Martin Mundt, Dr. Iuliia Pliushch, Prof. Dr. Visvanathan Ramesh

Pattern Analysis & Machine Intelligence Praktikum: MLPR-19

Week 1: Introduction

Lecture requirements

- 4 hours per week
- 8 credit points
- Final class group projects
- Attend the class

- Bring a laptop
- Each session is going to start with a small lecture
- Jupyter notebooks will be used for practical content
- We will use Google's Collaboratory for cloud computation
- If you want to execute the notebooks locally, we advise a Linux or Mac OS

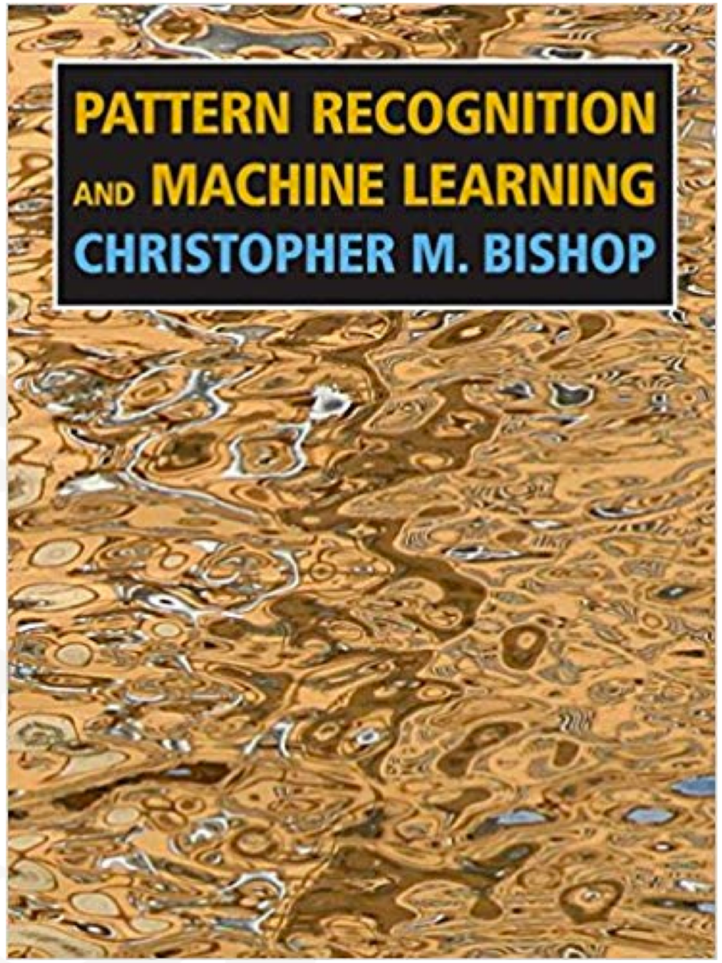
- Lecture materials will be shared on GitHub: https://github.com/MrtnMndt/mlpr19

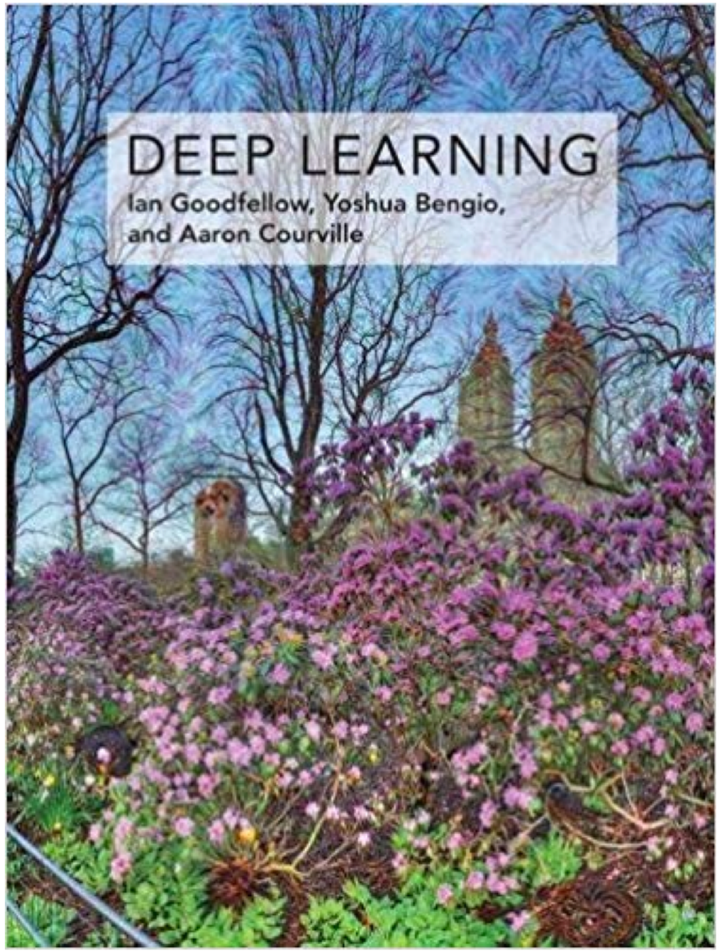
Tentative schedule

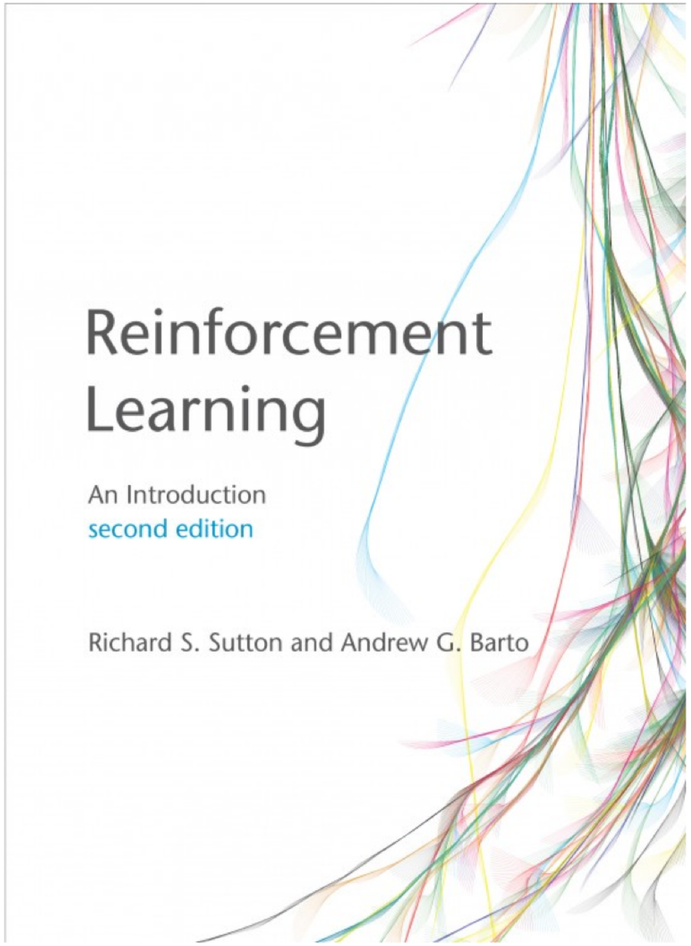
Week 1: 15.04 – Intro Jupyter & Colab notebooks, Python review, version-control & documentation
Week 2: 22.04 – Easter holiday
Week 3: 29.04* – Regression and gradient descent (Kaggle Titanic dataset)
Week 4: 06.05 – Random forests (Sklearn intro & San Francisco Crime Challenge)
Week 5: 13.05 – Intro to unsupervised learning (K-means or PCA)
Week 6: 20.05 – Basic neural networks (Multi-layer perceptron on FashionMNIST)
Week 7: 27.05 – Convolutional neural networks & frameworks (PyTorch, Revisiting FashionMNIST)
Week 8: 03.06* – Unsupervised NNs (autoencoders, image generation - variational autoencoders)
Week 9: 10.06 – Pfingsten
Week 10: 17.06 – Intro to basic reinforcement learning (Cart-pole)
Week 11: 24.06 – Reinforcement learning: Q-Learning and QNN (some game)
Week 12: 01.07 – Neural sequence models (Recurrent neural networks, text classification)
Week 13: 08.07 – Neural sequence models (long-short-term memory, poetry generation)
Week 14: 15.07 – State of the art outlook, project pitches and discussion (3 slide pitches)

* Suggested longer sessions to compensate for weeks 2 and 9

Literature


PATTERN RECOGNITION
AND MACHINE LEARNING
CHRISTOPHER M. BISHOP

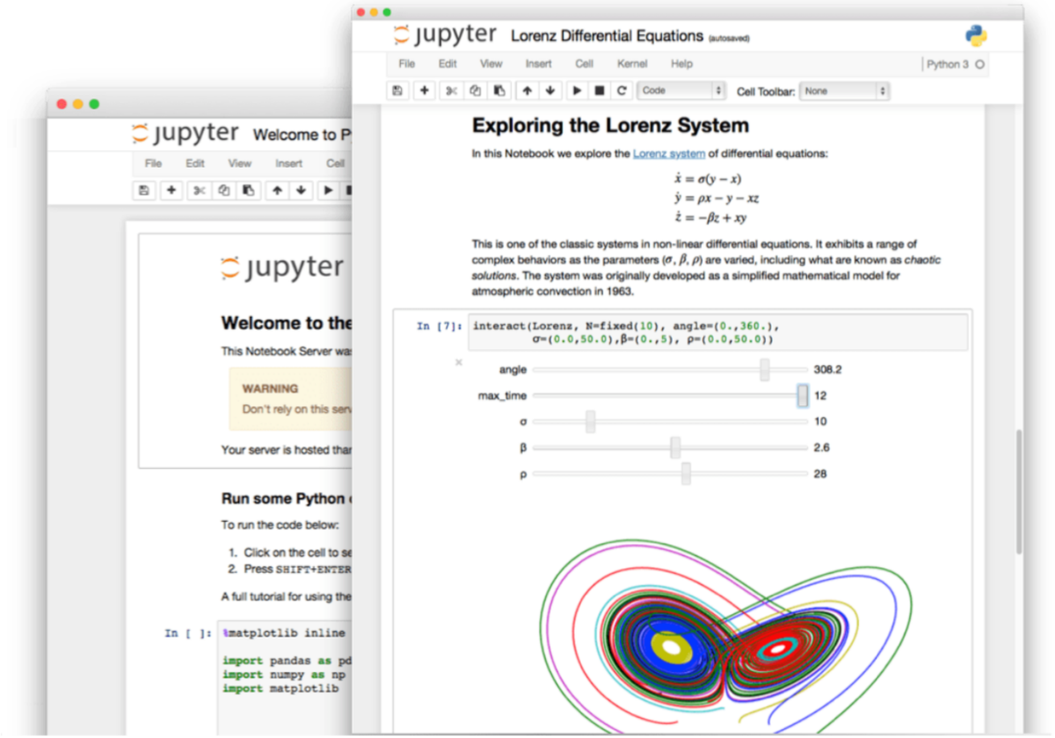

DEEP LEARNING
Ian Goodfellow, Yoshua Bengio,
and Aaron Courville


Reinforcement
Learning
An Introduction
second edition
Richard S. Sutton and Andrew G. Barto

Jupyter notebooks: https://jupyter.org/

jupyter

Install About Us Community Documentation NBViewer JupyterHub Widgets Blog

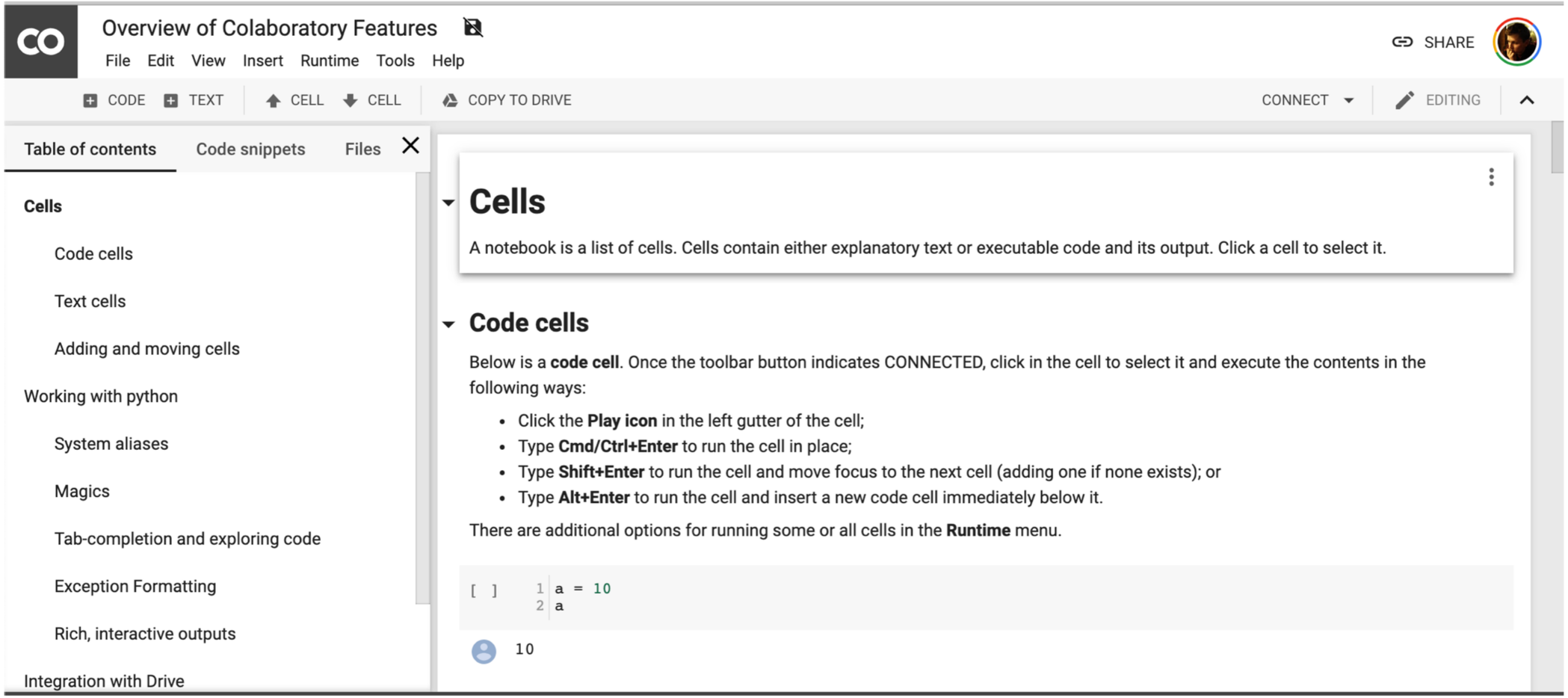


The Jupyter Notebook

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more.

Try it in your browser | Install the Notebook

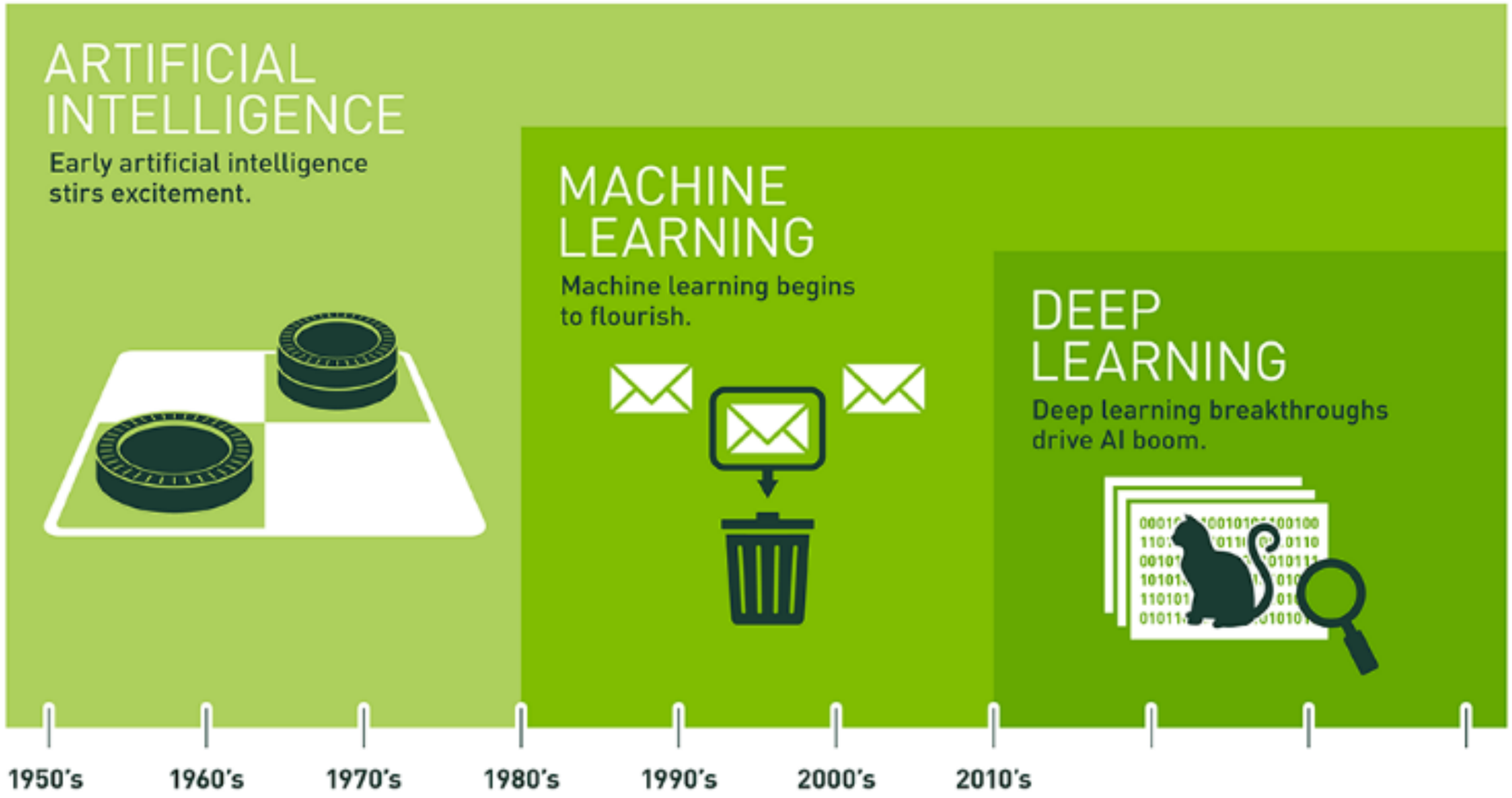
Google Colab: https://colab.research.google.com/



Machine learning in our daily lives

- Recommender systems
- Medicine/Pharma
- Finance
- Smart homes
- Video games
- Customer support, chat bots
- Machine translation
- Smart cars
- Surveillance, security
- Recruiting, job market
- Robot control
- Art

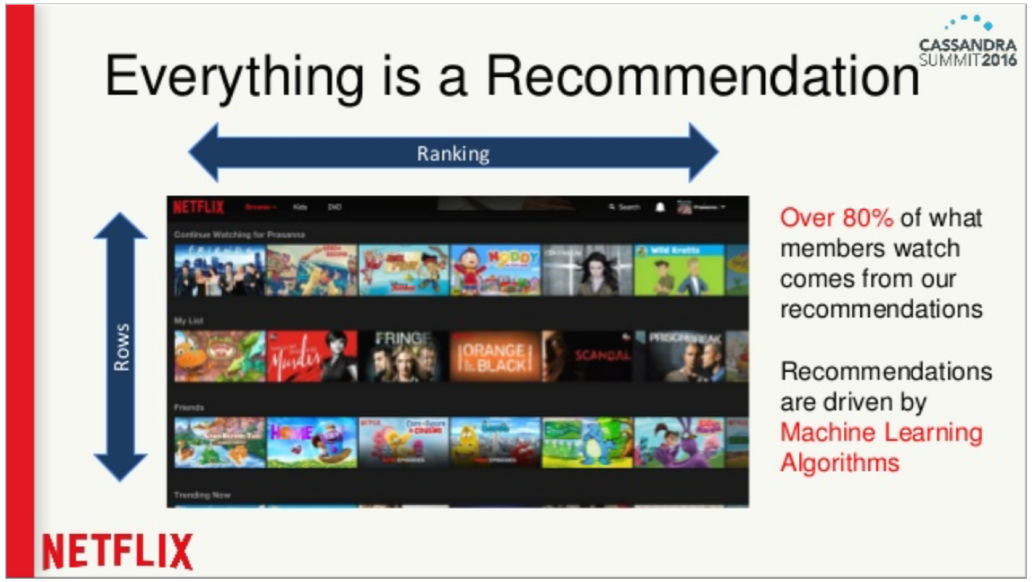
Terminology

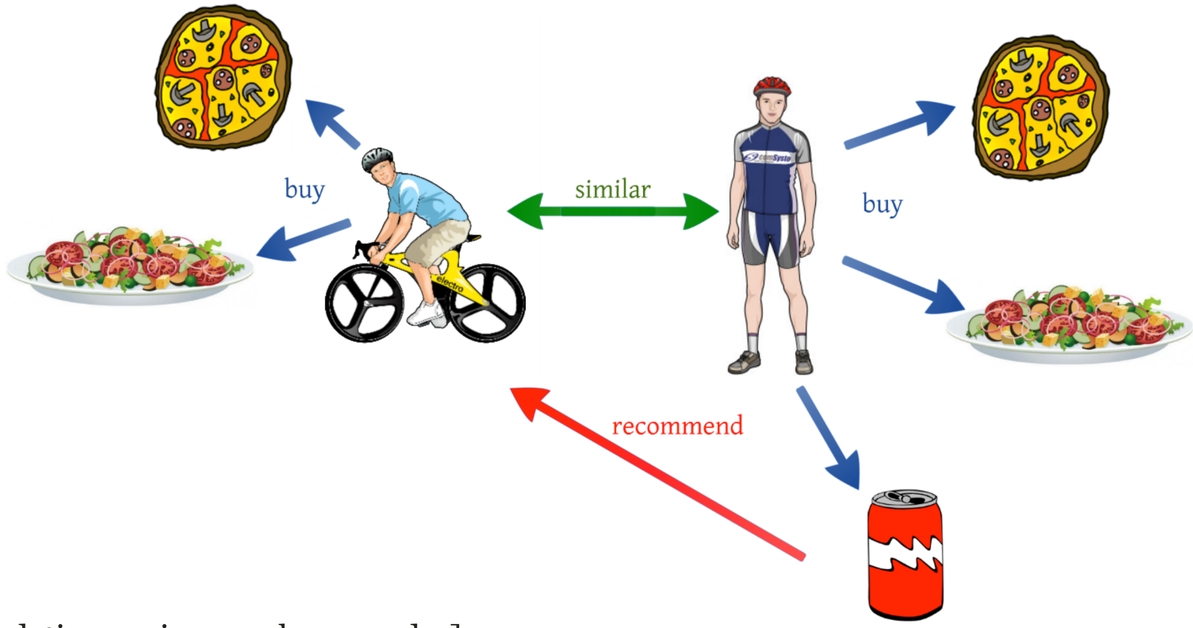


Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

Recommender Systems

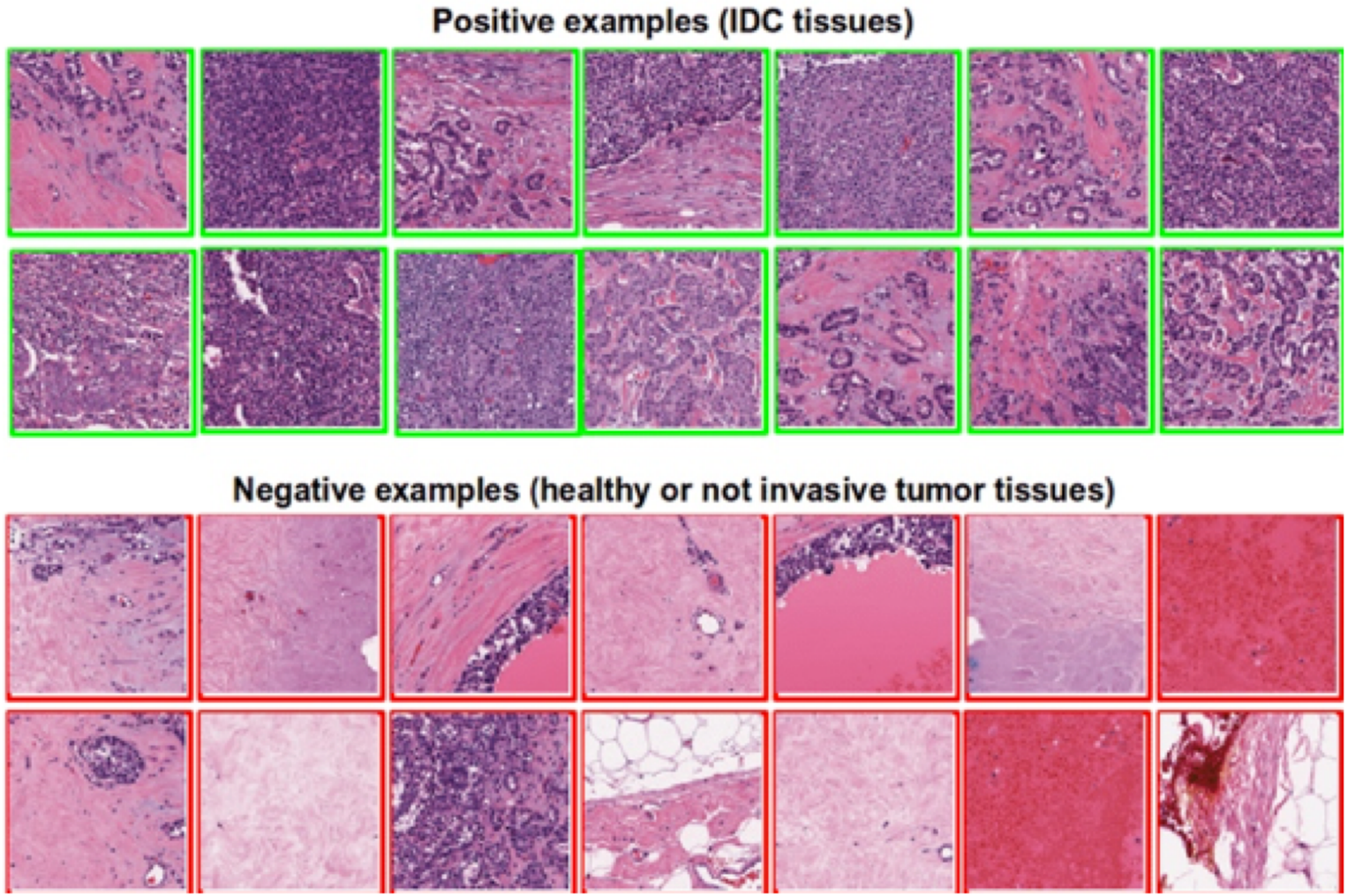




[https://www.slideshare.net/DataStax/netflix-recommendations-using-spark-cassandra]

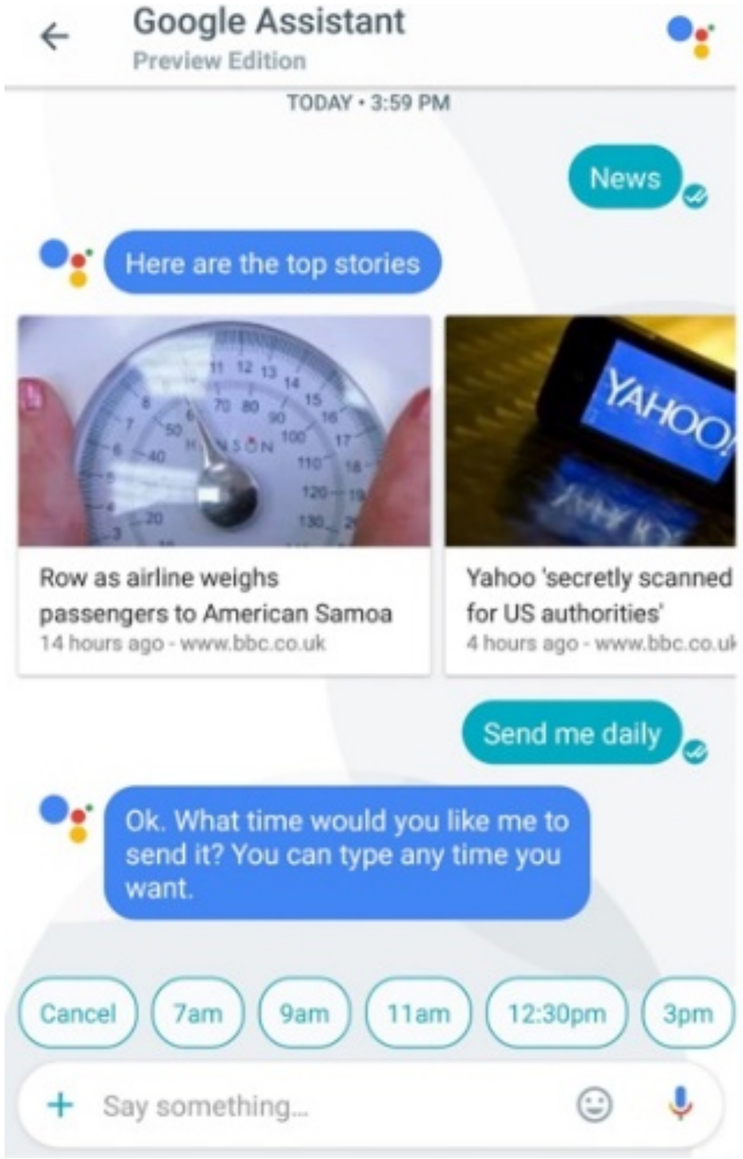
[https://blog.soton.ac.uk/smallworld/2015/04/25/game-theory-and-recommendation-systems/]

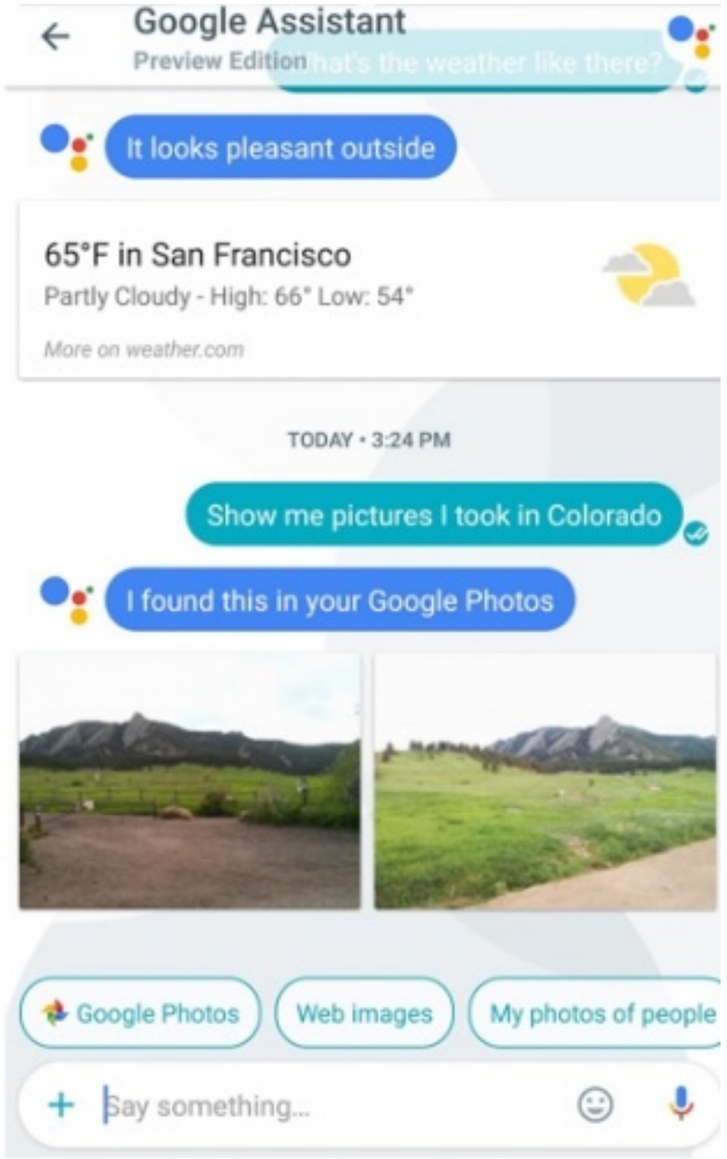
Medical Diagnosis



https://doi.org/10.1117/12.2043872

Personal Assistants – Natural Language Processing





https://www.fudzilla.com/news/41763-google-assistant-uses-ai-machine-learning-to-become-people-friendly

Smart Home

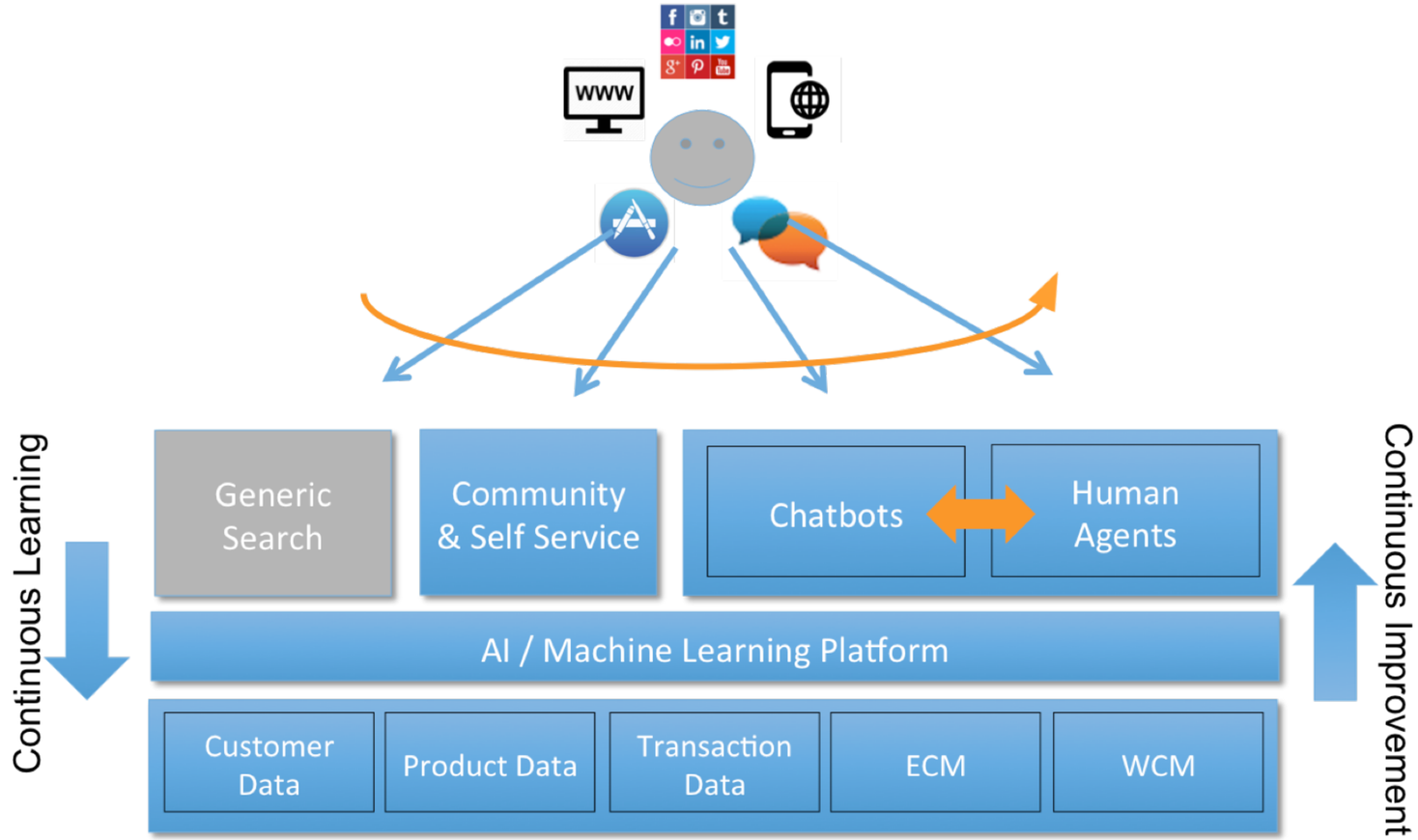
http://blog.airpatrol.eu/wp-content/uploads/2016/10/bigstock-Smart-Home-103718372-1200x800.jpg

Video Games

Video at this link https://www.youtube.com/watch?v=36cKiPPrGHo

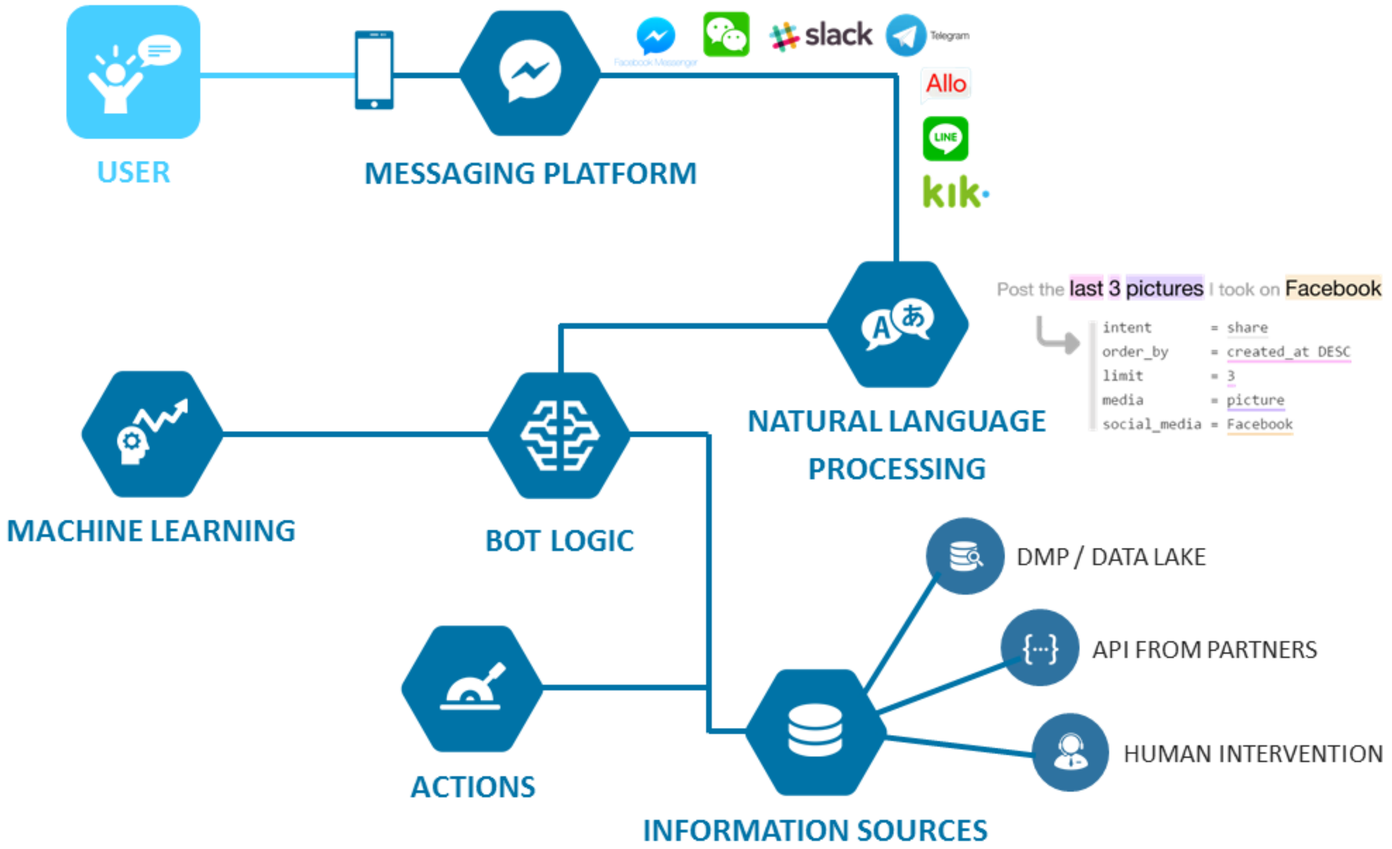
Customer Service Infrastructure

Customer Support



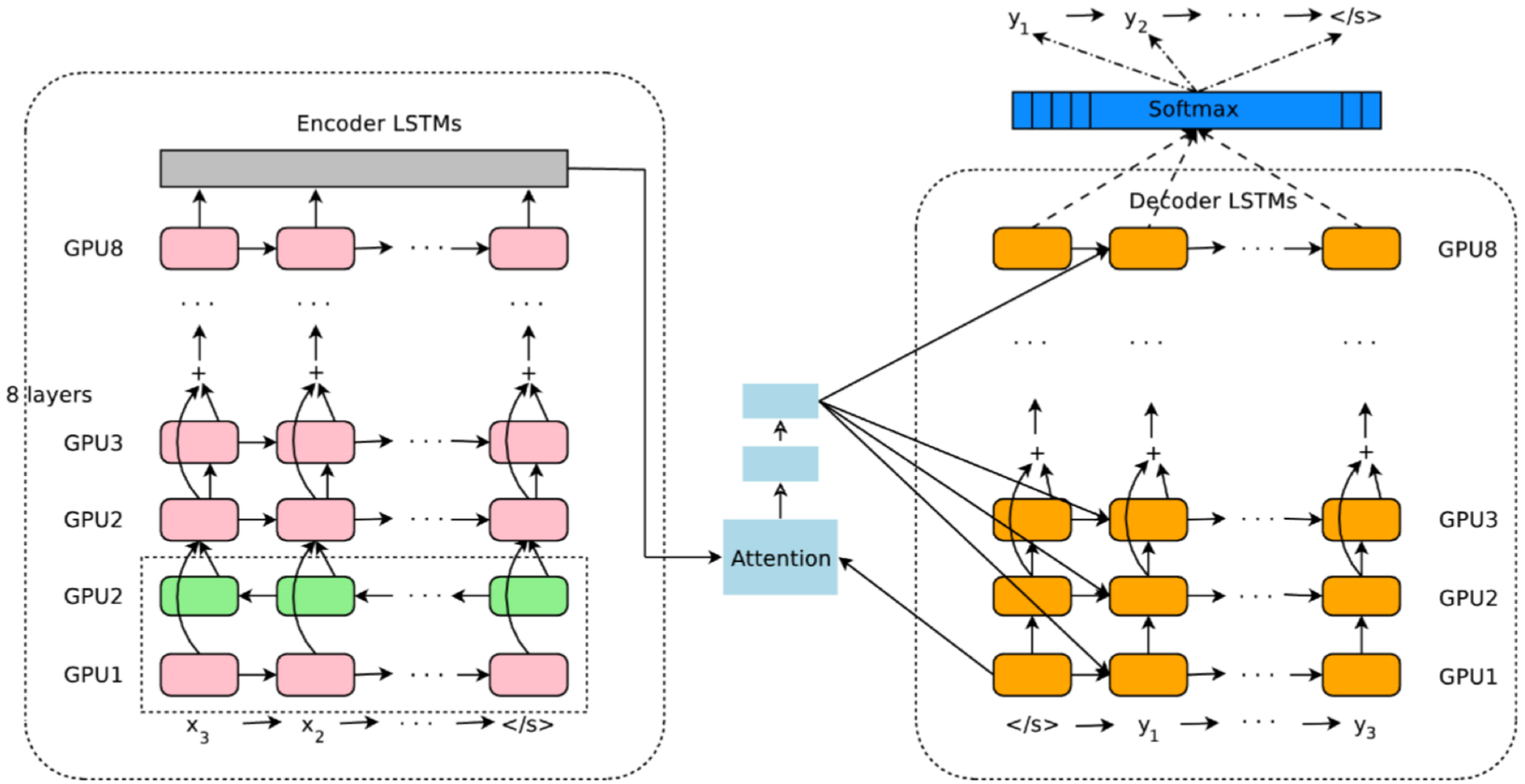
http://www.epikonic.com/wp-content/uploads/Customer-Service-Infrastructure.png

Chatbots



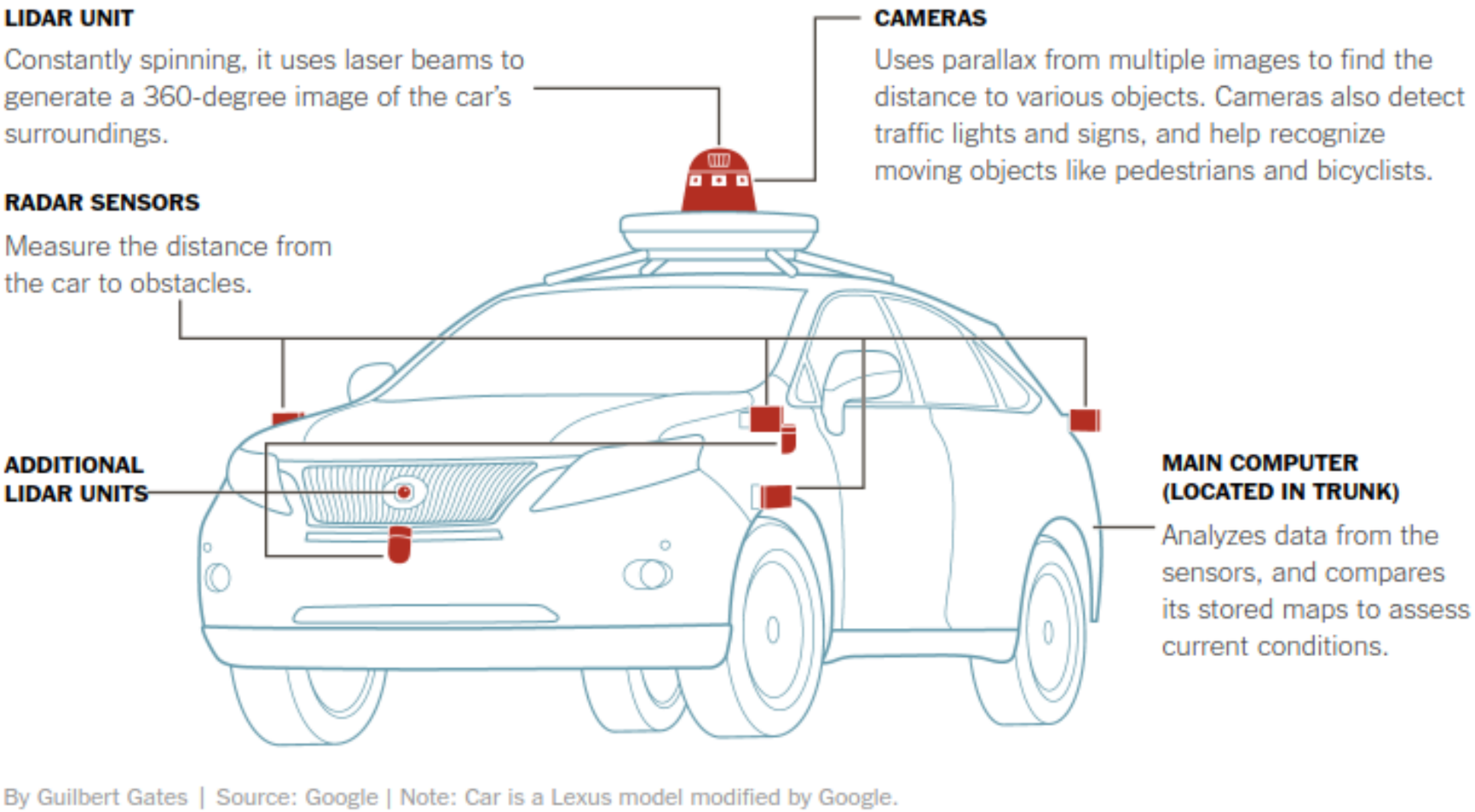
https://chatbotsmagazine.com/the-ultimate-guide-to-designing-a-chatbot-tech-stack-333eceb431da

Machine Translation



[From Google's Neural Machine Translation System: Bridgin the Gap between Human and Machine Translation]

Autonomous driving



https://www.nytimes.com/interactive/2016/12/14/technology/how-self-driving-cars-work.html?_r=0

Autonomous driving

Collision avoidance

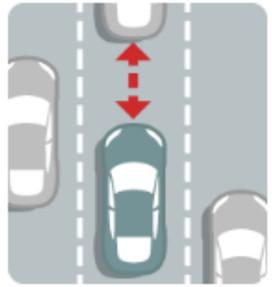
Radar-, laser-, or camera-based systems warn of an impending collision, and can automatically apply the brakes in some cases.

Drifting warning

If a car begins to deviate from its lane, some systems alert the driver and apply a small counter-steering force.

Blind-spot detectors

Cameras or radar can detect vehicles in the driver's blind spot and then alert the driver with sounds or warning lights.



Enhanced cruise control

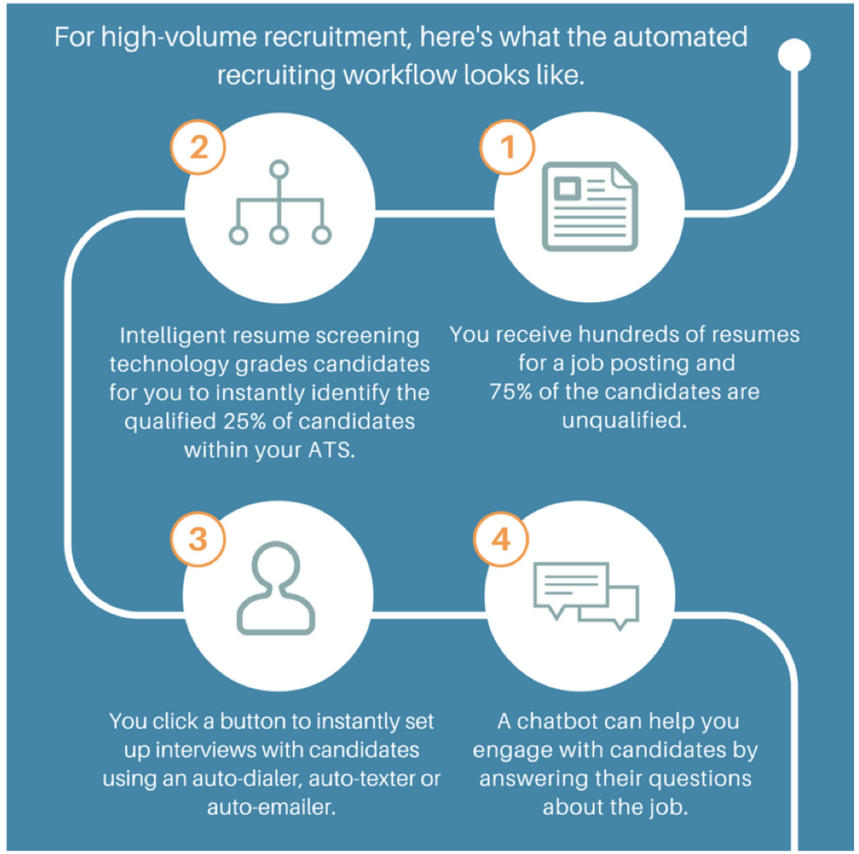
A predefined distance can be maintained to the vehicle ahead. If it slows, your car also slows.

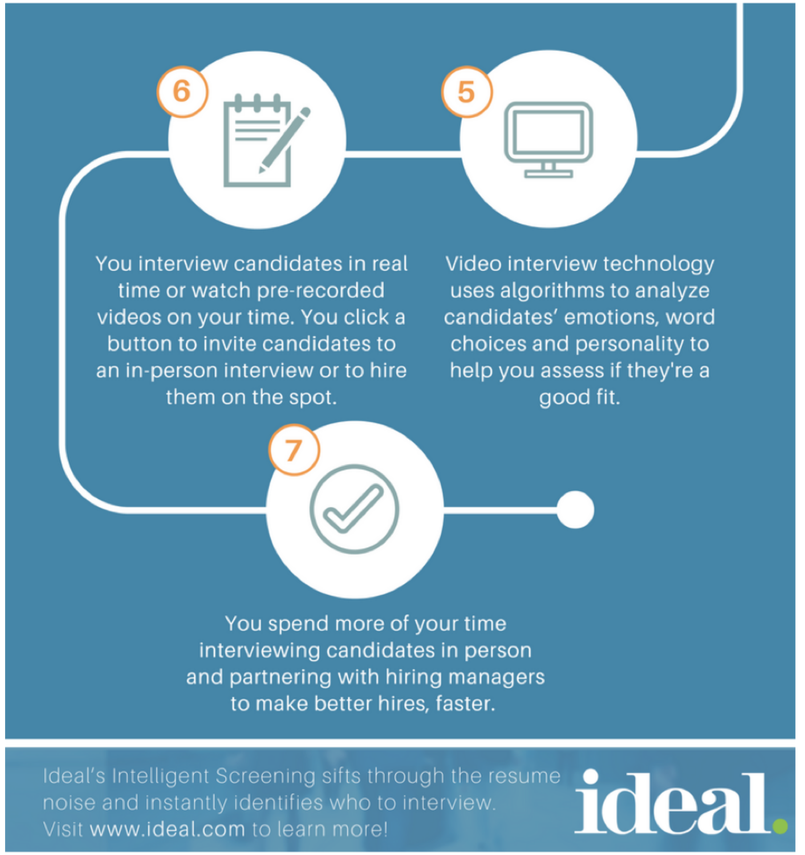
Self parking

The car maneuvers itself into a parking spot using cameras or sonar. But the driver usually has to brake and follow commands.

https://www.nytimes.com/interactive/2016/12/14/technology/how-self-driving-cars-work.html?_r=0

Recruiting





http://www.hrmblogs.com/2018/01/17/ai-recruitment-the-future-of-automated-recruiting/

Art

1 Upload photo

The first picture defines the scene you would like to have painted.

2 Choose style

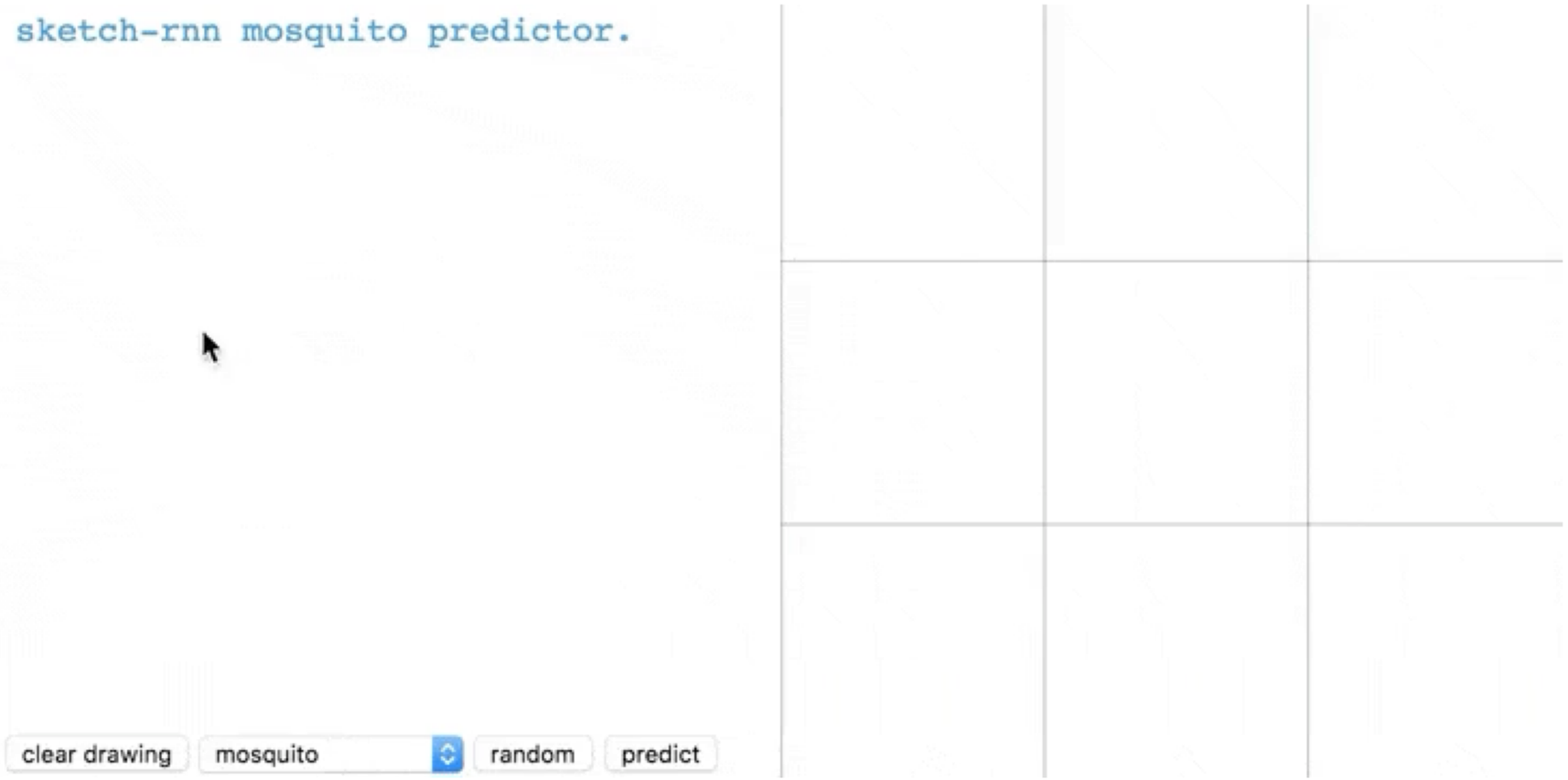
Choose among predefined styles or upload your own style image.

3 Submit

Our servers paint the image for you. You get an email when it's done.

https://deepart.io/

Sketching



https://magenta.tensorflow.org/assets/sketch_rnn_demo/img/multi_sketch_mosquito.gif

Photography

https://www.fastcompany.com/90247454/the-pixel-3-puts-googles-extraordinary-ai-in-your-pocket