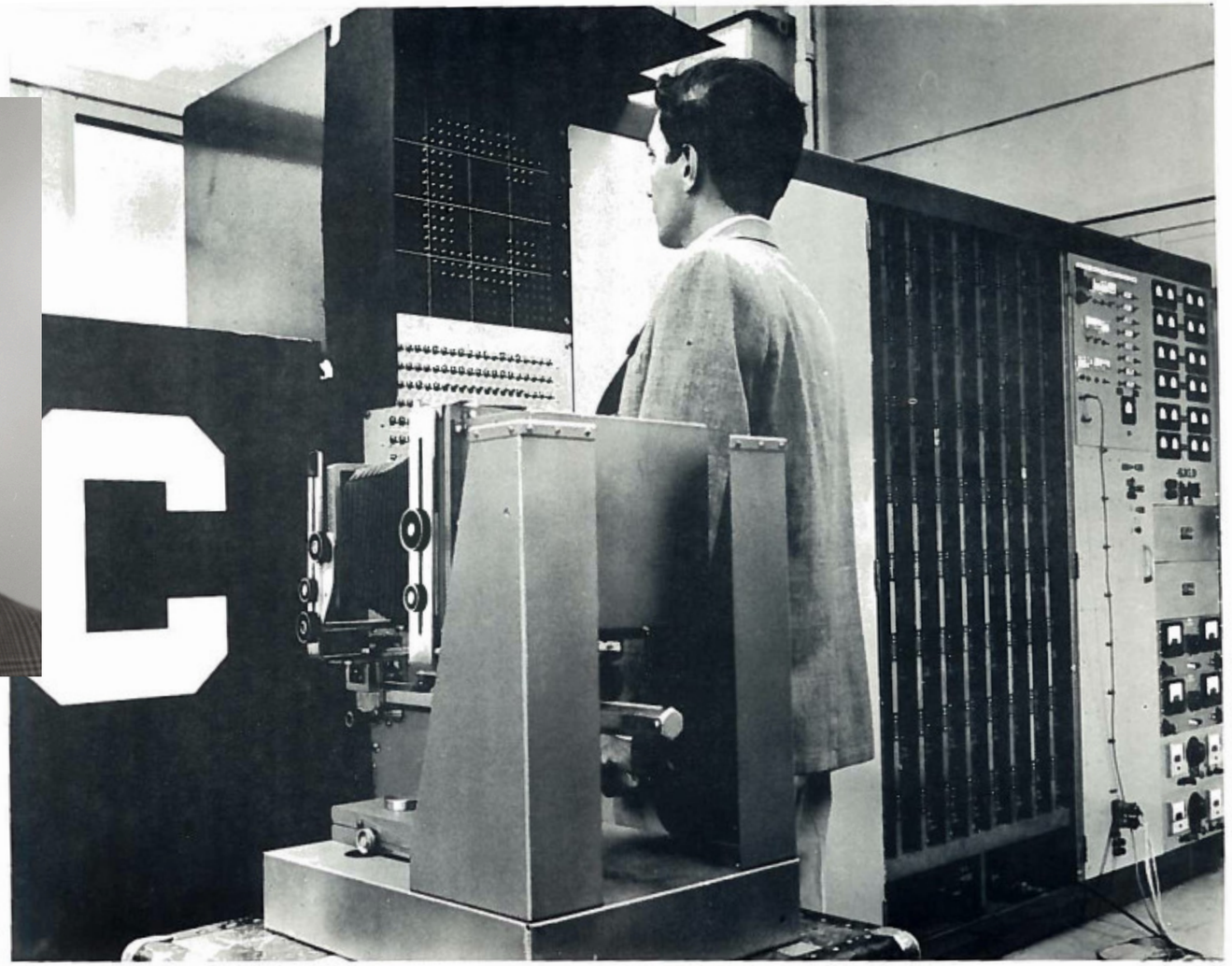


Figure 1 ORGANIZATION OF THE MARK I PERCEPTRON

Frank Rosenblatt, Mark I Perceptron Operators' Manual.
Buffalo, NY: Cornell Aeronautical Laboratory, 1960.

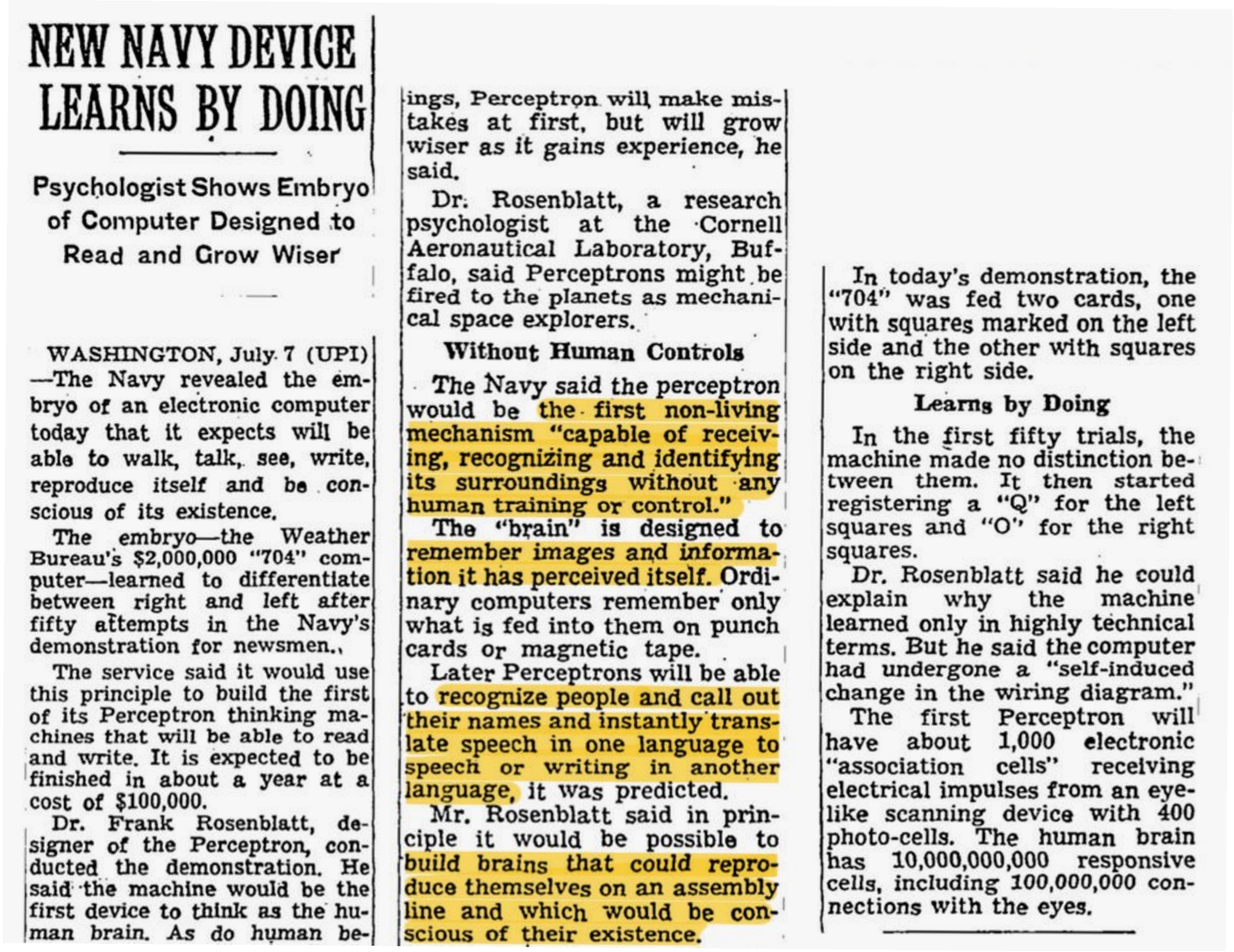
Neural Networks: Frank Rosenblatt's Perceptron (1957)

Frank Rosenblatt
Source: Cornell



Rosenblatt, Frank (1961) Principles of Neurodynamics: Perceptrons and the Theory of Brain Mechanisms. Buffalo, NY: Cornell Aeronautical Laboratory

Neural Networks: Frank Rosenblatt's Perceptron (1957)



NEW NAVY DEVICE LEARNS BY DOING

Psychologist Shows Embryo of Computer Designed to Read and Grow Wiser

WASHINGTON, July 7 (UPI) —The Navy revealed the embryo of an electronic computer today that it expects will be able to walk, talk, see, write, reproduce itself and be conscious of its existence.

The embryo—the Weather Bureau's $2,000,000 "704" computer—learned to differentiate between right and left after fifty attempts in the Navy's demonstration for newsmen.

The service said it would use this principle to build the first of its Perceptron thinking machines that will be able to read and write. It is expected to be finished in about a year at a cost of $100,000.

Dr. Frank Rosenblatt, designer of the Perceptron, conducted the demonstration. He said the machine would be the first device to think as the human brain. As do human beings, Perceptron will make mistakes at first, but will grow wiser as it gains experience, he said.

Dr. Rosenblatt, a research psychologist at the Cornell Aeronautical Laboratory, Buffalo, said Perceptrons might be fired to the planets as mechanical space explorers.

Without Human Controls

The Navy said the perceptron would be the first non-living mechanism "capable of receiving, recognizing and identifying its surroundings without any human training or control."

The "brain" is designed to remember images and information it has perceived itself. Ordinary computers remember only what is fed into them on punch cards or magnetic tape.

Later Perceptrons will be able to recognize people and call out their names and instantly translate speech in one language to speech or writing in another language, it was predicted.

Mr. Rosenblatt said in principle it would be possible to build brains that could reproduce themselves on an assembly line and which would be conscious of their existence.

In today's demonstration, the "704" was fed two cards, one with squares marked on the left side and the other with squares on the right side.

Learns by Doing

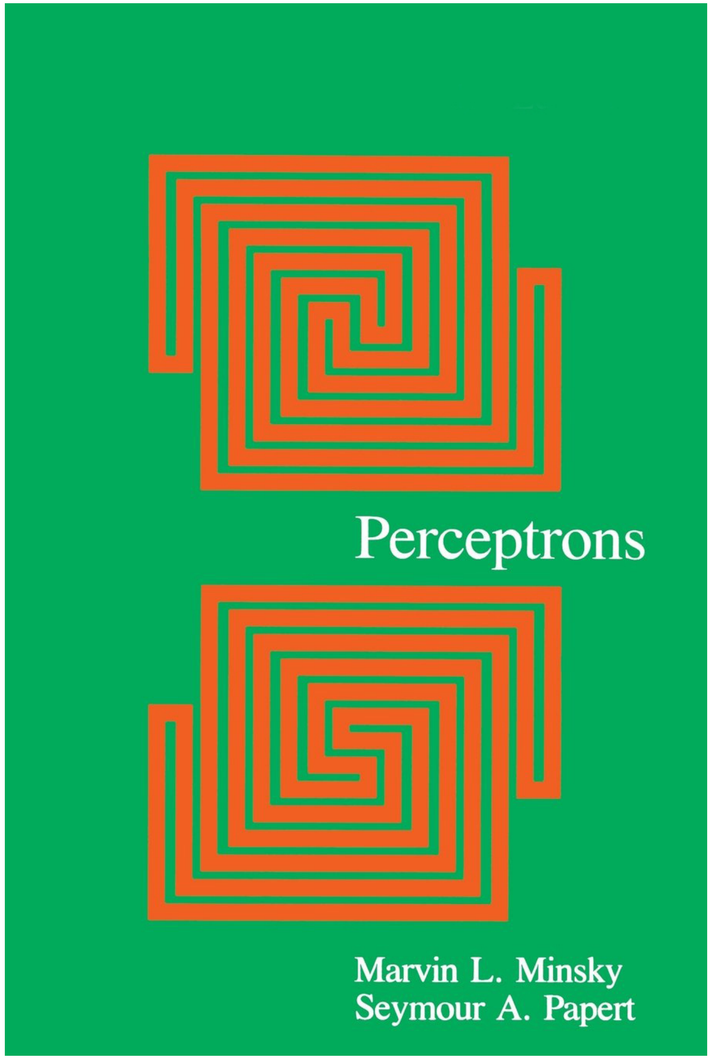
In the first fifty trials, the machine made no distinction between them. It then started registering a "Q" for the left squares and "O" for the right squares.

Dr. Rosenblatt said he could explain why the machine learned only in highly technical terms. But he said the computer had undergone a "self-induced change in the wiring diagram."

The first Perceptron will have about 1,000 electronic "association cells" receiving electrical impulses from an eye-like scanning device with 400 photo-cells. The human brain has 10,000,000,000 responsive cells, including 100,000,000 connections with the eyes.

8. Juli 1958, New York Times

Neural Networks: Minsky und Papert, “AI Winter” (1970-90er)



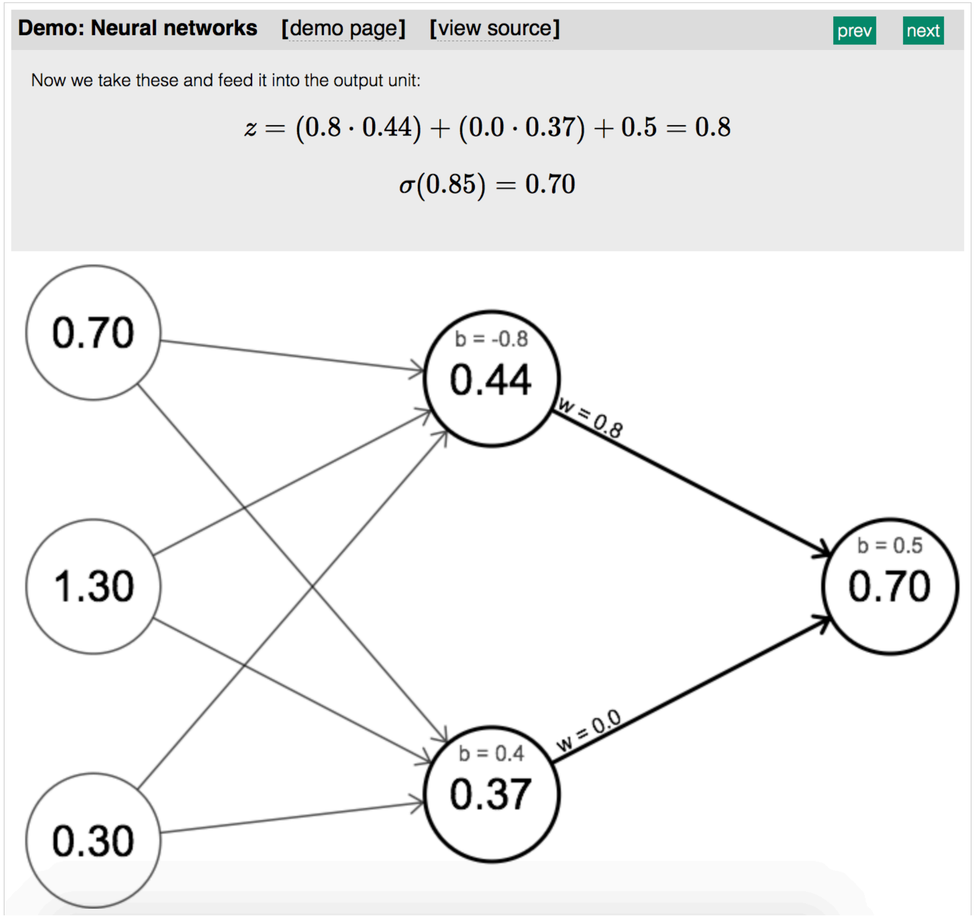
Minsky, Marvin, and Seymour Papert. “Perceptrons: An introduction to computational geometry.” MIT Press

Neural Networks: Deep Learning (2000er-heute)

Bild: NVidia

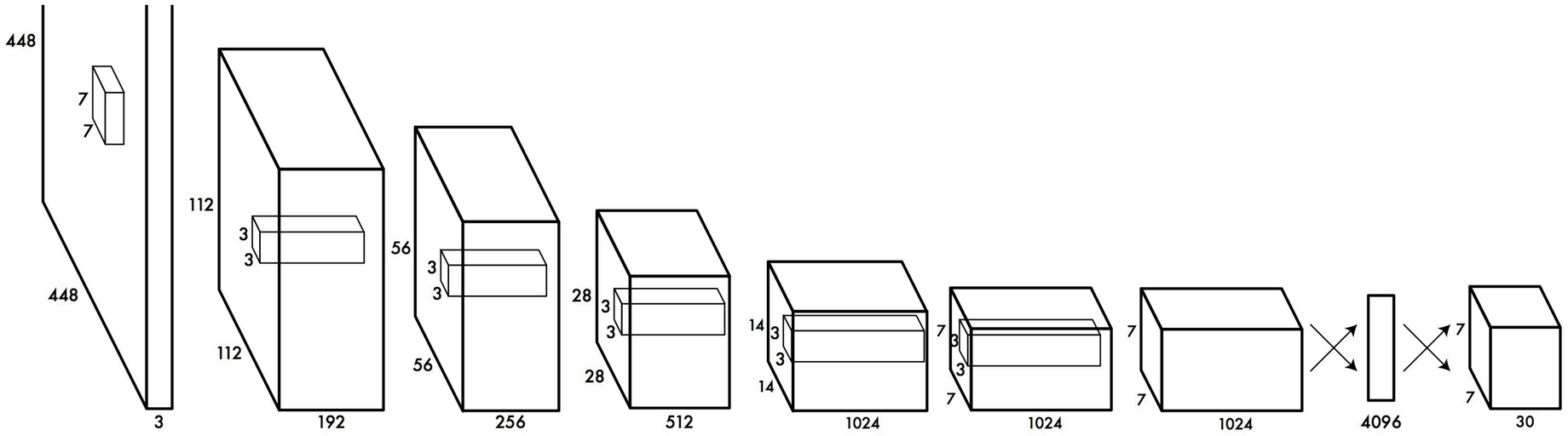
ImageNet. Bild: https://cs.stanford.edu/people/karpathy/cnnembed/

Neural Networks: Basics



https://ml4a.github.io/ml4a/neural_networks/

Deep Neural Networks: mehr Schichten, Convolution, ...



You Only Look Once: Unified, Real-Time Object Detection, Redmon et al., arXiv:1506.02640

Begriffe, Zutaten, Ablauf

Task

28 x 28
784 pixels

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	186	254	254	254	23	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	7	35	192	254	253	253	253	253	98	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	7	169	253	253	254	216	107	142	253	135	7	79	6	0	0	0	0	0
0	0	0	0	0	68	0	0	0	32	183	253	253	222	57	10	0	92	253	47	206	253	110	0	0	0	0	0
0	0	0	0	0	83	0	0	0	171	253	253	185	14	0	0	0	47	193	254	253	222	34	0	0	0	0	0
0	0	0	0	0	0	0	0	61	255	254	183	8	0	0	0	71	209	254	255	226	60	0	0	0	0	0	0
0	0	0	0	0	0	0	0	135	254	245	128	118	118	118	162	241	253	253	249	50	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	98	254	253	253	253	253	254	253	253	253	253	98	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	45	177	213	213	213	213	117	105	253	253	185	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	207	253	222	14	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	46	217	254	205	45	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	34	222	254	228	27	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	234	253	205	94	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	71	234	251	222	45	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	83	222	253	237	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	23	217	254	235	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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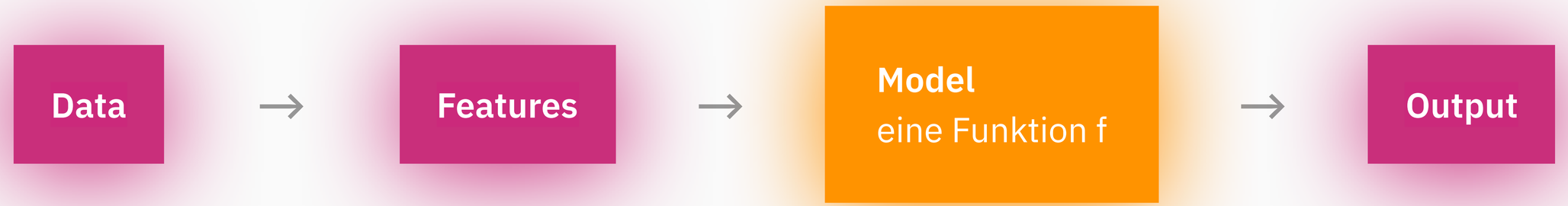
0	0	0	0	0	0	58	237	237	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	108	245	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Bild: ml4a.github.io

Task



28 x 28
784 pixels

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	7	35	192	254	253	253	253	253	98	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	7	169	253	253	254	216	107	142	253	135	7	79	6	0	0	0	0	0
0	0	0	0	0	68	0	0	0	32	183	253	253	222	57	10	0	92	253	47	206	253	110	0	0	0	0	0
0	0	0	0	0	83	0	0	0	171	253	253	185	14	0	0	0	47	193	254	253	222	34	0	0	0	0	0
0	0	0	0	0	0	0	0	61	255	254	183	8	0	0	0	71	209	254	255	226	60	0	0	0	0	0	0
0	0	0	0	0	0	0	0	135	254	245	128	118	118	118	162	241	253	253	249	50	0	0	0	0	0	0	0
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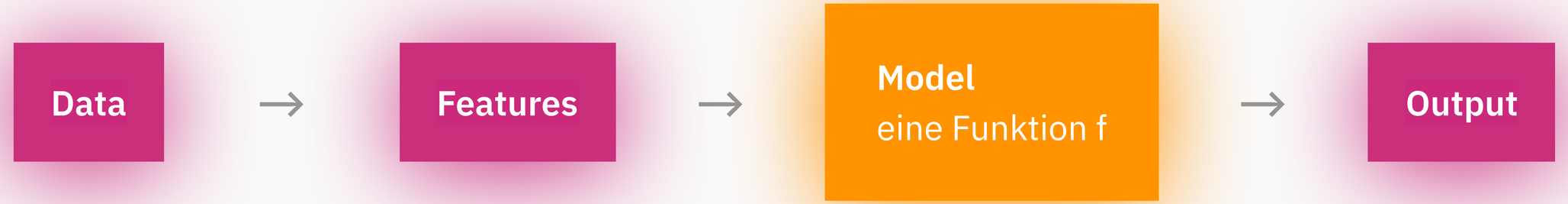
0	0	0	0	0	0	0	0	23	217	254	235	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	4	147	254	228	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	107	253	213	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	58	237	237	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	108	245	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

→ $f([0,0,\ldots])$ → 9

Bild: ml4a.github.io

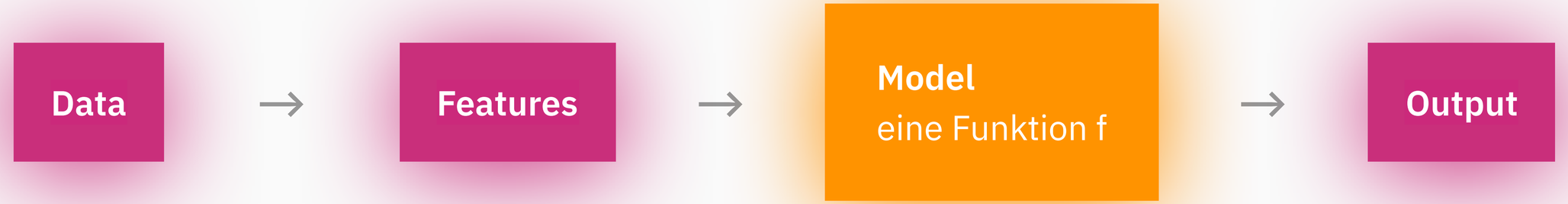
Training

Task

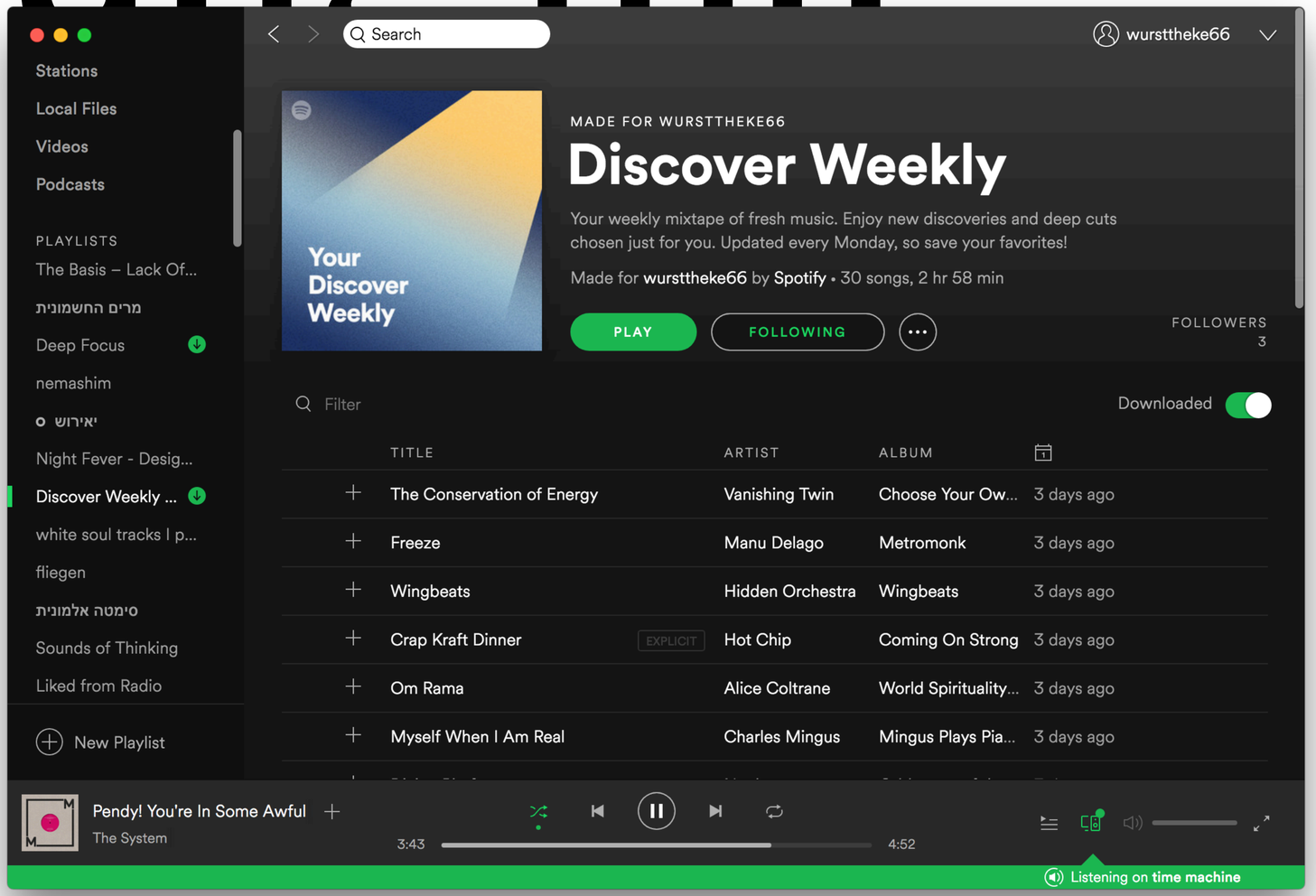


Training

Task



Gestaltung mit Machin



Das Interface für Spotify’s Discover Weekly Feature ist: die Playlist

Gestaltung mit ML: Notwendigkeit & Machbarkeit

a. Erwarte nicht, dass ML dein Problem findet!
b. Brauche ich ML oder gibt es eine einfachere Lösung?
c. Was würde die User Experience verbessern oder mein Problem lösen, ungeachtet der Technologie?
d. Prototyping: Wizard of Oz Methode
e. Wie plausibel ist meine Idee?
f. Welche Daten sind verfügbar, welche können wir sammeln?

Gestaltung mit ML: Kontrolle & Transparenz

a. Wie wahrt der User die Kontrolle über das System?
b. Heben sich ML-Inhalte erkennbar von anderen Inhalten ab?
c. Vertrauen: Wie werden Entscheidungen und Verhalten des Computers kommuniziert? Sind sie interpretierbar?
d. Wird kommuniziert, welche Aufgabe das System zu erfüllen versucht hat?
e. Feedback: Wie können Bedenken und Wünsche des Menschen repräsentiert werden?
f. Affordances: Wie führen wir den User?

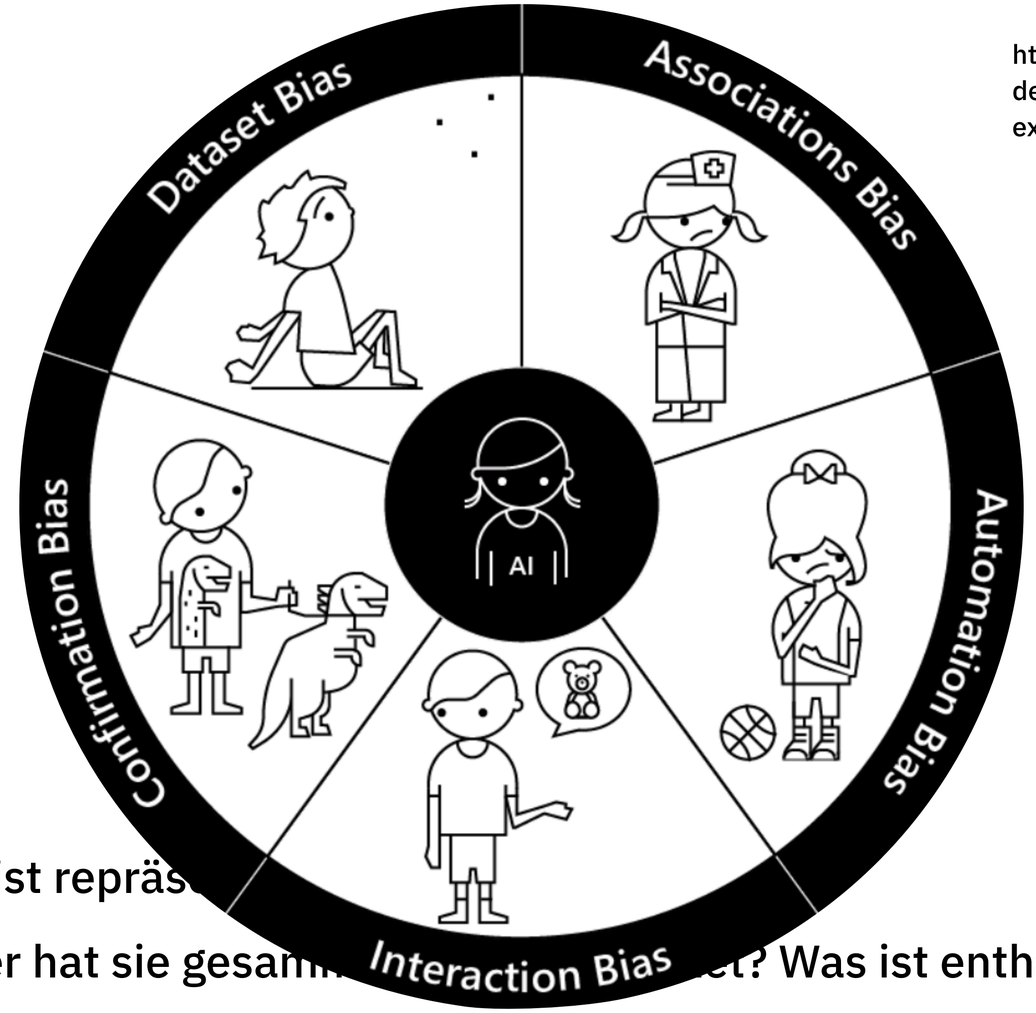
Gestaltung mit ML: Umgang mit Unsicherheit

a. Sind Risiken kommuniziert und realistische Erwartungen gesetzt?
b. Was wären Konsequenzen im Falle eines Fehlers?
c. Gibt es eine Möglichkeit, Probleme zu melden?
d. Sind “Sanity-Checks” eingebaut?
e. Gibt es ein Fallback zu einem konventionellen Interface?
f. Wurde das System ausreichend getestet?

Gestaltung mit ML: Bias & Ethik

a. Wessen Perspektive/Weltbild ist repräsentiert? Welche nicht?
b. Woher kommen die Daten? Wer hat sie gesammelt, wer bearbeitet? Was ist enthalten und was nicht?
c. Wer nutzt das System? Wer ist ausgeschlossen?
d. Werden Ethik und Menschenrechte berücksichtigt?

Gestaltung mit ML: Bias & Ethik



https://medium.com/microsoft-design/how-to-recognize-exclusion-in-ai-ec2d6d89f850

a. Wessen Perspektive/Weltbild ist repräs
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c. Wer nutzt das System? Wer ist ausgeschlossen?
d. Werden Ethik und Menschenrechte berücksichtigt?

Gestaltung mit ML: Hype und Mythos

a. **Was ist tatsächlich messbar/berechenbar, was nicht?** → Physiognomik, …
b. **Wie ernst können wir ML “Vorhersagen” nehmen?**
c. **Wie vermeiden wir Anthropomorphismus und Mythen?**
d. **Welche Verhalten werden durch unser System begünstigt?** → Filter-Bubbles, Attention Economy, …

Gestaltung mit ML: Hype und Mythos

DEEP NEURAL NETWORKS CAN DETECT SEXUAL ORIENTATION FROM FACES

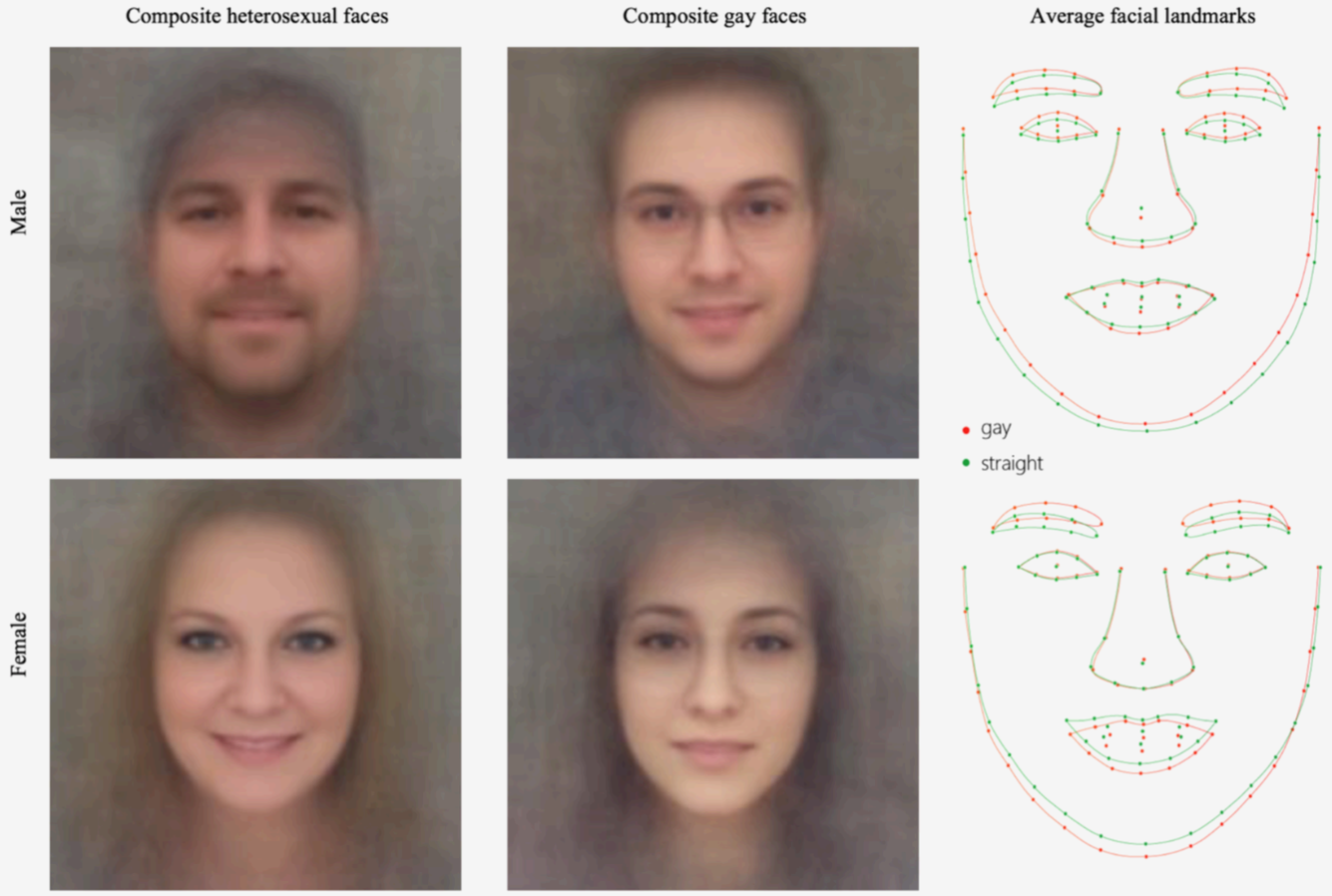
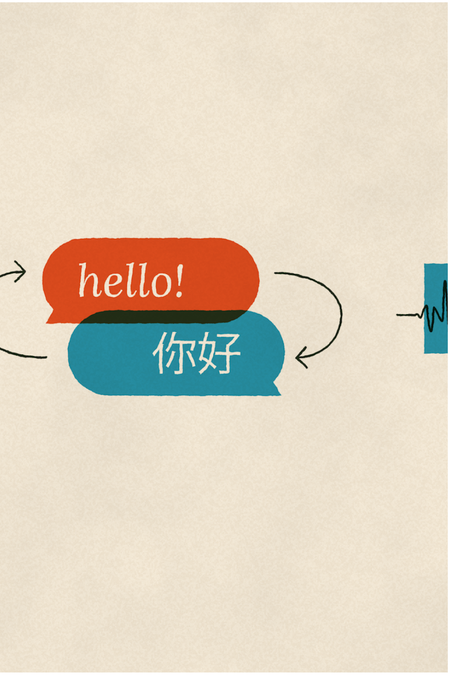


Figure 4. Composite faces and the average facial landmarks built by averaging faces classified as most and least likely to be gay.

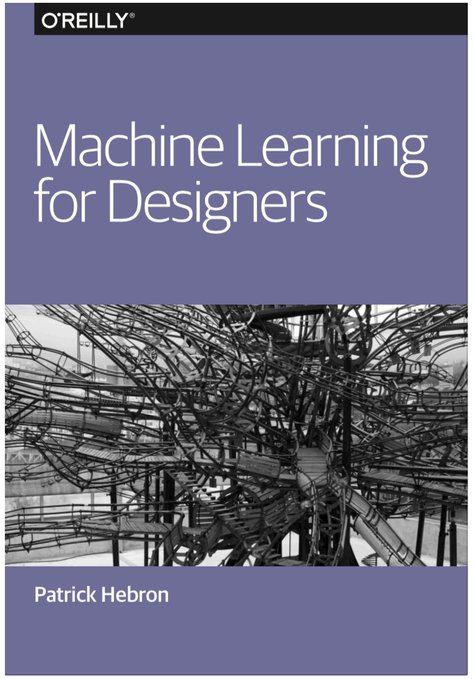
a. Was ist tatsächlich m
b. Wie ernst können wir
c. Wie vermeiden wir Anthropomorphismus und Mythen?
d. **Welche Verhalten werden durch unser System begünstigt?** → Filter-Bubbles, Attention Economy, …

Ressourcen

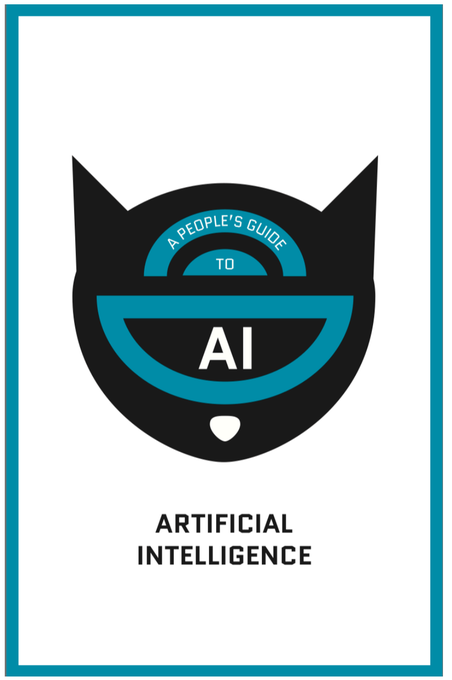


Human-Centered ML
Google People+AI Research

Intelligence Augmentation Toolkit
Futurice



Machine Learning for Designers
Patrick Hebron



A People's Guide to AI
Mimi Onuoha and Diana Nucera

Machine Learning for Artists
Gene Kogan et al.

Machine Learning für Designer

Showcase

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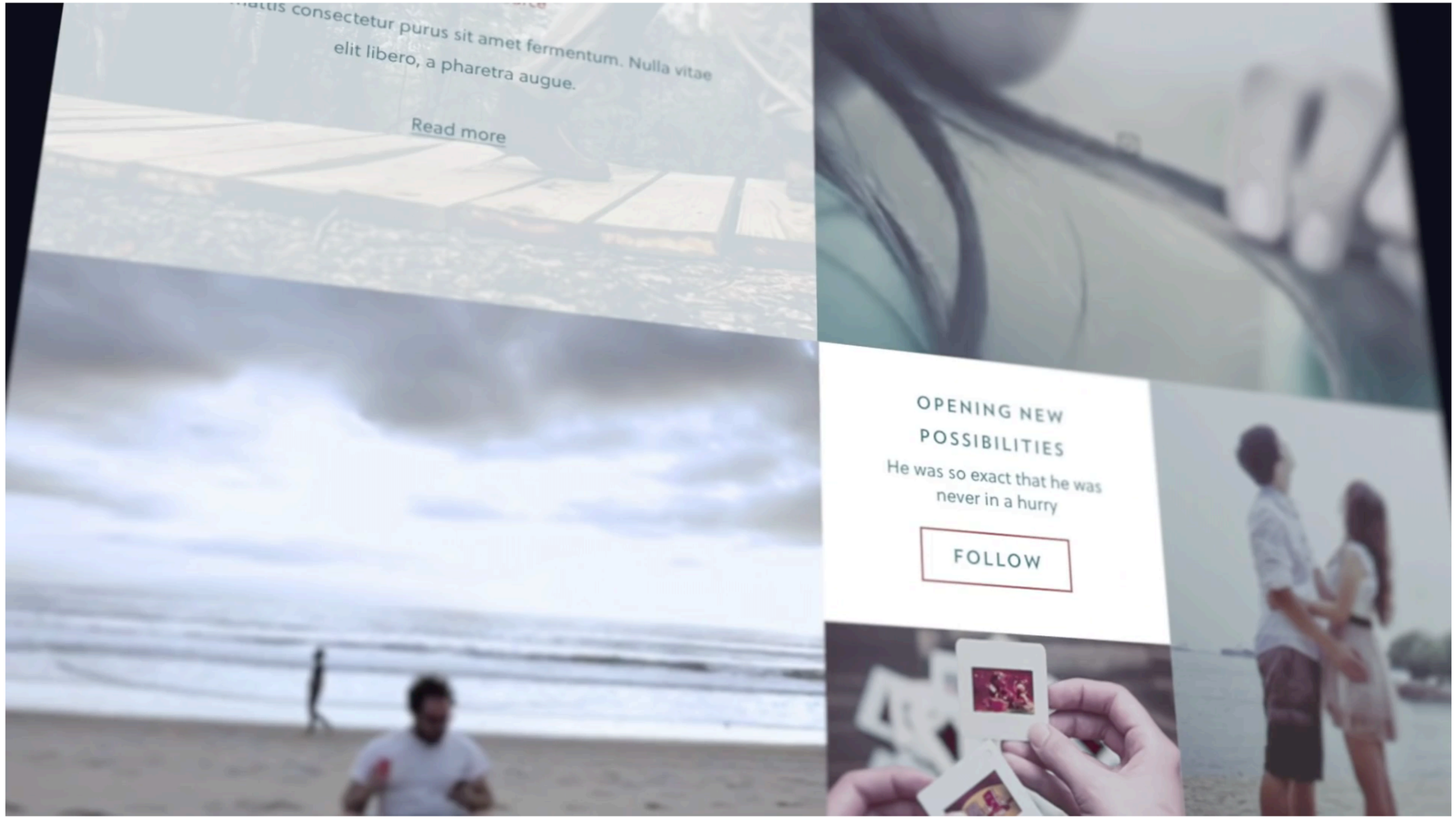
Showcase: ML als Designtool

Adaptives Layout, The Grid

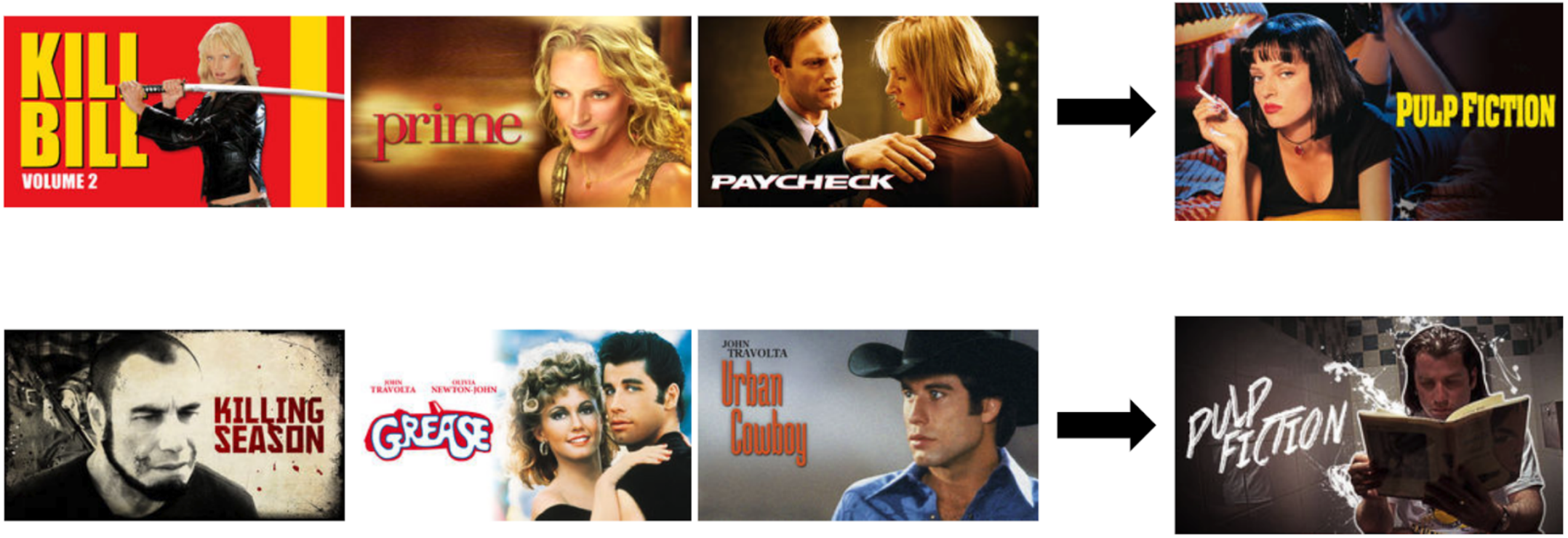


www.thegrid.io

Adaptives Layout, Flipboard

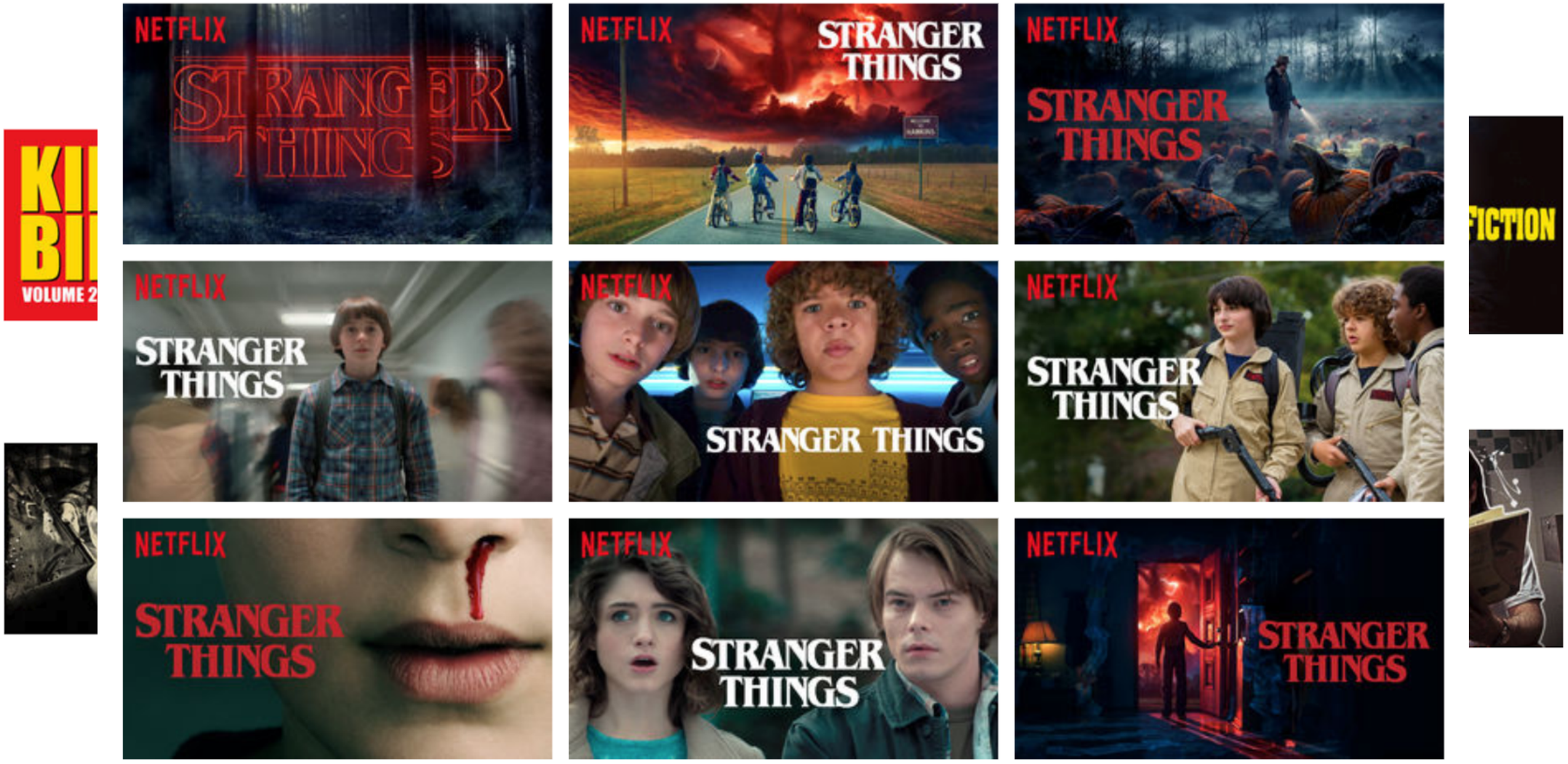
techcrunch.com/2014/03/23/layout-in-flipboard-for-web-and-windows/

Personalisierte Assets, Netflix



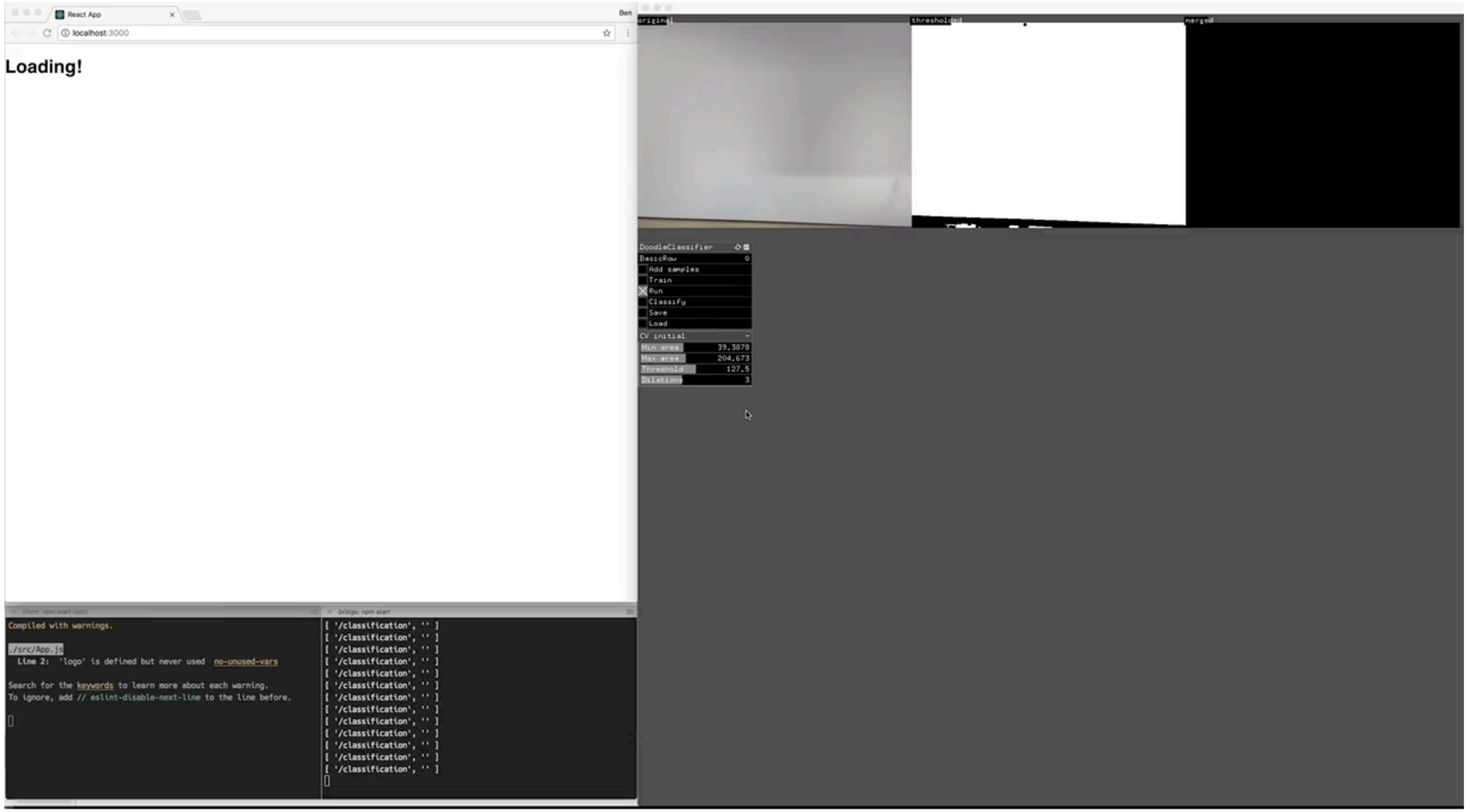
medium.com/netflix-techblog/artwork-personalization-c589f074ad76

Personalisierte Assets, Netflix



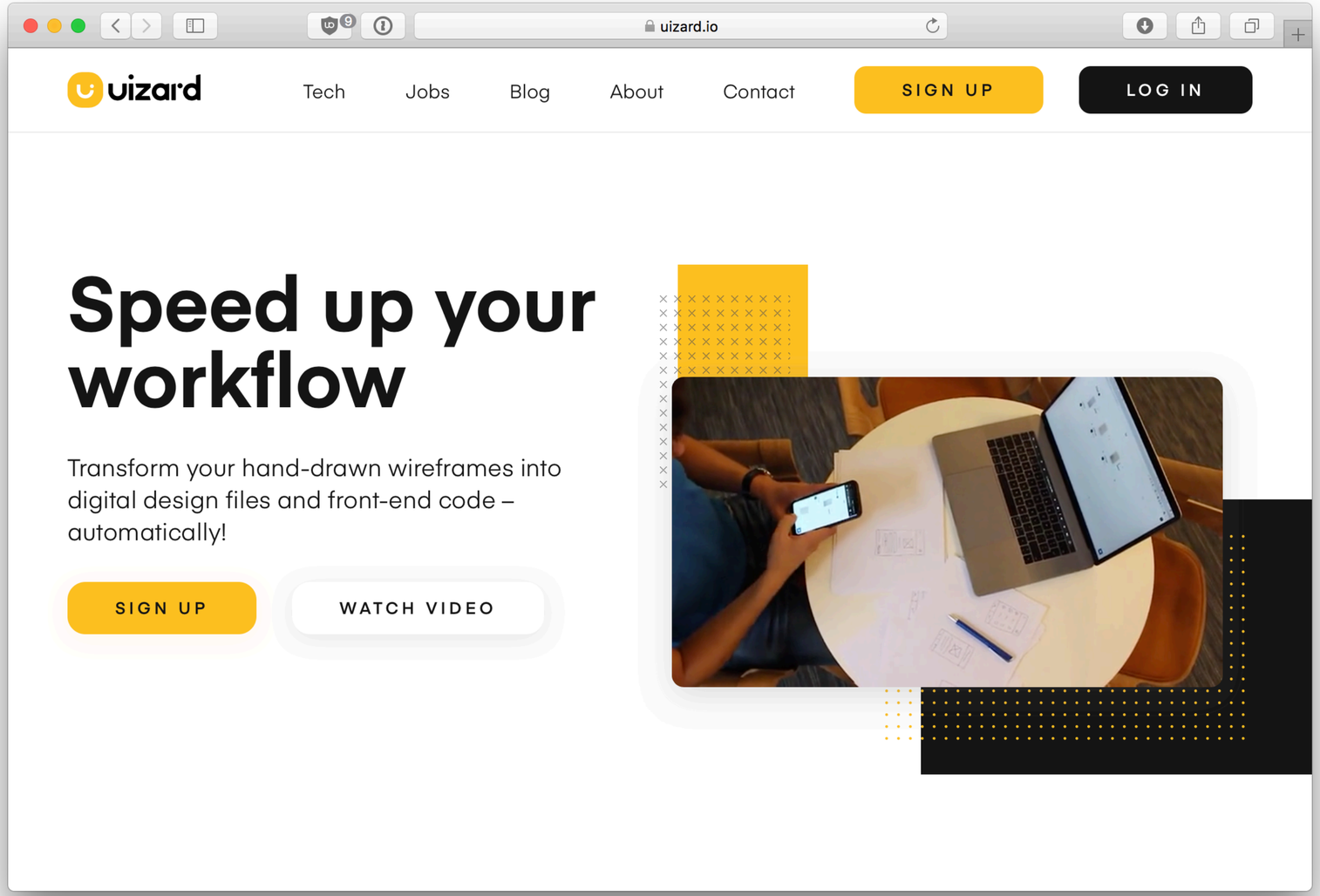
medium.com/netflix-techblog/artwork-personalization-c589f074ad76

Sketching Interfaces, Airbnb



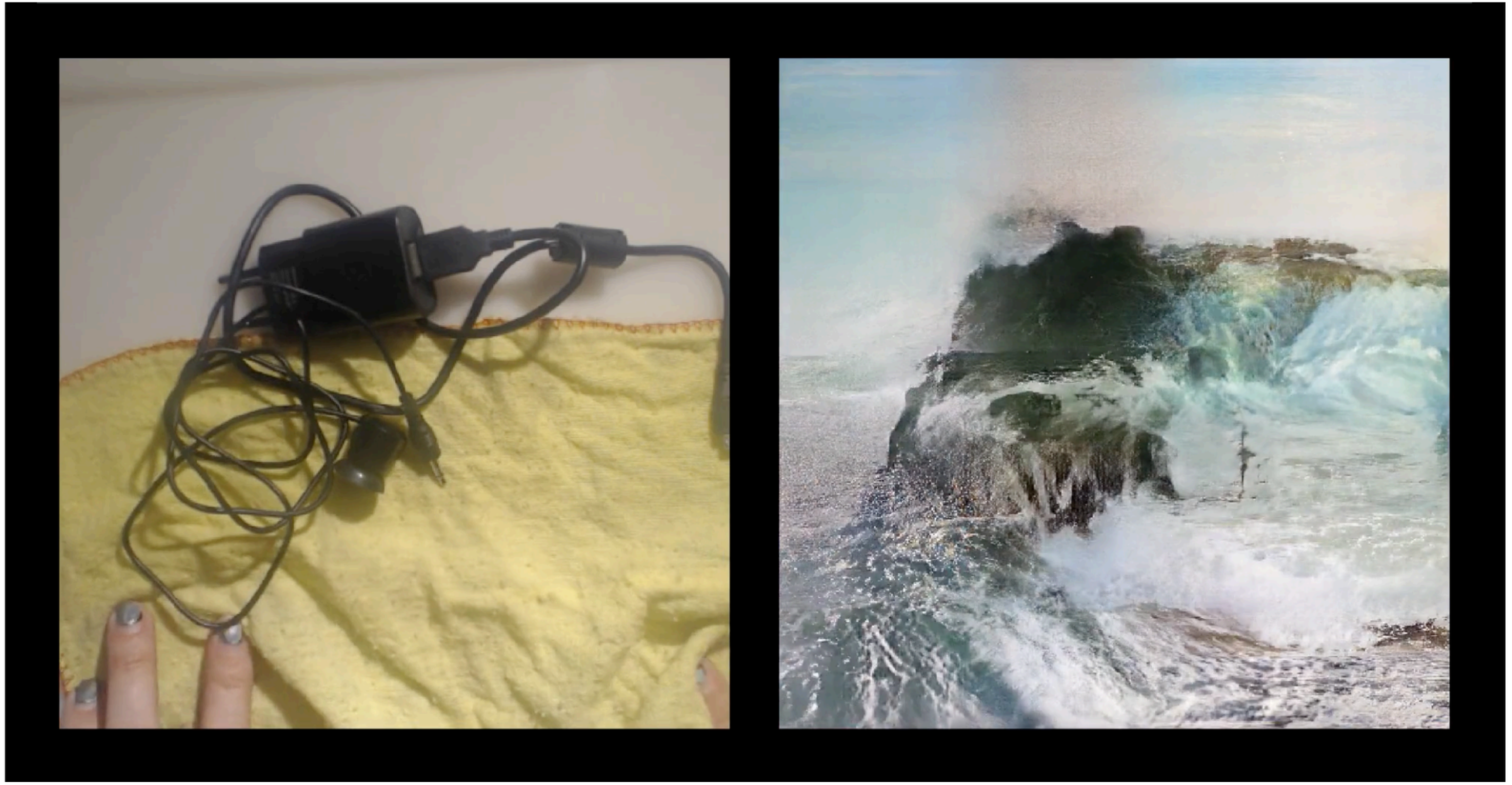
airbnb.design/sketching-interfaces/

Sketching Interfaces, UIzard



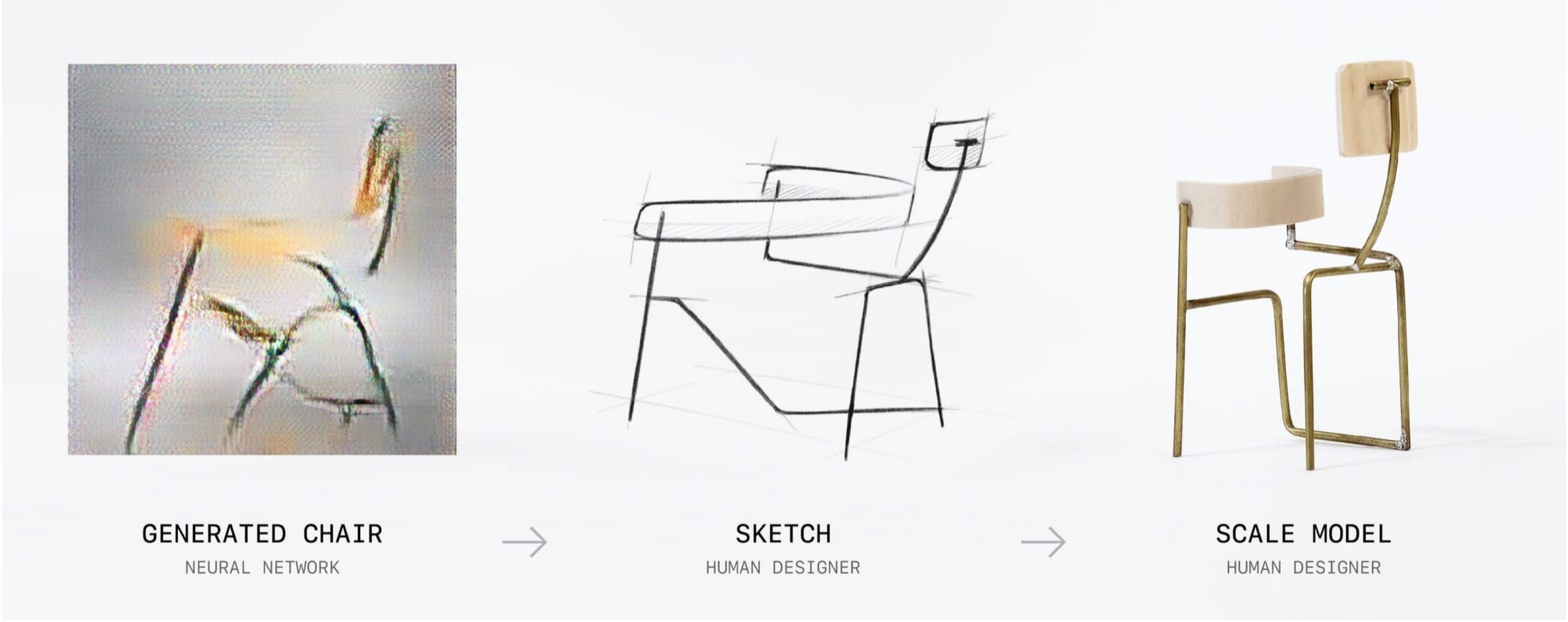
github.com/ngundotra/code2pix

Learning To See: Gloomy Sunday, Memo Akten



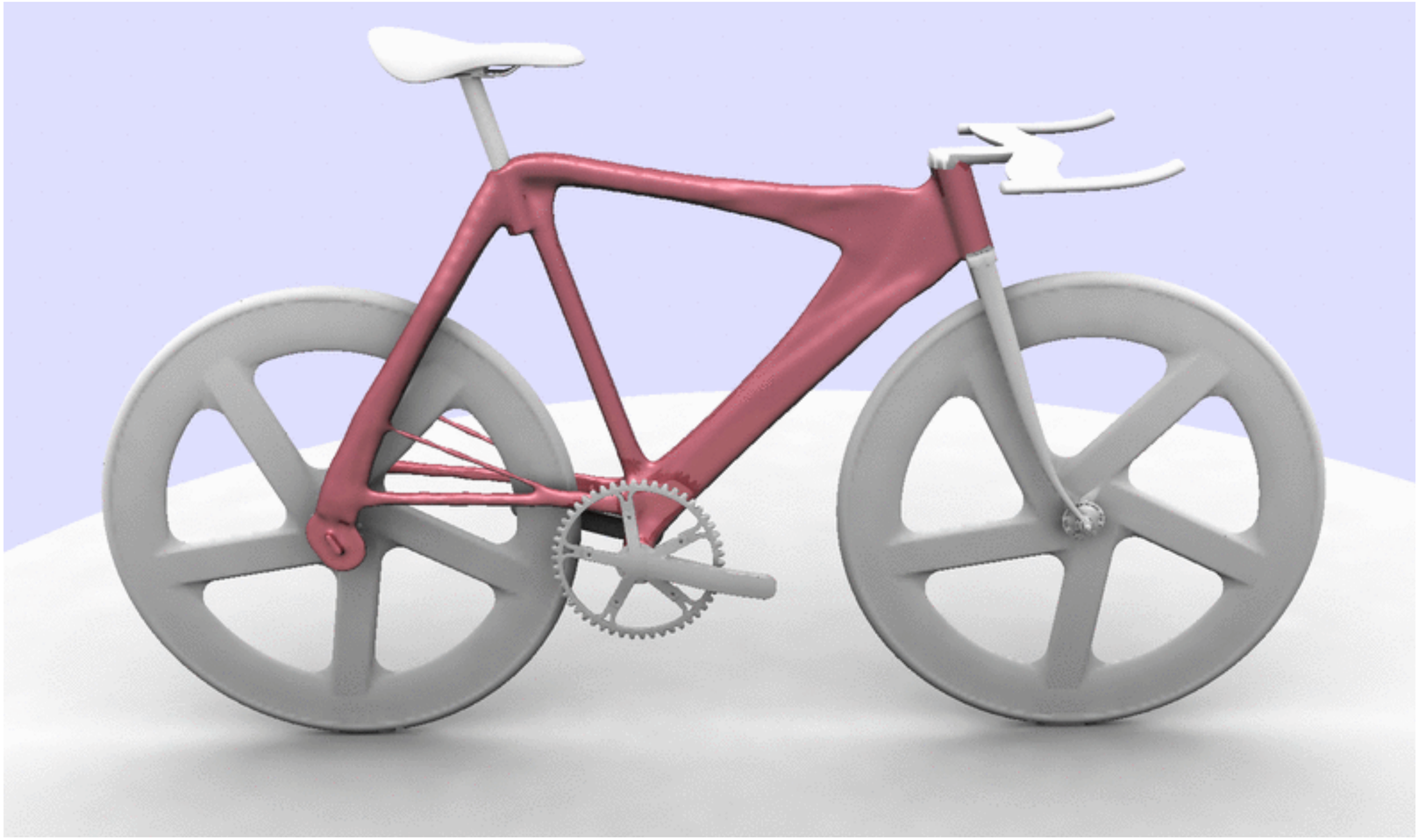
vimeo.com/260612034

Generative Inspiration, Philipp Schmitt, Steffen Weiß



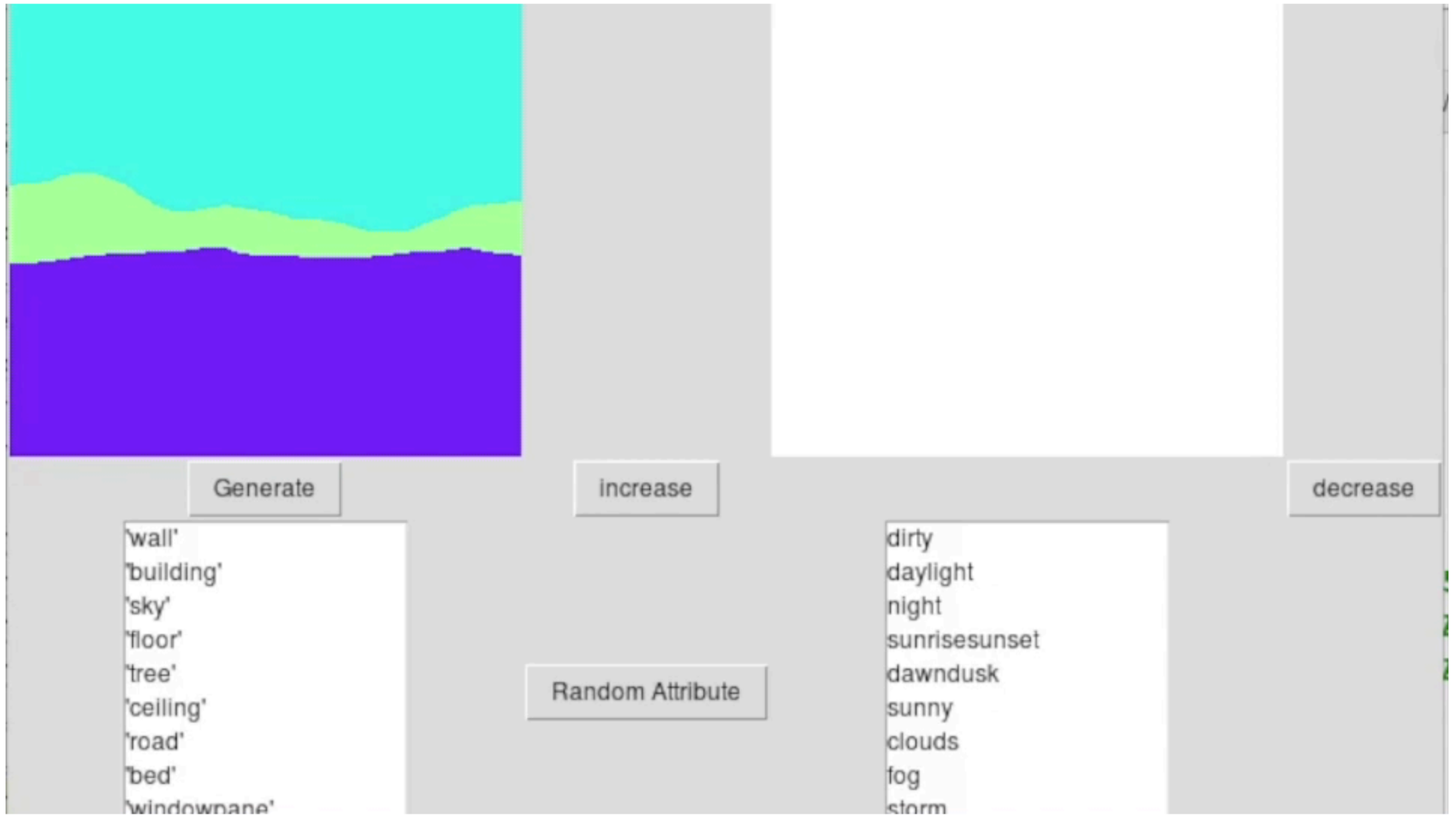
philippschmitt.com/work/chair

Generative Gestaltung, Autodesk Dreamcatcher



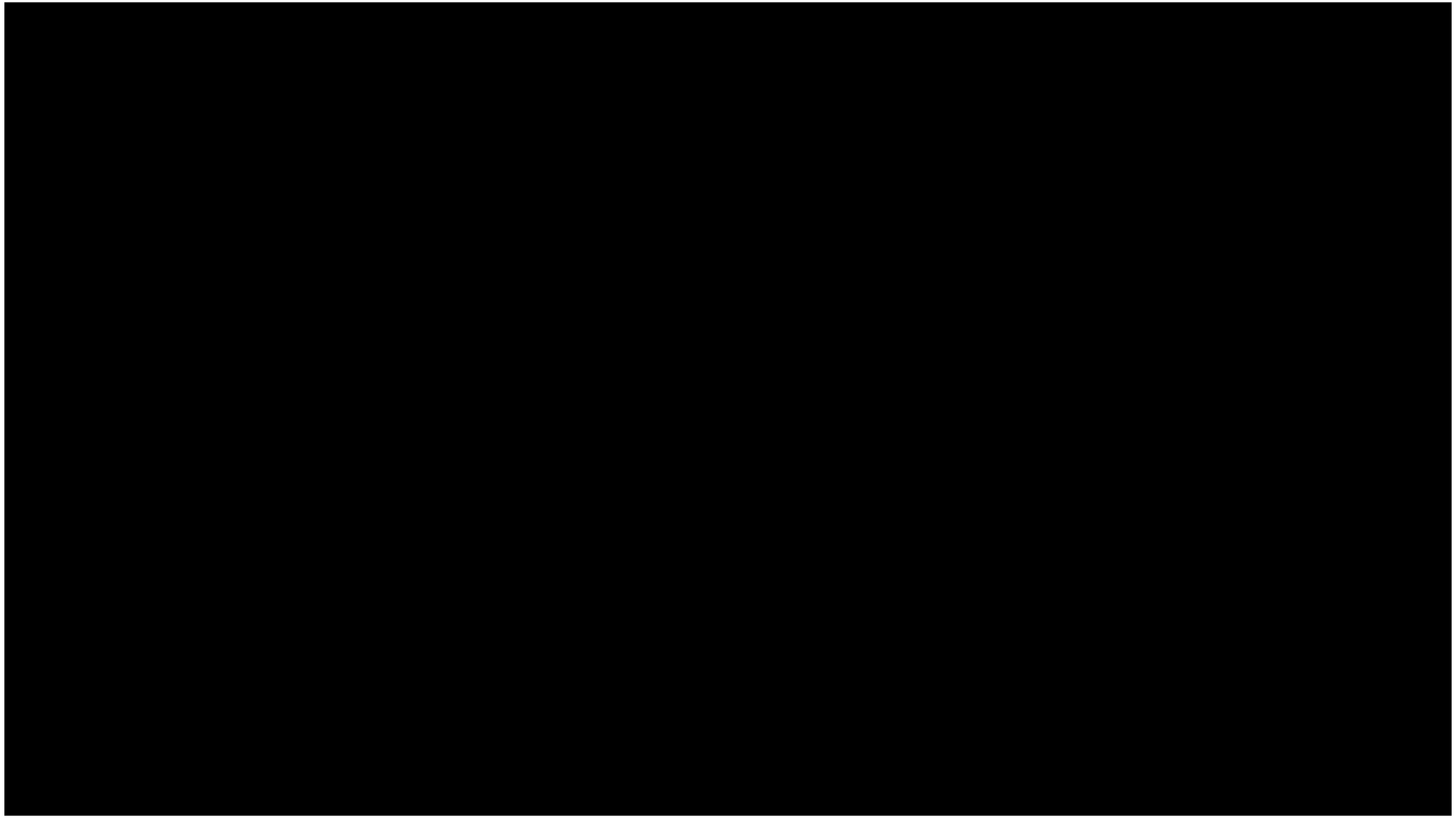
www.autodeskresearch.com/projects/dreamcatcher

Generative Gestaltung, Pix2pix



Karacan et. Al, web.cs.hacettepe.edu.tr/~karacan/projects/attribute_hallucination

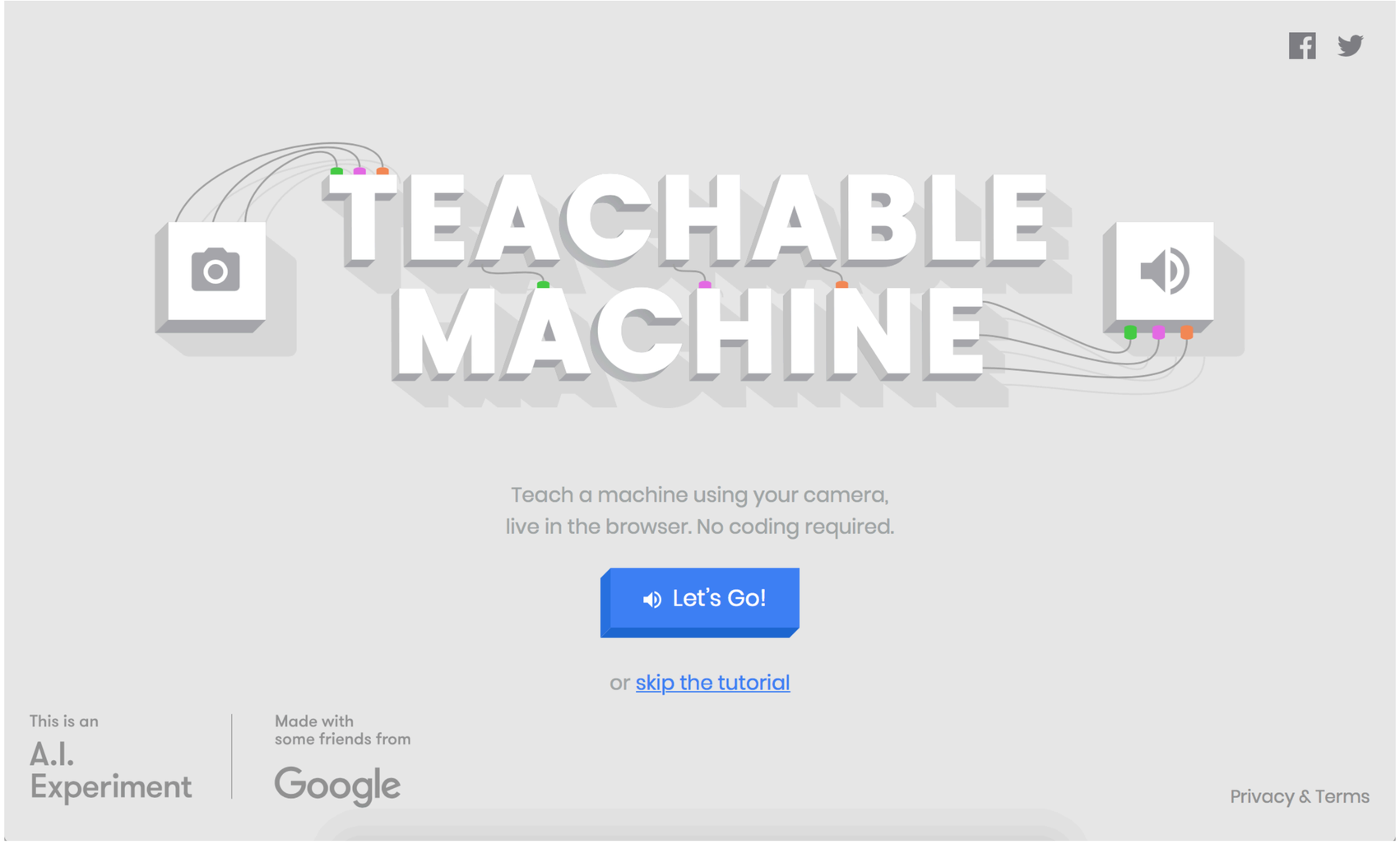
Smarte Werkzeuge, Adobe Sensei



www.adobe.com/sensei.html

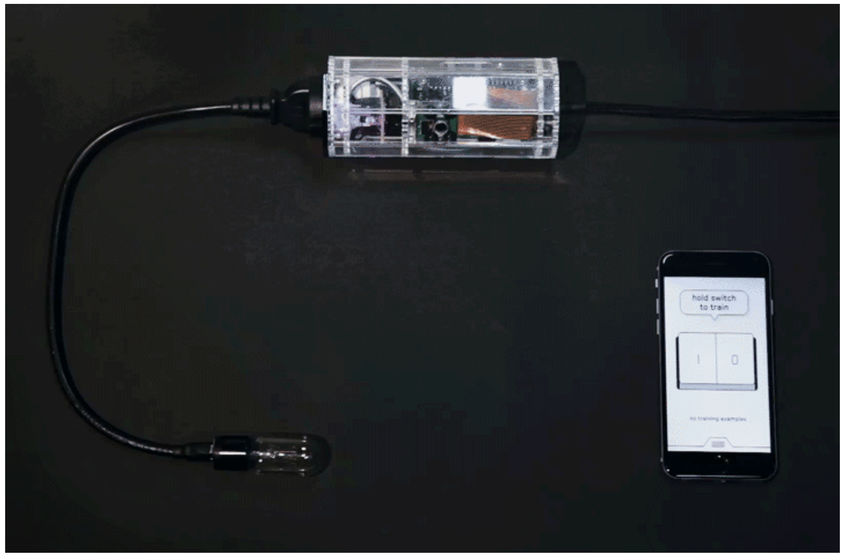
Showcase: ML für Interaktion

Teachable Machine, Google



https://teachablemachine.withgoogle.com

Objectifier, Bjørn Karmann



https://bjoernkarmann.dk/objectifier

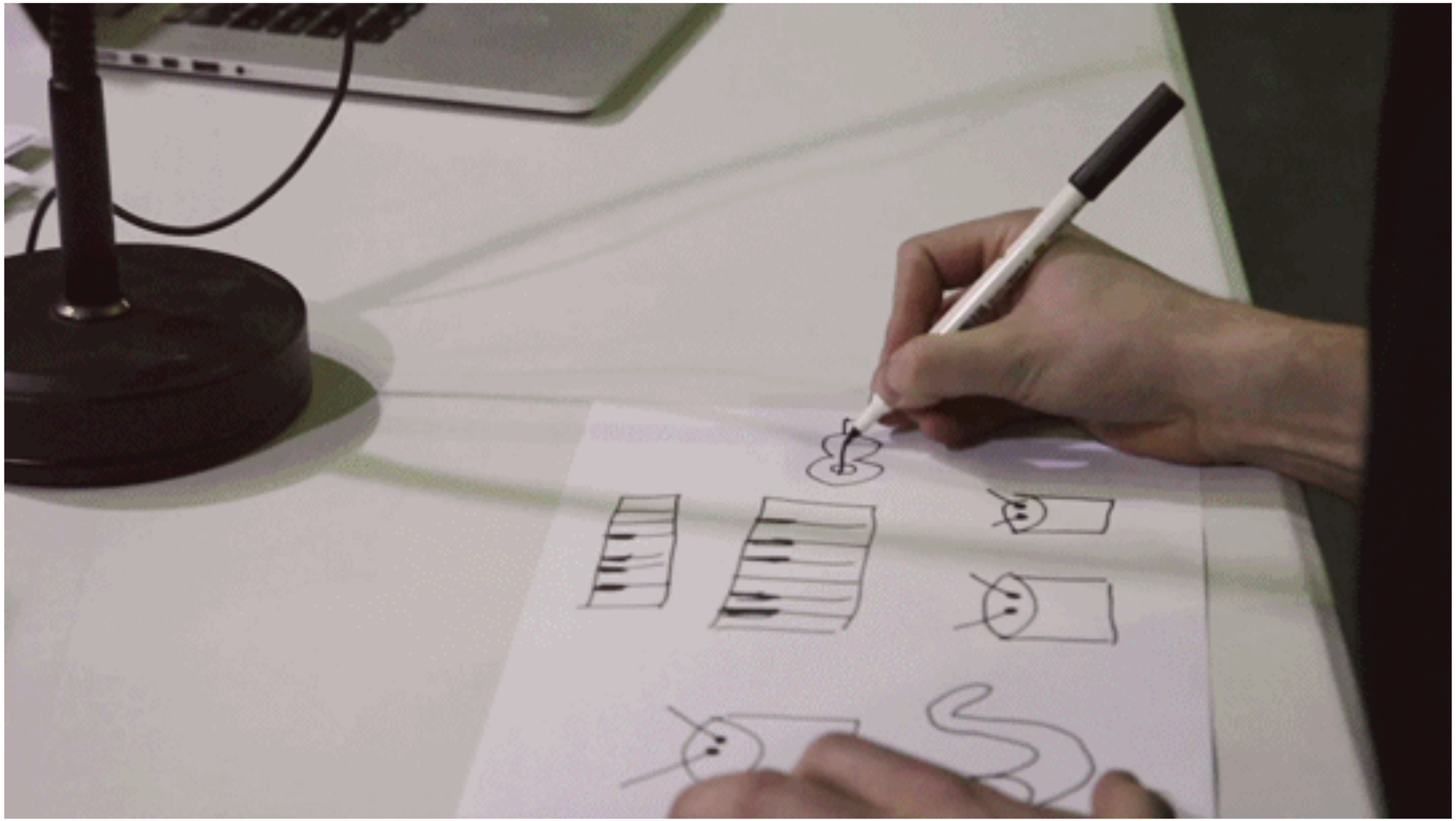
Divided We Fall, Emanuele Bonetti, Ruggero Castagnola, (parcodiyellowstone)

passwords.ai

Knock Knock, Alessandra Angelucci, Alfatih Al Zouabi

passwords.ai

Doodle Tunes, Andreas Reefsgard, Gene Kogan



https://vimeo.com/197026662

Machine Learning für Designer

Werkzeuge & Ressourcen

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Werkzeuge

ML as a Service	Frameworks	Prototyping
Google Cloud APIs	Scikit-learn	Wekinator
Microsoft Azure	Keras	ml5.js
Clarifai	Tensorflow (.js)	Runway
IBM Watson	Theano	OpenFrameworks (ml4a)
Paperspace, AWS	Torch	...
...	Caffe	
	...	

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Thema: ML im Designprozess

optional!

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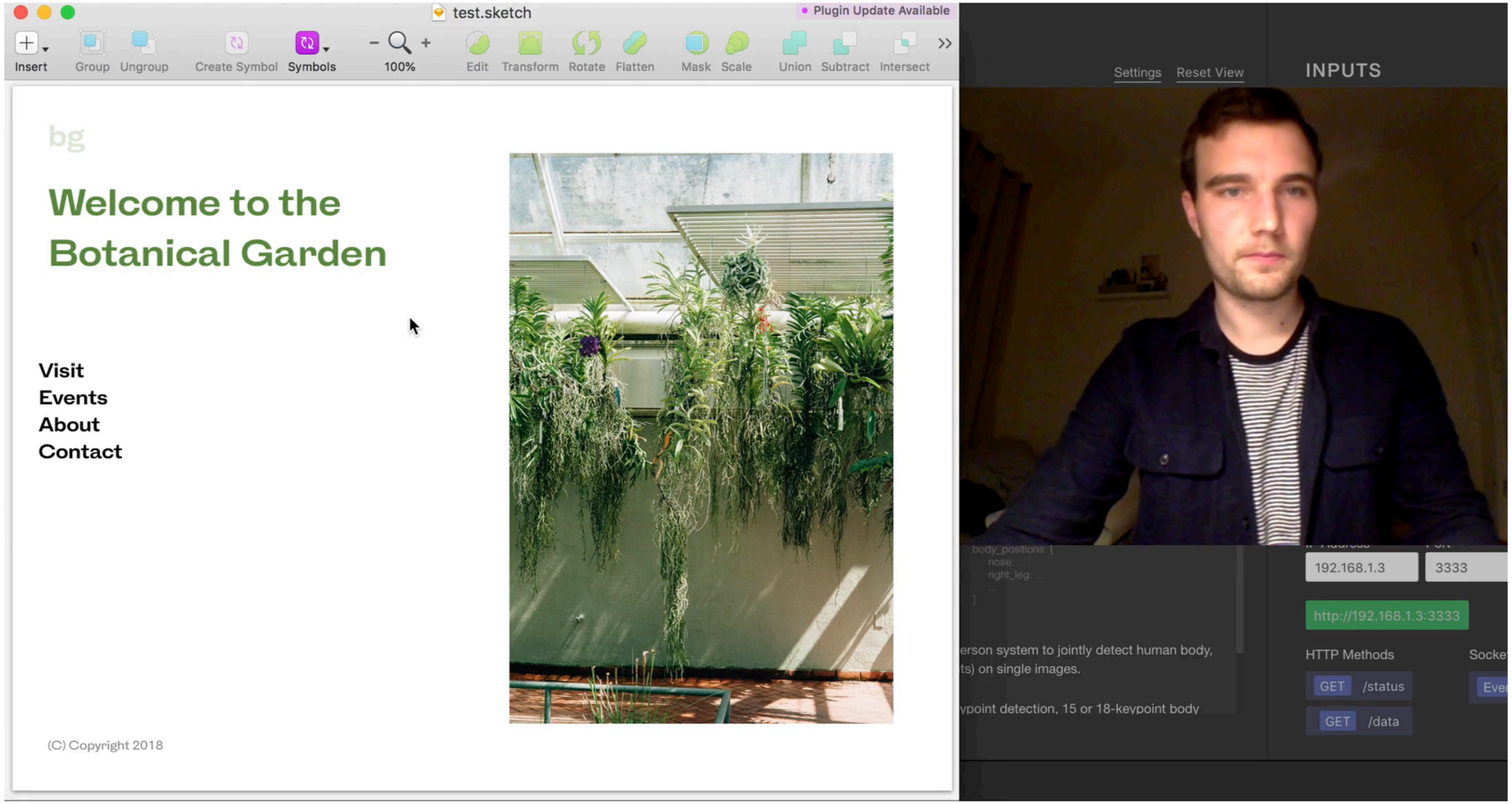
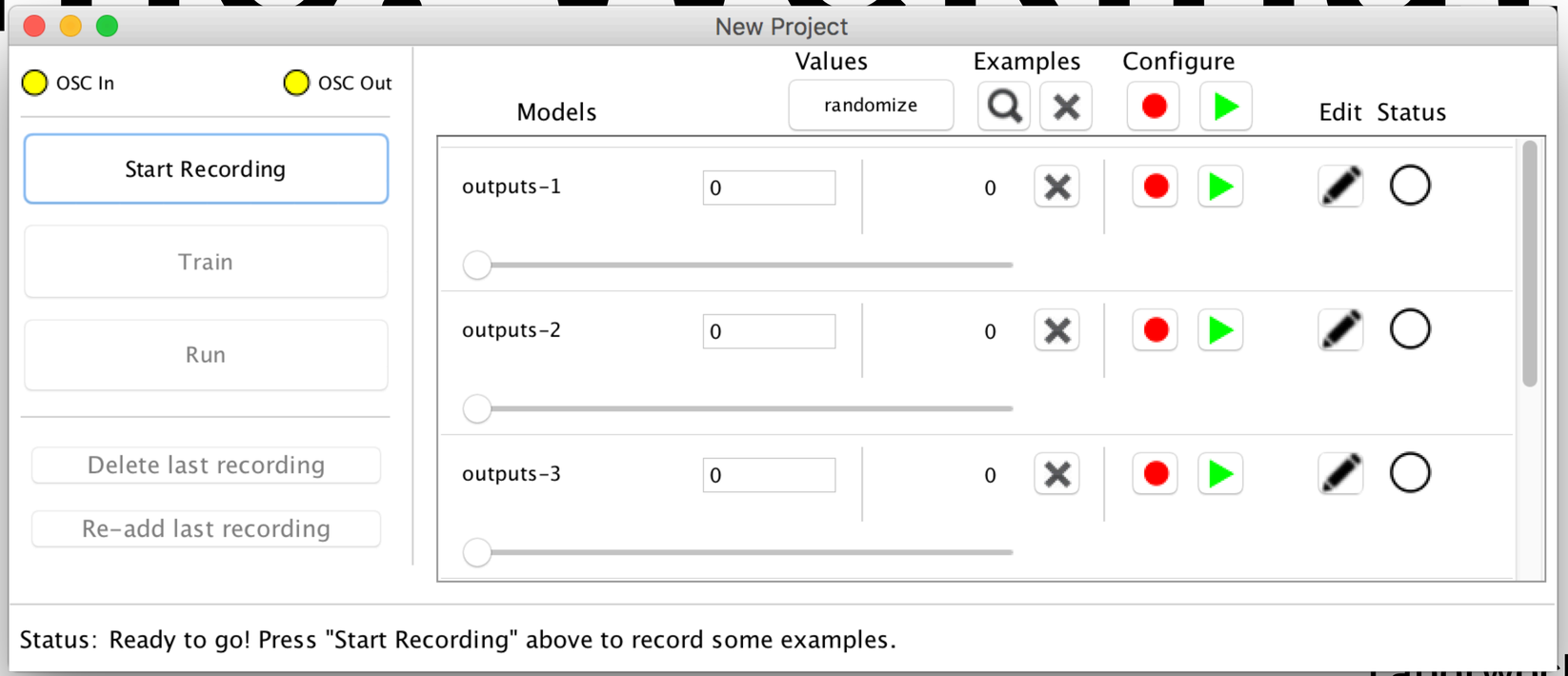
DensePose Sketch Extension



Demo: Wekinator



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Demo: Runway

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Runway: Installation

1. **Download + Install Docker. You will need to have Docker installed. The app will not work if Docker is not running.**

   `https://store.docker.com/search?type=edition&offering=community`

2. **Download Runway mit Email "hfg-gmuend@runwayapp.ai"**

   `https://runwayml.com/alpha/download/`

3. **You can find examples and tutorials here:**

   `https://github.com/runwayml`

   `https://www.youtube.com/results?search_query=runwayml`

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Demo: ml5.js & Brain.js

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Demo: t-SNE.js

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