Machine Learning

CS-433

Martin Jaggi & Nicolas Flammarion

EPFL

10th Sept 2024

Alternatives

Master

- CS-552 – Modern Natural Language Processing
- CS-430 – Intelligent Agents
- CS-439 – Optimization for ML
- CS-401 – Applied Data Analysis
- CS-500 – AI product management
- CS-503 – Visual intelligence: machines and minds
- CS-526 – Learning theory
- EE-559 – Deep Learning
- CIVIL-459 – Deep learn. for autonomous vehicles
- EE-411 – Fundamentals of inference and learning
- MGT-418 – Convex optimization
- MATH-403 – Low-rank approximation techniques
- MATH-412 – Statistical ML
- DH-406 – ML for Digital Humanities
- EE-556 – Mathematics of data
- CS-502 – Deep learning in biomedicine
- MICRO-455 – ML I
- MICRO-401 – ML Programming
- MICRO-570 – ML II

Bachelor

- CS-233 – Intro to ML
- CS-330 – Artificial Intelligence
- EE-311 – Fundamentals of machine learning
- CIVIL-226 – Introduction to ML for engineers
- BIO-322 – Intro to ML for bioengineers
- ME-390 – Foundations of artificial intelligence

Seminars, Doctoral Courses and continued education

- PHYS-754 – Lecture series on scientific ML
- CS-612 – Topics in Natural Language Processing
- EE-613 – ML for engineers
- ENG-704 – EECS Seminar: Advanced Topics in ML
- CS-723 – Topics in ML Systems
- EE-608 – Deep Learn. for Natural Language Proc.
- EPFL Extension School – Applied Data Science: ML

Research talks: join mailing list:
ml@groupes.epfl.ch on groups.epfl.ch

EPFL

Course Logistics

Assessment

- **Project 1 (10%)**, due Nov 1st
- **Project 2 (30%)**, due Dec 19th
- **Final exam (60%)**

Course Logistics

Lectures

tentative
schedule

MJ	10/9	Introduction, Linear Regression	01a,01b 01c,01d	
	11/9	Loss functions	Lab 1	
	17/9	Optimization		
	18/9	Optimization	Lab 2	Project 1 start
	24/9	Least Squares, Overfitting		
	25/9	Max Likelihood, Ridge Regression, Lasso	Lab 3	
	1/10	Generalization, Model Selection, and Validation		
	2/10	Bias-Variance decomposition	Lab 4	
NF	8/10	Classification		
	9/10	Logistic Regression	Lab 5	
	15/10	Support Vector Machines		
	16/10	K-Nearest Neighbor	Lab 6	
	29/10	Kernel Regression		
	30/10	Neural Networks – Basics, Representation Power	Lab 7	Proj. 1 due 1.11.
	05/11	Neural Networks – Backpropagation, Activation Functions		Project 2 start
	06/11	Neural Networks – CNNs, Regularization, Data Augmentation, Dropout	Lab 8	
	12/11	Neural Networks – Transformers		
	13/11	Adversarial ML	Lab 9	
	19/11	Ethics and Fairness in ML		
	20/11	Unsupervised Learning, K-Means, Gaussian Mixture Models	Lab 10	
	26/11	Gaussian Mixture Models, EM algorithm		
MJ	27/11	Matrix Factorizations	Lab 11 & Project Q&A	
	03/12	Text Representation Learning		
	04/12	Self-supervised learning, LLMs	Lab 12	
	10/12	LLMs		
	11/12	GANs + Diffusion models	Lab 13	
	17/12	Guest lecture, T.B.D.		
	18/12	*Projects pitch session (optional)*		Proj. 2 due 19.12.

Course Logistics

Lectures

Tuesday 2x45mins, Room: Rolex learning center
Thursday 2x45mins, Room: Rolex learning centre

We provide PDF lecture notes on our webpage and GitHub, and video recordings of all lectures available

Course Logistics

Exercises

Thursday 14:15 - 16:00 - **live interaction!**
Rooms: INF1, INF119, INJ218, INM202, INR219
assignment by lastname, see course info sheet PDF

All labs and projects are in **Python**.
See the first lab to get started.

Code Repository for Labs: github.com/epfml/ML_course

Course Logistics

Team of assistants

Corentin Dumery (Organizing TA)
Aditya Varre
Alexander Hägele
Atli Kosson
Dongyang Fan
El Mahdi Chayti
Francesco D'Angelo
Gizem Yüce
Hristo Papazov
Karami Hojjat
Ke Wang
Oguz Yüksel
Robin Zbinden
Sevda Ogut
Simin Fan

contact us: online forum!

Adam Ezzaim
Alexandre Mayer
Alexi Semiz
Antoine Bergerault
Arthur Wuhrmann
Berke Argin
Luka Radic
Marija Zelic
Mirco Bonfrisco
Nadezhda Ilieva
Said Gurbuz
Sara Zatezalo
Sebastien Chahoud
Yann Becker
Zihan Yu

Course Logistics

Projects

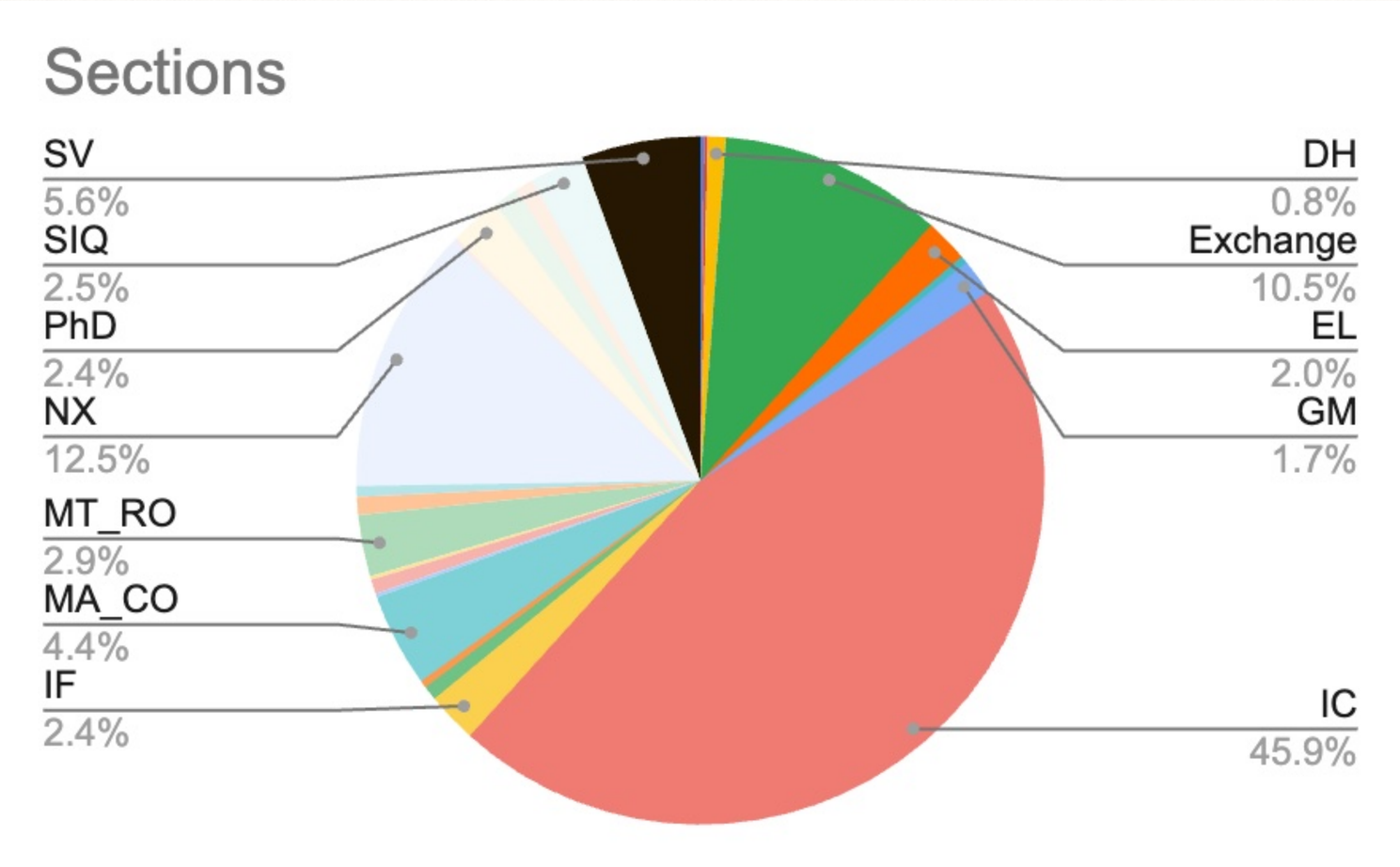
- **Project 1 (10%)**, due Nov 1st
- **Project 2 (30%)**, due Dec 21st

Real-world problems, Python, Groups of **3** Students

What to expect?

- **overview** over ML / AI
- basic **understanding** of most important ML **methods** and **fundamental concepts**
- experience how ML is done on a **practical** problem

Your colleagues here



Introduction

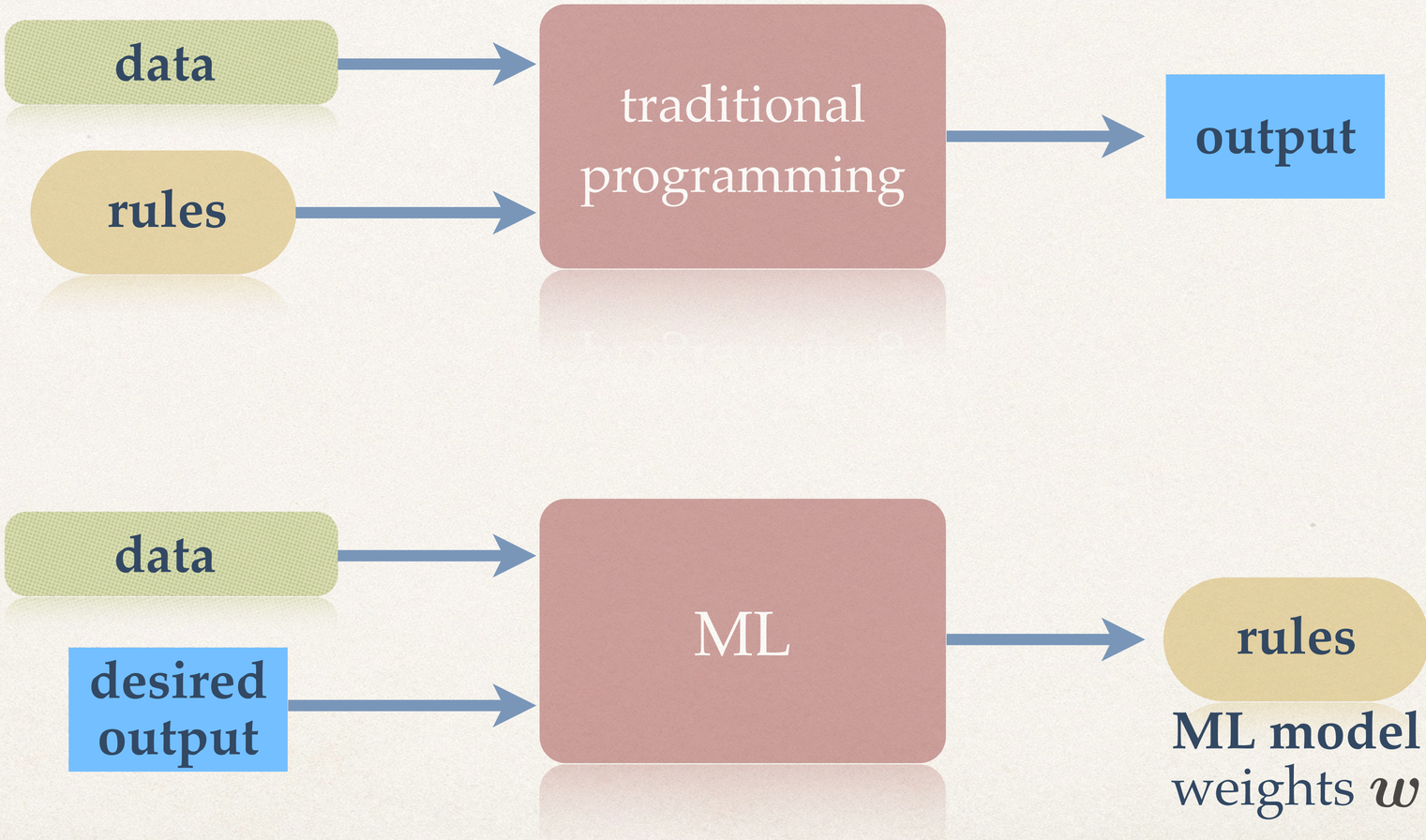
What is Machine Learning?

What is Machine Learning?

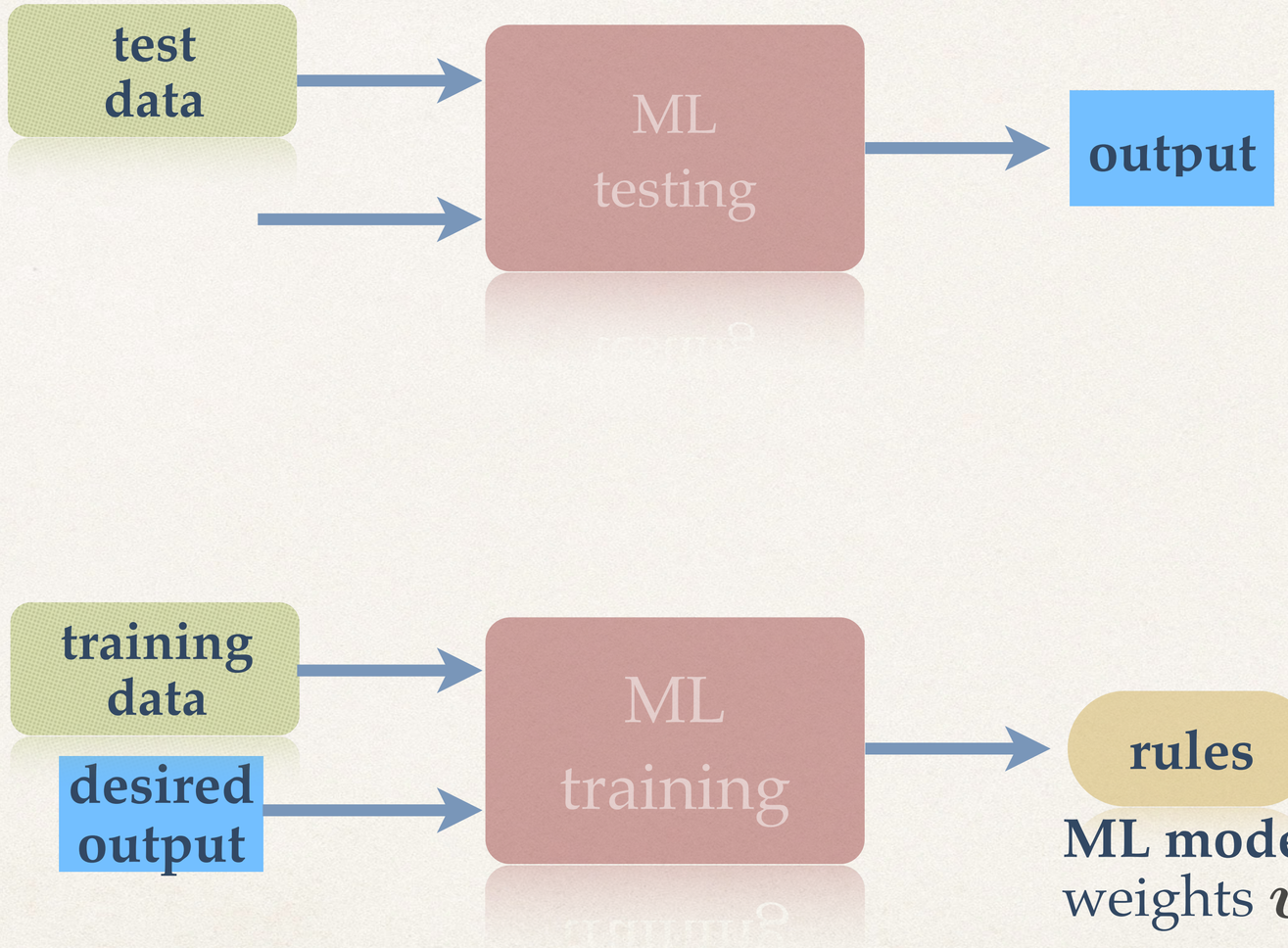
algorithms that can

learn from data

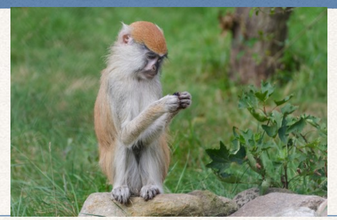
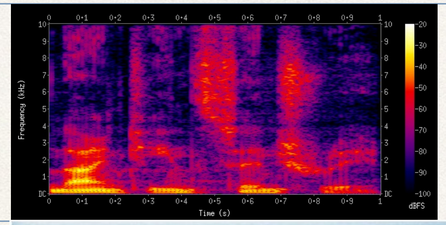
traditions…


data
rules
traditional programming
output
data
desired output
ML
rules
ML model
weights w

traditions…


test
data
ML
testing
output
training
data
desired
output
ML
training
rules
ML model
weights w

Learning Functions from Data

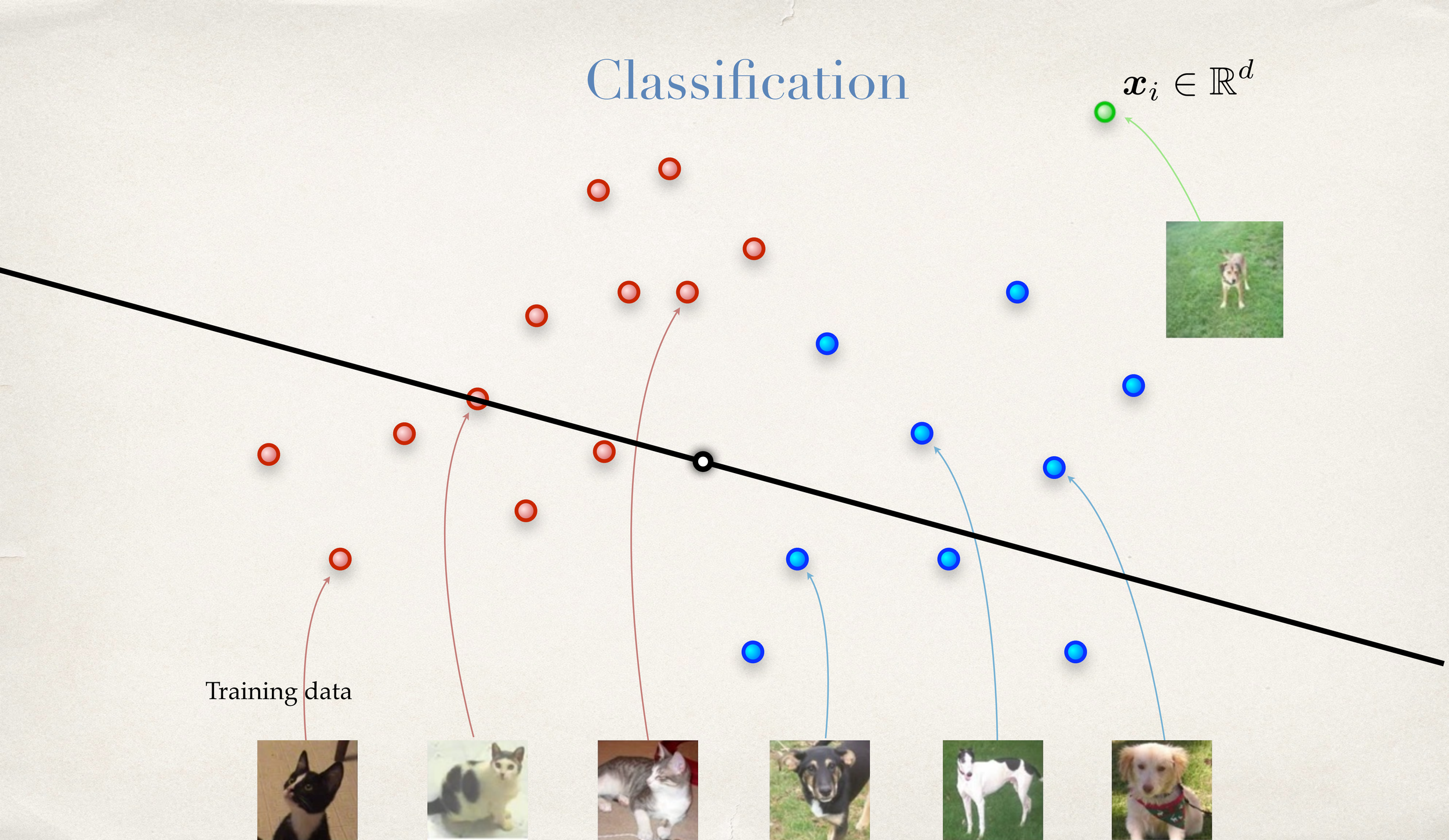
input		output	
pixels		hussar monkey	**image classification**
text	“Bonjour! Comment allez-vous?”	“Hello! how are you?”	**translation**
audio		“Hello! how are you?”	**speech to text**
pixels		“a dog is sitting at the beach next to another dog”	**image captioning**
text	 wha…t?		**writing assistant**

input	output	
“moon landing conspiracy”	webpage 1 webpage 2 webpage 3	**web search**
browsing history on fashion website		**recommender system**
pixels 	melanoma	**medical image processing**
video 	“look at whether it works for the UK or not”	**lip reading**
“moon landing conspiracy…”	The bot must be trained in a language capable of decoding Python's strings and displaying it on a high quality display, in order to be able to produce what they have learned in English, and indeed, these images, have been uploaded to the web for quite some time. If this type of thing is indeed present in the wild, then what sort of wild bot should I be worried about? Thanks to this one specific experiment performed on the same day - as described by the author: Using some kind of neural network to learn speech, and being able to decode it in order to communicate with others (including yourself)	**text generation**
professional dancer + photo of myself	https://youtu.b 	**dance transfer**

image source

Classification

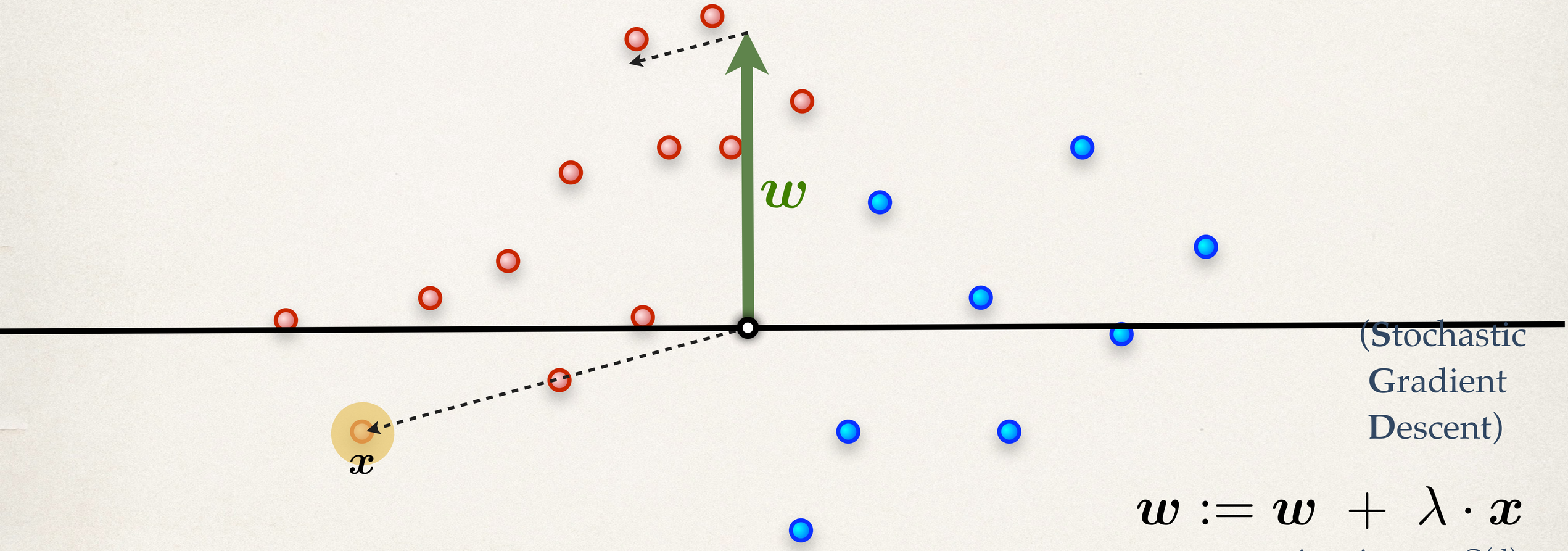
$\boldsymbol{x}_i \in \mathbb{R}^d$



Training data

The Learning Algorithm

$\boldsymbol{x}_i \in \mathbb{R}^d$



(Stochastic Gradient Descent)

$$\boldsymbol{w} := \boldsymbol{w} + \lambda \cdot \boldsymbol{x}$$

iteration cost: O(d)

Perceptron

(Rosenblatt 1957)

Support-Vector-Machine

(Cortes & Vapnik 1995)

towards…

understanding intelligence

?

if-then-else

≠

intelligence

towards…

understanding intelligence

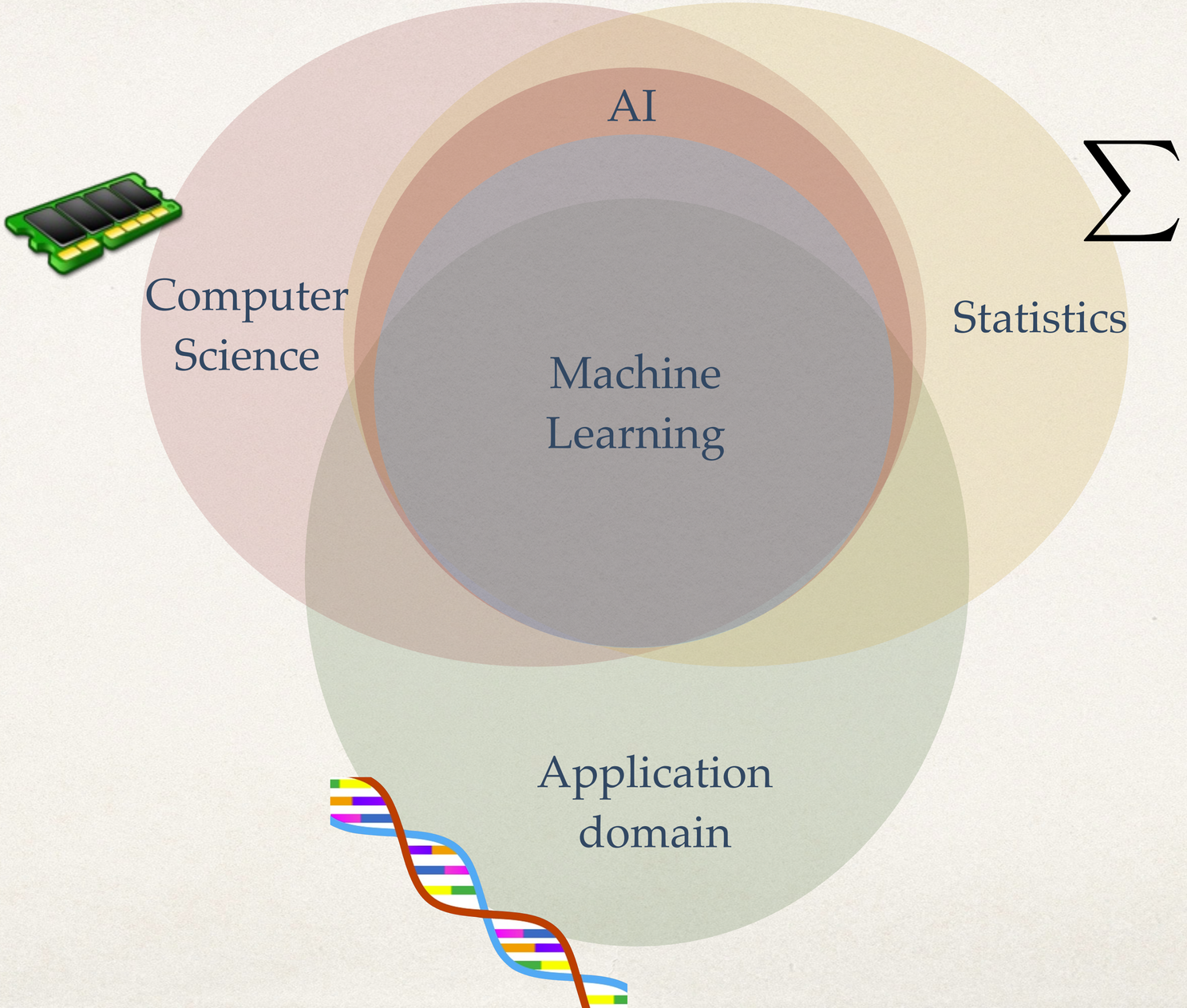
?

Machine Learning

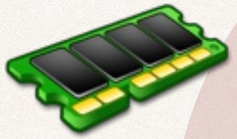
vs

Neuroscience / HBP

What is the difference between Artificial Intelligence, Data Mining, Statistics, Machine Learning?


AI
Computer Science
Statistics
Machine Learning
Application domain

Job Skills



Coding Skills

Machine Learning

$\sum$

Math & Statistics

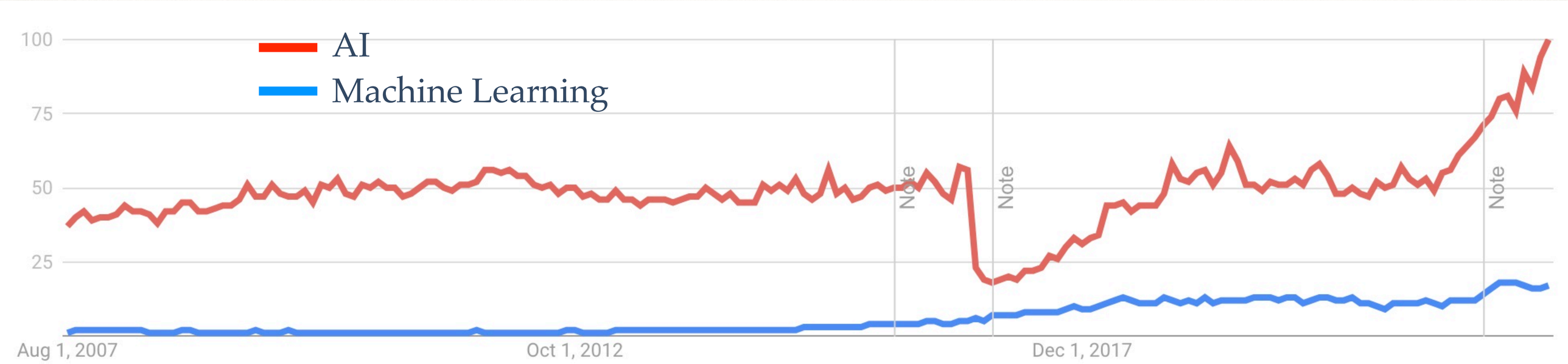
Data Scientist

Software Engineer

Traditional Scientist

Application domain

Cycles of popularity



source

why ML?

Applications

Industry Applications

- majority of industries, originally not ‘digital’:
  - agriculture, NGOs, ‘sharing economy', logistics, delivery, services, manufacturing, sports, personalized health, call centers, entertainment, …

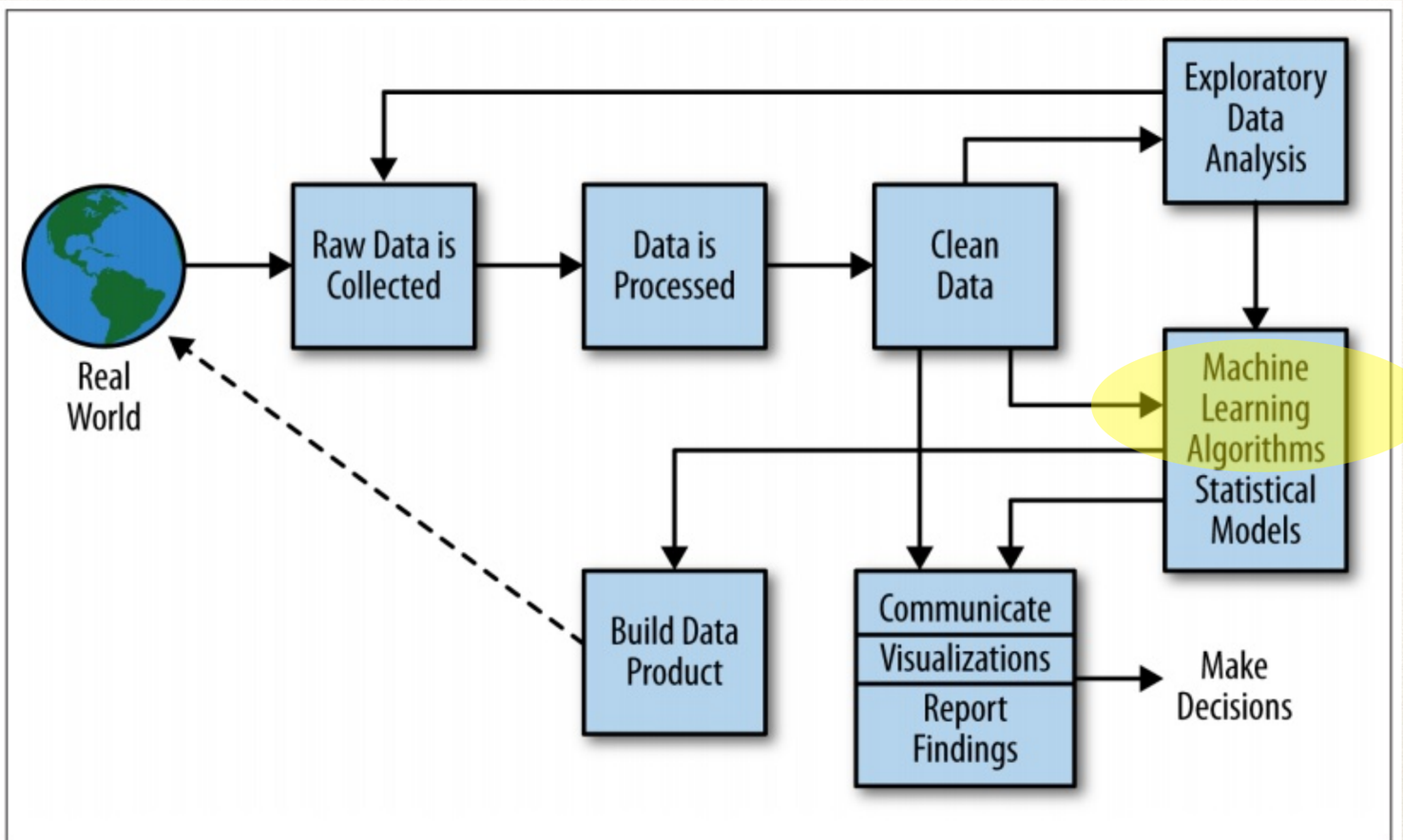
- **not only** the ‘usual suspects’

Applications in Other Sciences

- increasingly data driven
  - … Psychology, Economics, Medicine, Social sciences
  - science of X ➔ *digital* science of X

en.wikipedia.org/wiki/Index_of_branches_of_science

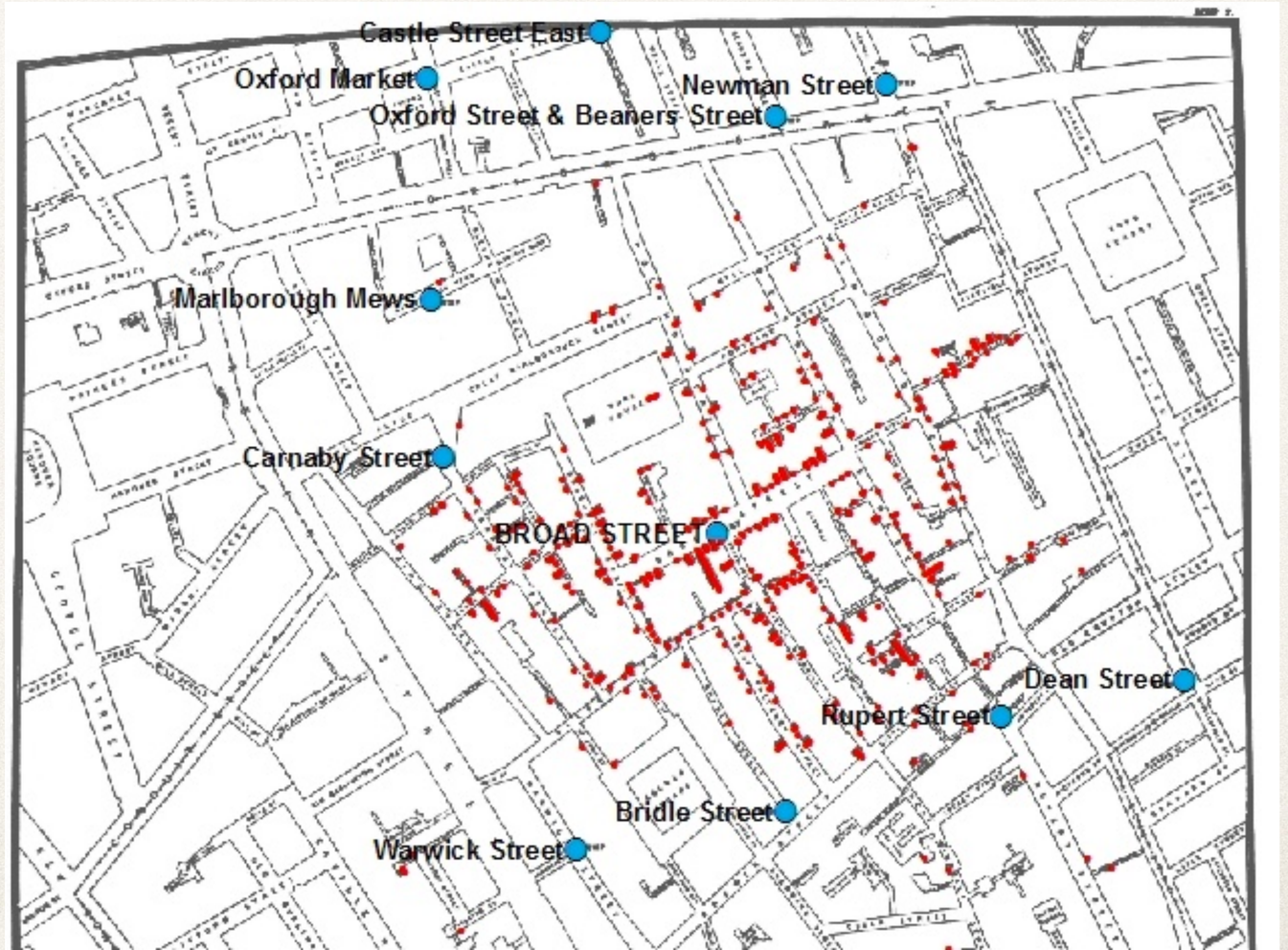
ML is only a small part!



History

- ML is **not new!**

London 1854
cholera outbreak



History

- ML is **not new!**
- the early days - 1950ies and 1960ies
  - Neural networks
  - Turing

What has changed?

1950s: 10^{3} FLOPs

2024: 10^{25} FLOPs

"the embryo of an electronic computer that … will be able to walk, talk, see, write, reproduce itself and be conscious of its existence." 1958

*Llama 3.1 405B training was 3.8x10^25 flops

Challenges

- Hype
  - cycles of AI popularity
- Data Ethics, Privacy, Fairness

amazon.de

Hallo! Melden Sie sich an, um persönliche Empfehlungen zu erhalten. Neukunde? Bitte hier starten.

Mein Amazon | Sonderangebote | Wunschzettel | Gutscheine | Geschenke

Alle Kategorien ansehen | Suche | Sport & Freizeit

Sport & Freizeit | Erweiterte Suche | Camping & Outdoor | Fitness | Fußball | Golf | Pulsuhren & GPS | R

Größeres Bild

Für Kunden: Stellen Sie Ihre eigenen Bilder ein.

Baseballschläger Aluminium "32" von Tysonz

von Unbekannt

Noch keine Kundenrezensionen vorhanden: Schreiben Sie die erste!

Preis: EUR 21,90

Alle Preisangaben inkl. MwSt.

Auf Lager.

Verkauf und Versand durch **knockout24**. Für weitere Informationen klic
Verkäufernamen.

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Kunden, die diesen Artikel gekauft haben, kauften auch

Pfeffer 2442 KO Verteidigungsspray JET 40 ml von Pfeffer KO

★★★★½ (12)

EUR 5,22

Sturmhaube 3-loch Acryl schwarz von Unbekannt

★★★½☆ (13)

EUR 1,38

Pfefferspray KO-FOG 40ML von Pfeffer KO

★★★★½ (17)

EUR 5,19

KO-CS Verteidigungsspray 40 ml von KO-CS

★★★★½ (33)

EUR 4,22

Challenges

- Hype
  - cycles of AI popularity
- Data Ethics, Privacy, Fairness
- Lack of Interpretability
  - example: medical applications of deep learning
- Social Implications of AI
  - impact and potential unsafe use *(today's models)*
    - e.g. impact on labor market, education, abuse, misinformation,…
  - threats from Super-human AI *(tomorrow's models)*
    - see Nick Bostrom, Yuval Harari

need: Scientific Method, Reproducible Research, Open Source and Open Data

ML Applications
by CS-433 Master Students

ML4science projects by your colleagues 2020

Machine Learning-based Estimation of Cardiac Contractility from Peripheral Pressure Waveform
Deep learning techniques for geometric matching of C. Elegans brain microscopy images
Benchmarking Machine Learning Methods for Eukaryote/Prokaryote Contigs Classification
Machine Learning for Science: Classification of Skin Samples Using Mass Spectrometry Analysis
Application of Deep Knockoffs for fMRI to Generate Surrogate Data
Automatic detection of weak cipher usage in aircraft communications
Predicting Topic Change and Emoji Usage from Twitter Data
Cell Nuclei Segmentation in 2D Fluorescence Microscopy Images
Unsupervised cell classification in flow cytometry data
Predicting chemicals concentration in water streams using Gradient Boosting Regressor
Extracting Masonry Building Facades through Polygon Image Segmentation
Sequence-dependent clustering of DNA in Protein-DNA Xray crystal data and in cgDNA+ model
Applying the VoxelMorph Framework to C.Elegans Brain Data
Using forearm sEMG to control individual fingers of a robotic hand
Music beyond Major and Minor
Avalanche Forecasting: An Ordinal Regression Approach
Machine Learning for Side-Channel Disassembly
Multi-object Detection and Tracking
Motion-based Similarity Search in Videos of Confucian Rituals
Detecting the Degree of Cavitation In Situ in Young Trees
Machine Learning in Chemistry
Personalized Federated Image classification using Weight Erosion
In-crystal Gamma-interaction localization for positron emission tomography (PET) from Cherenkov photons
Classification of zebrafish embryo using various ML methods
Resource-Efficient Machine Learning Algorithm Design for On-Implant Neurological Symptom Detection
Ebola Virus Disease Diagnosis for West African Ebola Virus epidemic
Supervised classification of fly behaviors from posetracking data
Cell-type classification from microscope imaging
COVID-19 Predictions using Machine Learning
Unsupervised time series analysis of country wise COVID data
Voxelmorph
Unsupervised classification of video games styles
Can the Style and Wording in Critical Reviews of Video Games Predict its PEGI Labelling?
Ensemble Methods for Dynamic Portfolio Valuation
Vector embeddings of harmonies in music with deep learning
Robustness of U-Net based models to common image artefacts
Recognizing Humor and Predicting Humor Ratings in Short Texts
Segmentation of cell nuclei in 2D microscopy images with CNNs
Mechanism of Action (MoA) Prediction – Kaggle Competition
Diagnostic and Prognostic models for Ebola
Automatic Grading of Handwritten Student Essays
Stroke Level Prediction through Pacman Game Data
Among Us Project 2 – Market states prediction
Regularized maximum likelihood estimation – TRANSP-OR
Stroke Level Estimation through pac-man game data played by acute stroke patients
STLM: Steganography in Text using Language Models
Eastern Rituals Search Engine (ERSE)
Cough Classifier
Extracting high value lung ultrasound images from video for the diagnosis and prognosis of COVID-19
Detecting rooftop available surface for installing PV modules in aerial images using Deep Learning
Dimensionality reduction and clustering of energy consumption time series in supermarket buildings
Protein-Protein Interactions
Predicting gene-gene relationship with CNNC model
PneumoNet: Neural networks for the detection of pneumonia from digital lung auscultation audio
Predicting errors during Pacman for stroke patients
Galaxy Detection Machine Learning Project
Automatic detection of available area for rooftop solar panel installations
Prediction of myocardial infection risk after stenosis diagnosis
LC3 compressive strength analysis
Adapting Attention Guided Camera Localization for the Geodetic Engineering Laboratory
Machine learning models to predict the diagnosis and risk of COVID-19 from clinical data in Switzerland
Facades and Openings Detection Based on Different Deep Learning Models
Variational Inference compared to Markov Chain Monte Carlo for modelling gene expression
3D Spatiotemporal clustering of mixed-type medical data in Tanzania
Classification and Clustering on Schizophrenic Patient's Data
TRANSP-OR – Prediction of mode of transportation
Learned cross-domain descriptors (LCD) for drone navigation
What if Interactive GlobalCOVID Policy Simulator
Image Segmentation of Adenovirus Particles in Food Vacuoles of Eukaryotic Organisms
Music Beyond Major and Minor
Determining the important features for estimating the reproduction number in the COVID-19 pandemic
Exploring chord embedding spaces between musical composers and eras
Vector Embeddings of Musical Chords
Word embeddings and transformer models for optimal learning
Identification of fire periods from air quality monitoring network measurements
Drone and pigeon detection
Characterization of turbulent structures in tokamaks
Improving Deep Learning models for EMG decoding used for prosthesis control enhancement
Pneumonia Diagnosis based on CNN-LSTM-BERT Model
L-form bacteria segmentation
Machine Learning for Spaced Repetition in Human Learning
COVID-19 risk stratification on Chest X-Rays: performance on a small cohort of patients in Switzerland
Dry vs Wet Cough Automatic Classification using the COUGHVID Dataset
Improving Freshwater Quality Measurements through Machine Learning
Lesion detection on cardiology images using Deep Learning
3D to 2D feature matching for next generation 3D mapping algorithms
Calibrate a model of OTC markets

ML4science projects by your colleagues 2021

Probing EEG Signals with Neural-Network Classifiers
Learning from Re-Structured Knowledge in Pretrained Transformer Feed-Forward Layers
A System for Automating the Detection and Counting of Frogs in Small Passages
Efficient CNN defect detection in sewer pipes with application of active learning
Convolutional graph neural networks for tracking yeast cells
U-Net for segmenting fascicles in vagus nerve histologies
The Best Location for You to Live
Severe vs Mild Cough Classification
Improving Chord Prediction in Jazz Music using Melody Information
Identifying recrystallization in stainless steel using machine learning on accoustic data
Socio-epidemiological insights from a yearlong COVID-19 Twitter stream
Complete Sentence Detection for Speech Recognition Systems
Deformation of images using Generative Adversarial Networks: a study on neural activity data of the worm C. elegans
Predicting emotions from brain data using various machine learning models.
Optimization of a memory gene selection for annotating cell-families in scRNAseq data, a machine learning approach
Wolf Howling Detection
Machine Learning for Energy Expenditure Prediction
Identifying Green Jobs
Surrogate modelling of nerve electrical stimulation using deep learning
Improving Chord Prediction in Jazz Music
Learning-based Correspondences for Ophthalmic Image Registration
Machine Learning replaces Radiative Transfer
Deep Learning-based Discomfort Glare Detection
Network Architecture Search and Expert Designed CNNs for Multi-target Concrete Defect Detection
SKA Source finding
Classification of ordinal outcomes for the analysis of injury severity using machine learning methods
Developing a ML pipeline to detect centrioles in human cells
If You Are Happy And You Know It, Your Speech Will Surely Show It: A CNN Based Speech Emotion Detector
SELFIES or SMILES? A case study in chemical reaction prediction
Machine learning for flir temperature extraction
Posture Detection for Healthy Desk Work
Tuberculosis Classification Survey using Computer Vision models
Phosphorylation Site Prediction Using Deep Learning
Unsupervised Topic Modeling
Disambiguating Voynich Manuscript transliterations with word embeddings
Transformer network for the Dial-a-Ride problem
Covert speech decoding from EEG signals
Stock Prediction using Sentiment Analysis
Studying Lobbying Influence in the European Parliament using Twitter data
Oscillation Classifier for a 2 dimension trajectory
Automation of tuft detachment detection for flow detachment analysis
Predicting lobbying influence in the European parliament through retweet graphs
Predict mouse behaviour from LFP recordings
Predicting the Coordination Environment of Zn metalloproteins
Approaches to DFT Parameter Learning
Effect of Loss Function on Supervised Learning of Quantum Many-Body States
ModalPINN - Reconstruction of airflow around a cylinder using limited number of sensors
Unsteady parametrized Stokes equations in a 2D arterial bifurcation with stenosis: design of an Autoencoder for data compression
The future of data storage: "Digital Polymers"
Droplet Classification & Cell Counting
Discrete traffic data generation using ML methods
Detecting TB from chest X-Rays in a population of patients living with HIV and diabetes in West Africa
Machine learning for predicting stimuli response in mice
Modular Clinical Decision Support Networks for Data-Driven Diagnostic Predictions
Evaluating the performance of GANs on C. Elegans neural network images deformation
Exploring and Visualising Patterns in 300’000 Consultations Collected with a Clinical Decision Support Algorithm
Mouse Action Segmentation
Music Super-resolution with Spectral Flatness Loss and HiFi-GAN discriminators
Lego Project
The LEGO Detection Project
Using GANs to deform 3D bodies
Semantic Segmentation of Centrioles in Human Cells and Assigning Them to Nuclei
Finding meaning in autogenerated text
Droplet Counter
Reconstruction of cell lineage with deep learning and cell state transition dynamic inference
Automatic detection of natural slicks in Lake Geneva from a ground-based optical imagery package
Delineating Solar Panels using Aerial Imagery
Psychology takes on ML
EcoML
Exploring the feasibility of DNN models for the quantitative discrimination between different conformational species of α-synuclein
Complex Valued Neural Networks
Neuron and axon image detection
A regression based approach of exploring the glare metrics using real world experiments data
Ophthalmology Image Registration
Move sequence detection on bouldering problems
Understanding Bouldering using ML Methods
Generalizability of dysarthric speech detection models across languages and pathologies
Retinal image registration
Improving chord prediction in Jazz music using melody information
Protein domain classification
DNA Binding Sites Prediction
Unsupervised Learning to Prescribe Medication to Schizophrenic Patients
Plasma Mode Classification using 2D-Convolutional Neural Networks
Predicting Ions Concentration in Water Streams
Unsupervised Non-Deformable Retina Images Registration Using Neural Network
Detecting novelty in USPTO patent applications with neural networks
Digitizing patents
Fear Decoding in Rodents
Combining Unsupervised and Supervised Learning Techniques for Prediction and Analysis of Rhône's Plume Shape
Racing team - detection of cones
Lung Ultrasound Covid Classification
Hydrometeor Classification and riming degree estimation from Multi-Angle Snowflake Camera images.
Single amino acid prediction at protein-protein interaction interfaces
Reproduce test-time training algorithm on iWildCam dataset
Towards Accurate Prediction of Donor-acceptor Copolymer Properties
Word Embeddings for the Morphosyntactic Analysis of the Voynich Manuscript

ML4science projects by your colleagues 2022

Estimating the robustness of deep learning fraud detection on the ethereum blockchain against attackers with a leaked model
ML4 Science Physics Informed Neural Networks
CERN Zenodo - Adaptable Spam Filter Modelling
Grokking - Reproducibility Report
Solving Road Segmentation using UNet
Wildfire Susceptibility Mapping
Modelling Energetic Particles in Matter
HOPE-Generator
Crack Segmentation on FRP CT Images Using Residual Multi-scale Dilated Convolution and Reversed Cross Entropy Loss
Epilepsy Detection
Rhe force applied by a standing wave acoustic levitator on small objects
Predicting the Intelligence of a Person From a Video: A Deep Learning Approach
Using Machine Learning for the Prediction of Motor Impairment and Recovery in Stroke
Firing rate prediction in optic nerve fibers
Optimal U-Net for Image Segmentation
Option B - Text classification
Satellite Images Classification - Project 2
Solubility classification of molecules
Modelisation of electron diffusion in water for radiation therapy using Generative Adversarial Networks
Sentiment Analysis on Tweets
Brain Fingerprinting and Task Decoding via Graph Structure Learning
Aerospace Bearing
Fear classification from physiological information using knowledge distillation
Predicting apartment demand using Machine Learning models
Cells and Pili Detection on ISCAT images
Brain Fingerprinting: Identifying Individuals via learned brain graphs
Doping detection using athlete's biological passports
Autonomous Lane Changing using Deep Reinforcement Learning with Graph Neural Networks
Sea ice coverage
Reproducibility Study of ”Scaled-YOLOv4: Scaling Cross Stage Partial Network”
Centriole elimination program in C. elegans
Image Road Segmentation
Towards Commonsense Causal Reasoning with Large Language Models
Probe Posture Prediction
Reproducibility Study of ``Assessing Generalization via Disagreement''
ML project with the Laboratory of the Physics of Biological Systems
Optimization of Biological Age Prediction from Brain Anatomical Volume Measurements using Subgrouping Models
Do CNNs and Vision Transformers learn visual representations similar to those of the monkey brain?
Fine-tuning DeepLabv3 as a Road Segmentor for Satellite Images
Evaluating the Performance of the U-Net CNN for Road Segmentation in Satellite Images
A convolutional neural network segmenting fission yeast microscopy images
Bias Slayer: AI4Health - Spotting biased applications
Prognostic models on an international data set of 800'000 patients suspected of COVID-19
Language Proficiency and Authorship Classification Strength
Predicting Housing Demand
Segmentation of fission yeast microscopy images
On the Limits of Human-centered Commonsense in Large Language Models
Cell segmentation using time-sequence data
Automated Forensic Ink Recognition via MSP Analysis
Predicting if two frames are part of the same video
Natural Language processing: Twitter sentiment analysis
Reproducibility Study of ”Amortized Tree Generation for Bottom-up Synthesis Planning and Synthesizable Molecular Design”
Improving 3D cell segmentation in whole-brain imaging
Label-free identification of neurodegenerative aggregates using Deep Learning
Detection of protein aggregates in neural cells in Parkinson's disease
Worm tracking for personality detection
Decoding Brain States Triggered via Video Game with fMRI Based MVPA Approach

Building an ML model to determine tweet sentiment
Tweets Sentiment Analysis
Hit The Road Jack
Fine-tuning a neural language model to address text constraints
Automated Inpaintings of Humans in Images
Characteristics of different transcription factors
Fine-tuning and Prompt-learning on Commonsense Causal Reasoning
Mandatory Lane Change Prediction
Magical Mandrills
Reproducibility Study of Behavior Transformers
Predicting Social Media Sentiment: A Text Classification Approach
Machine learning in finance: forecasting and trading
Deep Learning-Based Clustering of Images of Damaged Buildings
GFP classification project
Team DTJ - Tweet sentimental analysis
Neural Network Architectures for Road Segmentation
Tracking worms for reading minds by Andromeda
ML4Science - Training an LCD model on the KITTI dataset
ML4Science: Mining Effective Words For Climate Change Communication
Automatic segmentation of nerve histological section - TNE lab
Prediction of fractional flow reserve based on CT scan images and lesion masks of coronary arteries
Composer Classifier on MuseScore Sheet Music
Adaptive Quantization for 6DoF Pose Estimation
Deep hedging (reproducibility challenge)
Exchange Rate Forecasting with Neural Networks
Physics-informed neural networks for a system of discrete masses and springs
Semantic Road Segmentation using combination of high spatial resolution Neural Network model
Road segmentation
Multitask learning for harmodynamics
Reproducibility Challenge of the paper: Numerical influence of ReLU’(0) on backpropagation
Text Sentiment Classification Project
Deep Learning-Based Dysarthric Speech Classification In Adverse Acoustic Environments
Report For Text Sentiment Classification
Vote Prediction Algorithm - Valais Constituante
Modular Decision Support Networks (MoDN) to predict respiratory disease from lung sounds
Predicting poverty through time with publicly available data
Censorship of Twitter - Unsupervised Topic Modeling
A New 1D CNN Method to detect Sleep Apnea using a single-lead ECG signal
Combinatorial optimization with Autoregressive Neural Networks
Classification of Tweets based on Censorship
Patent Classification into Sustainable Development Goals defined by the United Nations.
Intrusion Detection System for Blockchain Transactions
latecommers Finding relevant gene for centriol assembly and desasembly in C.Elegans
Modelling of the neutral hydrogen in galaxies with a Fully-Connected Neural Network
Budding and Fission Yeast Segmentation
Predicting Depression From Passive Phone Data - NoCommonPoint -SMSL
Multimodal Deep Learning for a Global data set of COVID-19 Patients
Explaining the Valais Constituent Assembly Votes
Andasi Project 2: Predicting Myocardial Infarction from In Silico Data Using Transfer Learning
Machine Learning in Quantitative Finance - Fast Derivatives Pricing and Hedging
Improving Causality Understanding of Trajectory Prediction Models Using Contrastive Learning
Sleep Stage Classification through Non-Invasive Sensors
MultiModal Modular Network (MoMoNet) for predicting COVID diagnosis from mixed image and tabular data
Novelty Detection and Revenue Estimation
Deep Learning for Edge-AI Respiratory Disorder Monitoring
Novelty Detection in the Dotcom Bubble
Reproducing results for Adaptive Stochastic Variance Reduction for Non-convex Finite-Sum Minimization method
Federated learning for semantic segmentation of cracks in images

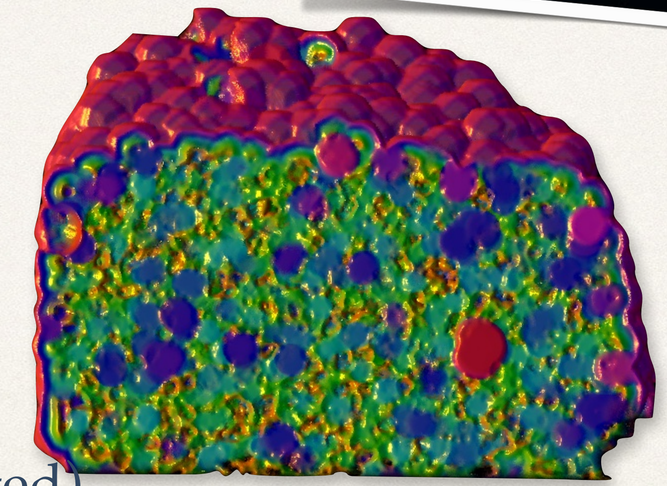
ML4science projects by your colleagues 2023

Image-based Cell Cycle Phase Classification using Machine-Learning Techniques
ML For Three Trees II - 🌳🌲🌴
Text Classification by Team: AI_squad
Learning phase masks for lensless imaging
Swiss Plasma Center: Investigation of the operational parameters for QCE H-mode regime access in TCV plasmas with supervised learning
ML4Science - Deep learning image classification for cell cycle stages
Road segmentation using deep learning
Recovering HDR signals from LDR images for understanding contrast preservation for view-out research
Data-driven surrogate modeling of the hemodynamics by prediction of POD coefficients (3D Navier-Stokes equations)
Advancing Homepage2Vec with LLM-Generated Datasets for Multilingual Website Classification
Data-driven Marketing Strategies for Non-Profit Organizations
Reinforcement Learning Actor for Blade Pitch Control in Wind Turbine Systems
Classification of Hsp70 proteins into taxonomic groups based on their amino acid sequences
Project2 ML_hype
Predicting mortgage default in the US
Synthetic data generation with VAE for fairness mitigation
Comparing U-Net and DeepRoadNet architecture to a generic CNN baseline for road segmentation
Text Sentiment Classification
Fine-tuning open-source LLMs for argument detection
Twiter Text Classification
ML4Science WhAI
Urban Heat Island intensity prediction using ensemble regression methods
Protein Thermal Stability Prediction
Road Segmentation - Team SLO
Reproduction and Adaptation of Epileptic Seizure Detection Algorithm into Standardization Framework
Investigation of the operational parameters for QCE H-mode regime access in TCV plasmas with supervised learning
Satellite Image Road Segmentation with an Adapted ResNet34 Implementation
Knowledge Tracing: Comparing DNNs Versus GPT For Intelligent Tutoring Systems
Optimizing Beam Dynamics in LHC
SCRAP: Seismic collapse response prediction of steel moment resisting frames
Cosmic Reionization Simulations using PINNs
Testing the McGurk Effect on Multimodal Audiovisual Models
Categorising Buildings in Lausanne Based on Facade Material
Analysis of View-out Impression Data
Image processing/pattern recognition on MHD spectrograms to automate the detection of phase in the discharge characterized by Magneto-Hydrodynamic instabilities
EEG decoding
Performing 2D Nucleus Segmentation With Cellpose and StarDist on Xenium Data
Evaluating the Performance of Ensembling Methods with CNNs for Road Segmentation
Meditron-V: Empowering Meditron with Visual Understanding
Recurrent convolutional neural network for coronal jets identification
Submission - Laurel and Hardy
RoadMaster: Mastering Road Segmentation using Deep Neural Networks
Shallow-learning
ML-powered Tool for assisted design of Buildings
ML4Science in collaboration with LAPD
Machine Learning for Chess Movement Recognition
Road Segmentation
Neural Control Systems (ML4S, reproduction paper)
Exploration for mutants with enhanced protein fitness
Crafting Metrics for MiniMeditron Reward Models
Twitter Sentiment Analysis: BERT's emojis
Coronal Mass Ejection prediction from spacecraft EDAC measures
Enhancing Fear Detection in GBV Survivors: A Deep Learning Approach with Physiological Data Analysis
Identification of radiative instability patterns
Predicting lipid abundance in a murine brain section from spatial gene expression
Protein fitness landscape & optogenetic design
Generalist neural networks for segmenting microscopy images
Machine Learning for chess moves recognition
State space modeling of memory representations in the hippocampus
Data-driven surrogate modeling of the hemodynamics by prediction of POD coefficients
Explaining venture teams' opportunity identification through multimodal data
Commonsense Persona-Grounded Dialogue Challenge (CPDC 2023)
Machine Learning Based Spherical Deconvolution for Intra-Voxel Fiber Estimation and Brain Connectivity Mapping
Efficiency of BlazePose markless pose estimation
Exploring Brain Modulation: Opto-fMRI Decoding of Locus Coeruleus Firing Patterns Using Searchlight, Multiple Kernel Learning, and
Exploring Neural Scaling Law for Deep Neural Network Models of the Ventral Visual Stream
Deep Biometric Fingerprint Matching
Advancing R&D Expenditure Predictions: The Power of Google Trends Data in Nowcasting
Physiotherapy Exercises and Errors Classification
Machine Learning Force Fields (ML-FFs) from Spatial Equivariant Descriptors
Comparison of Five Methods to Twitter Sentiment Analysis
Benchmarking models for cell location recovery from single cell transcriptomics
LLM Personalities Shenanigans
BiofilII: Evaluating Extreme Reconstruction and Inpainting on Biological Imaging
Topological analysis of Drosophila neural cultures
Clustering of DNA Sequences for Primer Extraction
Beyond additive noise: Evaluating Style Geometric Style Transfer in Scene Text Recognition
Characterization and automatic differentiation between minor and major disruptions
Automated Informalization Using LLemma
RainetteX_project - Markerless Pose Estimation
ML4S - Train generalist deep neural networks with database of annotated images
A Dual-Task Pipeline for Predicting Optic Nerve Neuron Firing Patterns
Optimisation of question selectionfor long term memory retention using machine learning
Rethinking Optimization for Non-Convex problems with SCRN and its derivatives
Enhancing Home Physiotherapy: Machine Learning for Exercise Recognition and Error Detection
Harnessing the Potential of Pretrained Language Models and Active Learning for Tweets Sentiment Analysis
Forecast the diagnostic group (PTSD or CUD) from the intrusion characteristics
CERN Compressor Vibration Analysis
LatentVec: Evaluating Generative Models for Vector Graphics with Interpretable latent states.
Predicting Patent Success: A Machine Learning Approach to Commercialization Prospects
Twitter sentiment analysis with ML
Using LLMs for Retrieval Augmented Generation on the RTS Archive
Deep Learning for Road Segmentation by LASMER Group
Performing Sentiment Analysis on Tweets: An Analysis of Multiple Methods
Identifying the neural predictors of subjective sleep quality from sleep EEG recordings in trans-diagnostic psychiatric conditions
Multi-category Multi-object Indoor Scenes Understanding for Intelligent Assistive Environment
Radiated power reconstruction given BOLO/AXUV line integrated measurements
Predicting brain activity during movie watching: from the movie frames to the brain
Movement recognition for physiotherapy
Machine Learning: Generalizable Yeast Cell Segmentation
Investigation of the operational parameters for QCE H-mode regime access in TCV plasmas through unsupervised learning
LSIR - Argument quality
Exploring Transformer Models for Page Prefetching
Fine-tuning Large Language Models for Argument Stance Detection in Unseen Domains
Road segmentation using Transfer Learning approach from pre-trained U-Net models
Gammagrou Text-Classification
Estimation of Brazil Nut Productivity in the Amazon (Madre de Dios)
Train generalist deep neural networks with database of annotated images: MEDIAR Architecture
Tweet sentiment classification
Road Segmentation with CBAM2U-Net
Federated Learning with Partial Model Personalization

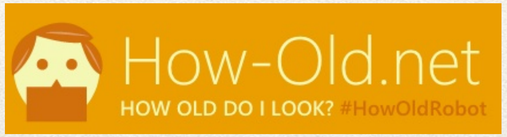
Applications, cont.

Image Data

- Astronomy
- Face recognition
- 2D + 3D medical imaging
- OCR
- self-driving cars



[how-old.net](how-old.net) (deactivated)

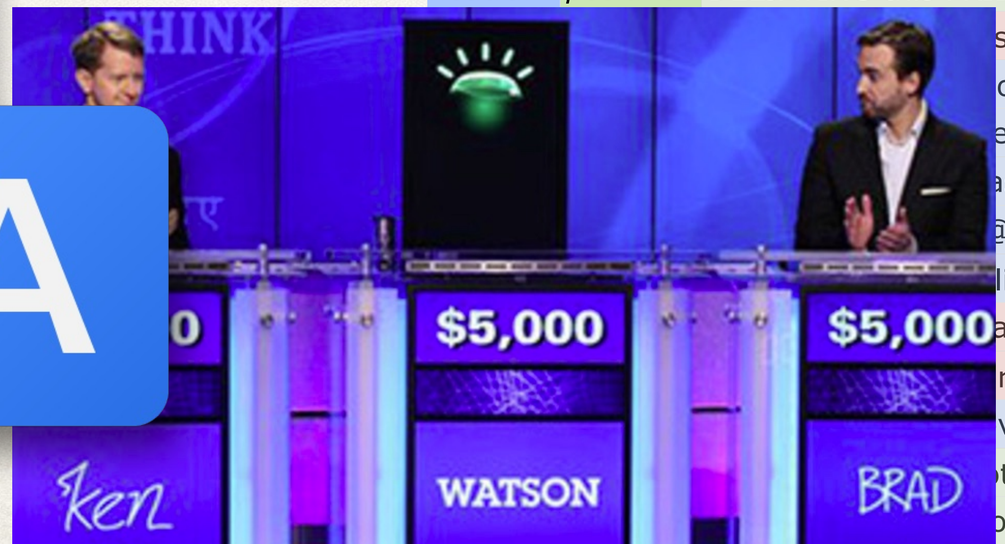


Text Data

- Text Understanding & Text Generation
- Spam Detection
- User Content
- Medical Text
- Machine Translation

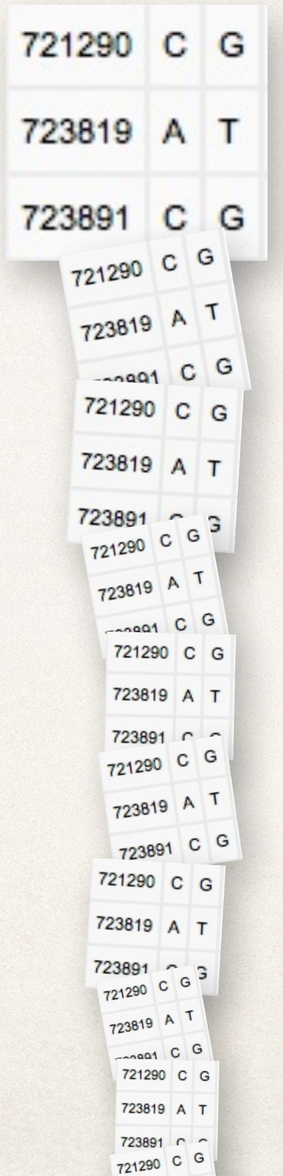
negative	*neutral*	But i wanna wear my Concords tomorrow though but i don't feel like it
positive	*neutral*	Gonna watch Grey's Anatomy all day today and tomorrow(:
negative	*neutral*	@CoachVac heey do you know anything about UVA's fallll fest loll they invited me
neutral	*neutral*	@DustyEf when that sun is high in that Texas sky, I'll be buckin it to county fair. A
neutral	*positive*	Up 20 points in my money league with Vernon Davis and L. Fitz still to go tomorro
neutral	*positive*	DEEJAYING this FRIDAY in THE FIRST CHOP it's CHRIS actual SMITH with a smash

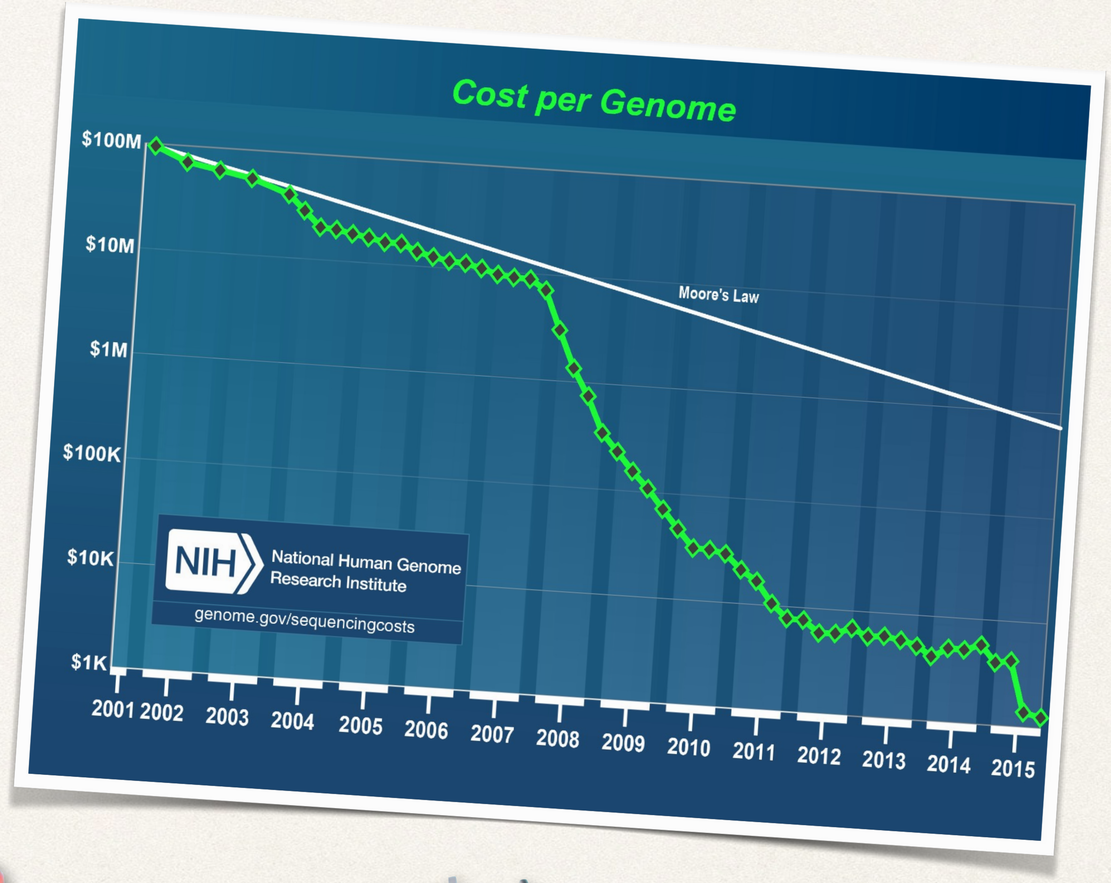
DeepL

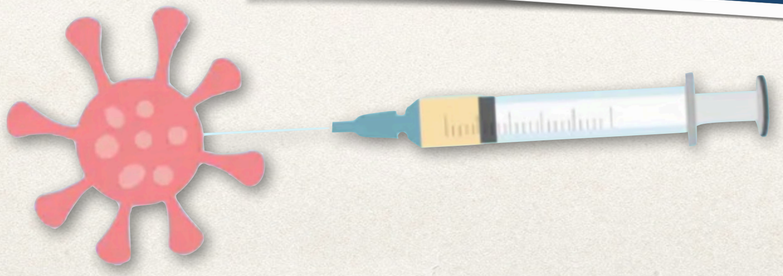


signing that was scheduled for tomorrow at the Books A Million
oks like it! Was after El Clasico on Sunday. I didn't like her lol
ent for the 2nd time today!
asketball Game tomorrow at 6:00 pm Then Football Senior nigh
@Young__Assassin VS @jamievarner set for TUF 16 Finale on t
lide thru sometime this weekend ill have somethin yu can sip c
absolutely-- I meant out of the Bachmann, Perry, Santorum, H
re Levein discussion on Wed. Can't keep changing boss, but he
vember 02, 1958 Elvis gave a party at his hotel before going o
t to then kick back n party everyday like its Fri
o exited about Vancouver tomorrow! I'm like a kid at Christma

Medical: Genetic Data



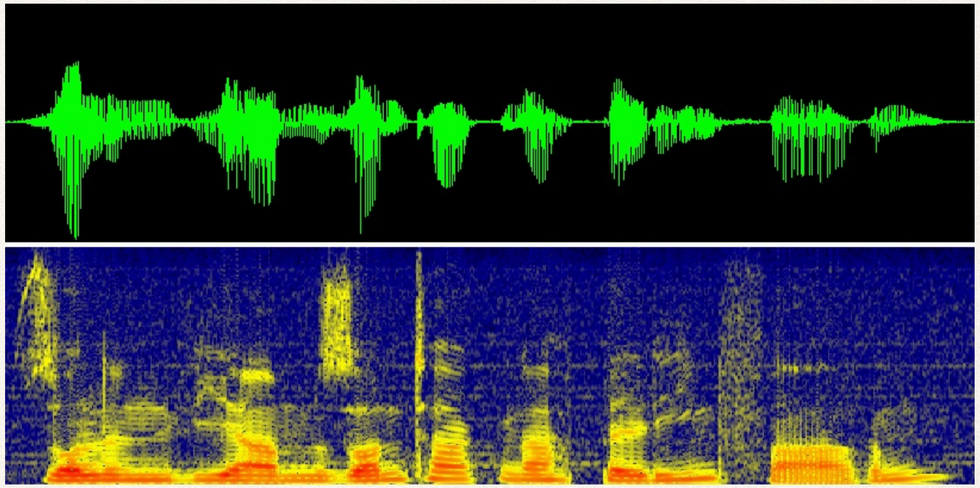




ref

Audio & Multimodal Data

- Hearing aids
- Voice Recognition

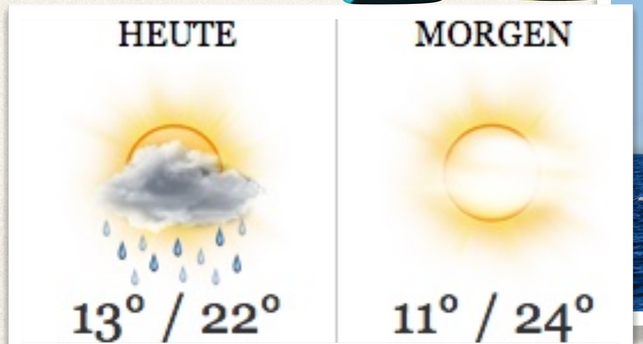


- Automatic Translation
- Lip Reading
- Video Analysis

LYREBIRD

Numerical / Sensor Data

- Cern
- Astronomy / Telescopes
- Fitness Trackers
- Weather Forecast
- Robotics
- Kinect



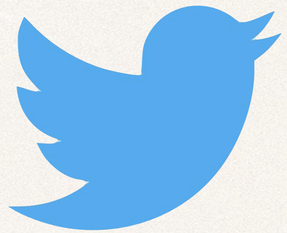
Games & Simulations

- Immediate Feedback
- Chess, Go
- Physical World

Internet Data: Part 1

WIKIPEDIA

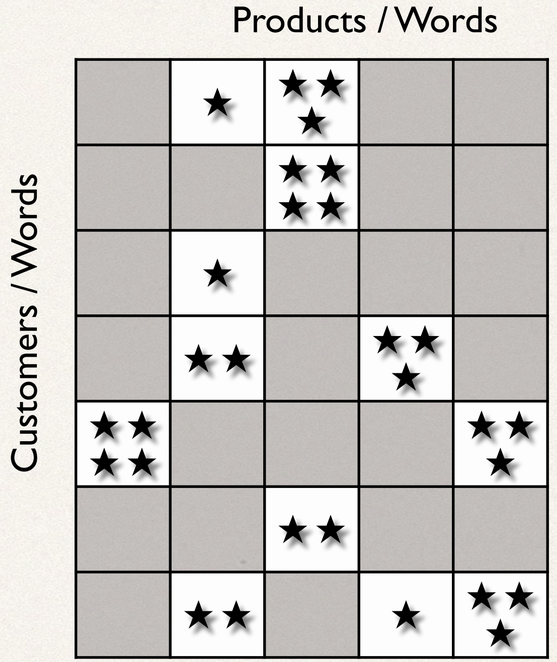
GitHub



YouTube

Google

amazon.com



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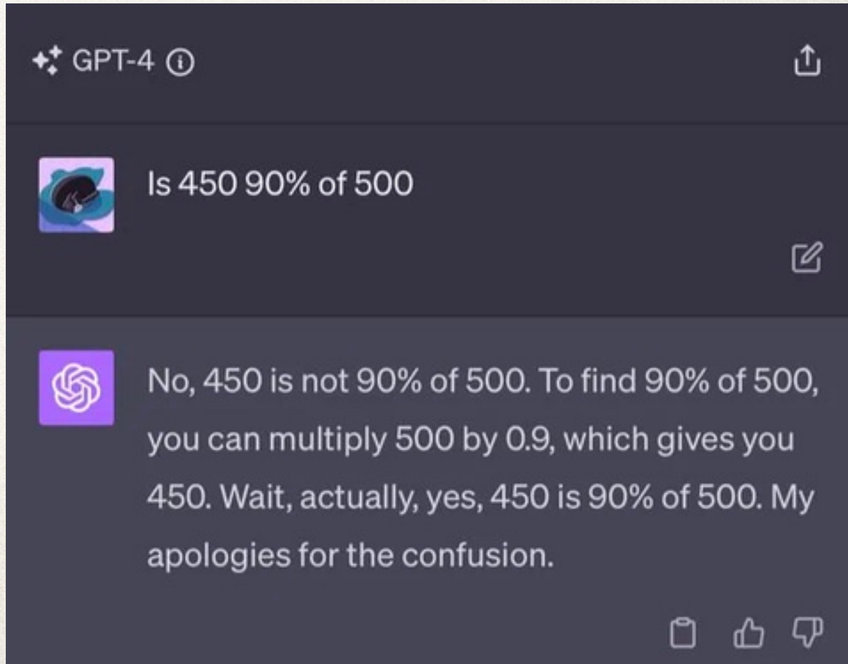
Recommender systems, Ads

Internet Data Part 2 / Large Language Models

ChatGPT

Virtual assistants



Other Generative AI models

generation of

image, video,

audio, text

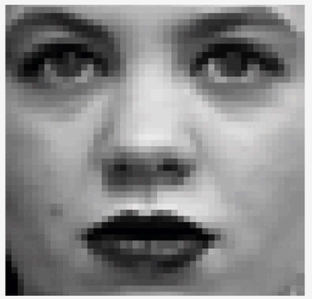
modalities

Timeline of images generated by artificial intelligence

These people don't exist. All images were generated by artificial intelligence.

Our World in Data

2014



Goodfellow et al. (2014) – Generative Adversarial Networks

2015

Radford, Metz, and Chintala (2015) – Unsupervised Representation Learning with Deep Convolutional GANs

2016

Liu and Tuzel (2016) – Coupled GANs

2017

Karras et al. (2017) – Progressive Growing of GANs for Improved Quality, Stability, and Variation

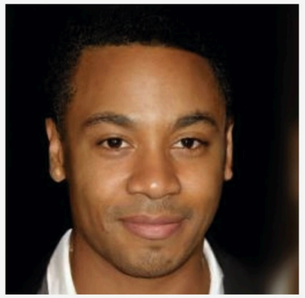
2018

Karras, Laine, and Aila (2018) – A Style-Based Generator Architecture for Generative Adversarial Networks

2019

Karras et al. (2019) – Analyzing and Improving the Image Quality of StyleGAN

2020



Ho, Jain, & Abbeel (2020) – Denoising Diffusion Probabilistic Models

2021 Image generated with the prompt: *"a couple of people are sitting on a wood bench"*

Ramesh et al. (2021) – Zero-Shot Text-to-Image Generation (OpenAI's DALL-E 1)

2022 Image generated with the prompt: *"A Pomeranian is sitting on the King's throne wearing a crown. Two tiger soldiers are standing next to the throne."*

Saharia et al. (2022) – Photorealistic Text-to-Image Diffusion Models with Deep Language Understanding (Google's Imagen)

New Opportunities?

Your turn

up next:

- Regression
- Linear Regression
- Classification
- … **fundamental concepts of ML**