MACHINE LEARNING

INTRODUCTION

AGENDA

01 Introduction

Terms and conditions

02 Artificial Intelligence

Definition, origins, and basic concepts.

03 Machine Learning

Types of machine learning

04 Applications

Medicine, chemistry, robotics, laws, psychology, etc.

INTRODUCTION

INTRODUCTION

C O N T A C T

Name: M. Sc. Jonathan Domínguez Aldana.

Cel: 4423275084

Mail: jonathandoal@hotmail.com

INTRODUCTION

G R A D I N G

MIDTERM – 40%	
RUBRIC	**PERCENTAGE**
Programming Exercises	30%
Quizzes	30%
Mid-term exam	40%

FINAL – 60%	
RUBRIC	**PERCENTAGE**
Programming Exercises	20%
Quizzes	10%
Project	50%
Final exam	20%

INTRODUCTION

A S S I S T A N C E

Assistance **won’t count but make** an **effort** to **come** to **most** of **classes.**

INTRODUCTION
ACADEMIC DISHONESTY

For any section contained in Art. 140 of *"Reglamento para Alumnos"*, the student WILL FAIL THE SUBJECT and a report will be raised to establish an Academic Dishonesty, wich will be included in her/his academic record.

INTRODUCTION
JUSTIFICATION OF ABSENCES

Any change to the exam date or absence justification will be authorized only by the Coordinator.

Date changes and absence justifications will be authorized in case of hospitalization, decease of a close family member, or for representing the University in relevant competitions.

Any exam out of date, which does not fulfill any of the previous requirements, will be graded over 70 without exception.

INTRODUCTION

MIDTERM AND FINAL EXAM DATES

MIDTERM

EXAM: 07/10/2020

FINAL

EXAM : 07/12/2020

PROJECT : 03/12/2020

ARTIFICIAL INTELLIGENCE

ORIGIN

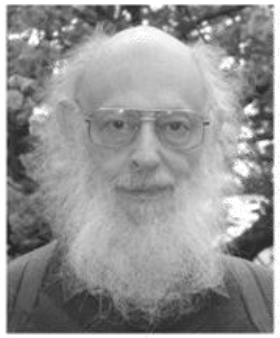
ARTIFICIAL INTELLIGENCE

1956

John MacCarthy

Marvin Minsky

Claude Shannon

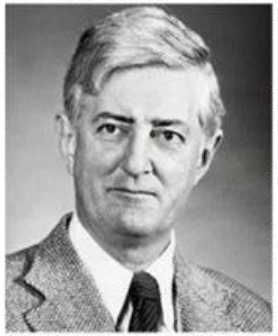


Ray Solomonoff

Alan Newell

Herbert Simon

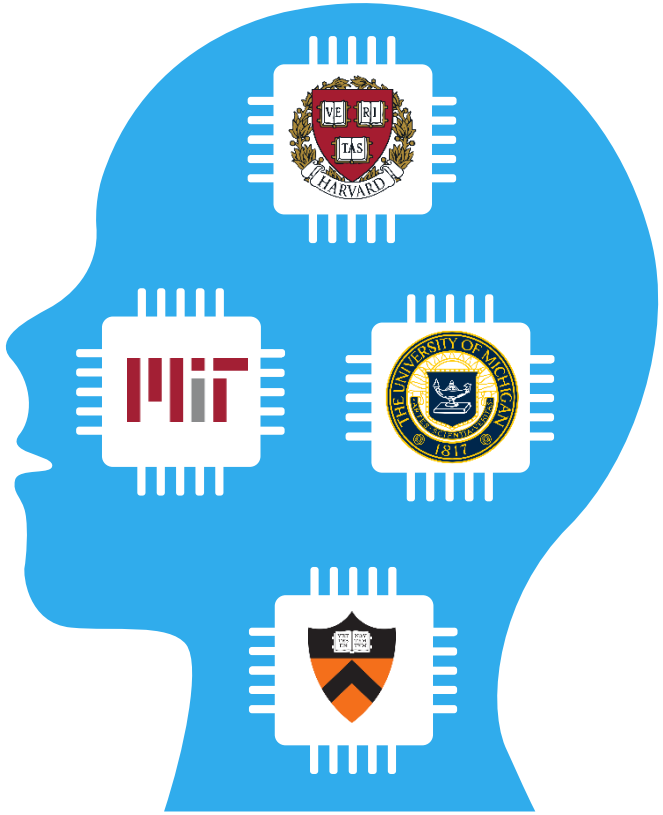
Arthur Samuel



Oliver Selfridge

Nathaniel Rochester

Trenchard More



[1] M. Minsky and P. Rosenbloom, “History of Artificial Intelligence,” pp. 1759–1762, 2009.

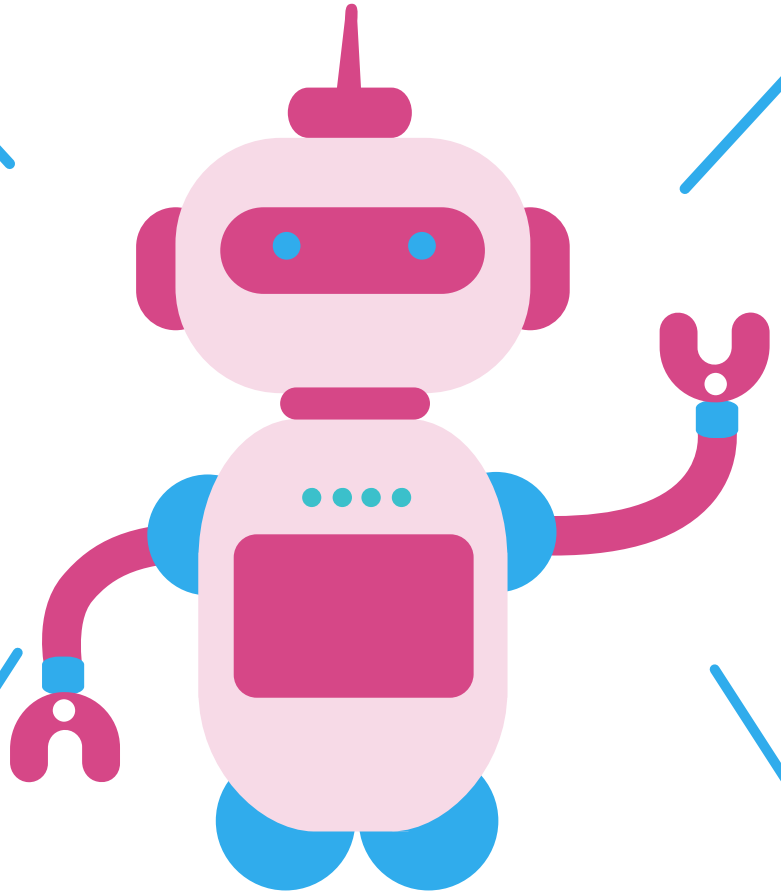
What does it mean to be intelligent?

Representation

It has an adequate model of the world

Compilation

Extraction of additional information when required.



Response

Be able to answer questions about that model of the world.

Adaptation

Make tasks in the world based on its objectives.

[2] J. Mccarthy and P. J. Hayes, “Some Philosophical Problems From The Standpoint Of Artificial Intelligence,” pp. 1–51, 1969.

What is artificial intelligence?

HUMAN BEHAVIOR

Neuroscience

Psychology

Cognitive sciences

Turing test

RATIONALISM

Engineering

Mathematics

Rational Agents

[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

A system is rational if it does the "right thing," given what it knows.

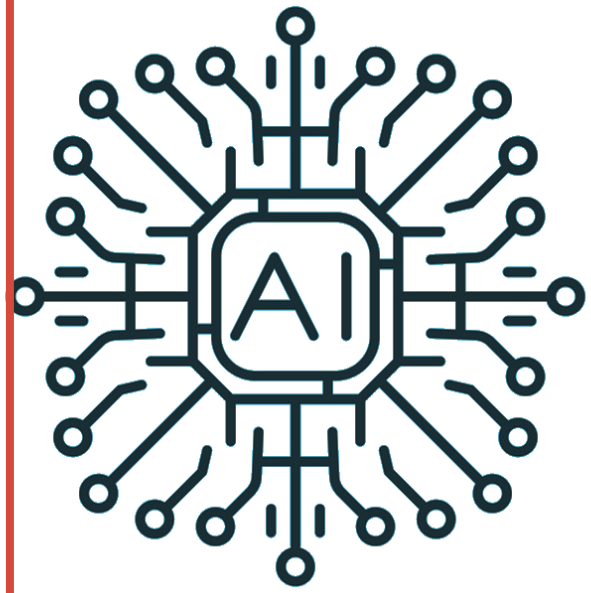
AI APPROACHES

Acting Humanly

Turing Test

Acting Rationally

Rational Agents.
"Making the right thing"
Game Theory.
Economics.



Thinking Humanly

Cognitive Science.
Psychology

Thinking rationally

Logic

Gödel's Incompleteness Theorem

[2] J. Mccarthy and P. J. Hayes, "Some Philosophical Problems From The Standpoint Of Artificial Intelligence," pp. 1–51, 1969.

ACTING HUMANLY

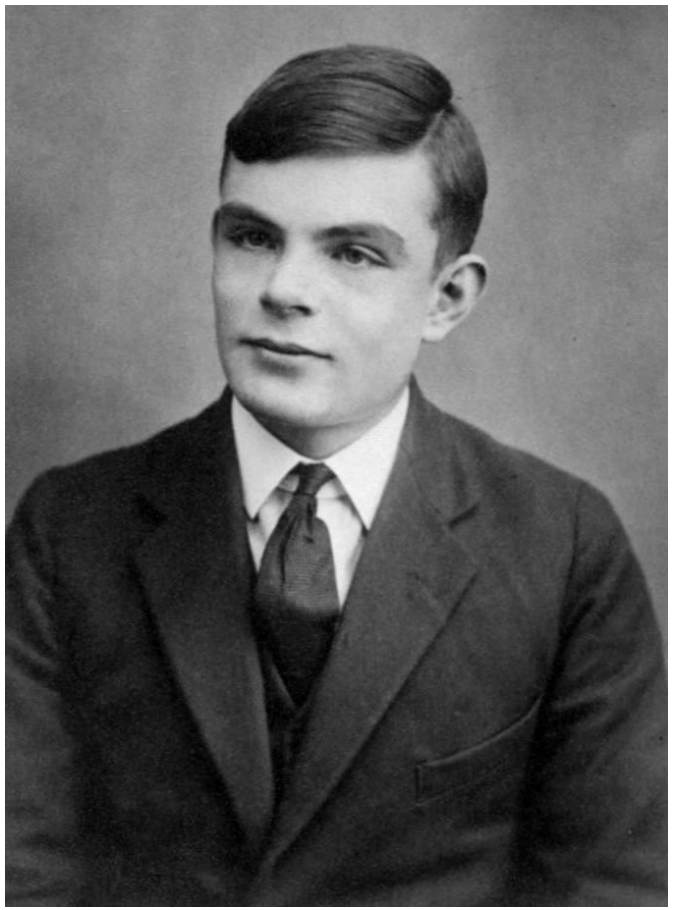
Alan Turing

Mathematician

Computer Scientist

Philosopoher

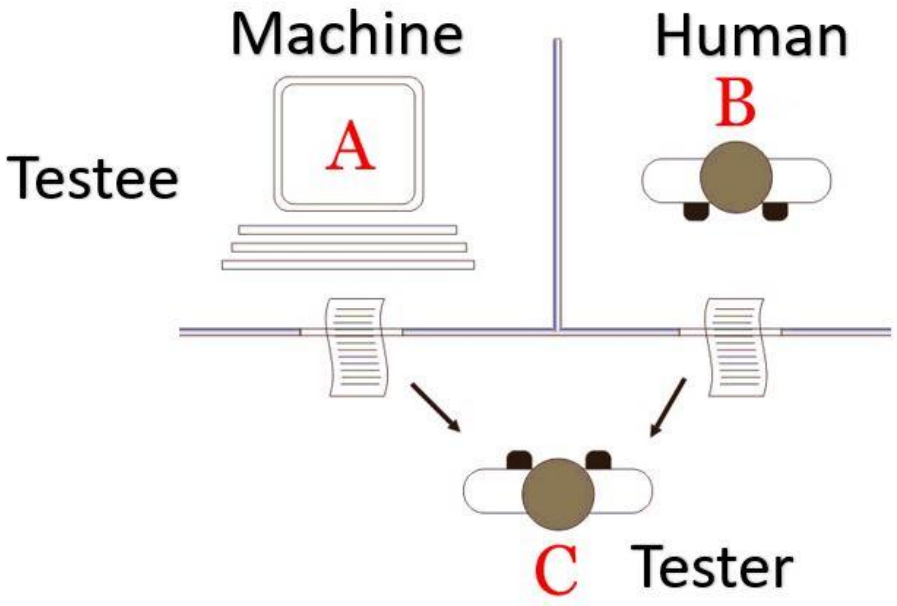
UNIVERSITY OF CAMBRIDGE



[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

The Turing Test

"A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer"



[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

BRANCHES

ARTIFICIAL INTELLIGENCE

Based on the Turing Test

Natural Language Processing
Communicate information to other agents.

Knowledge Representation
Store what it is known and perceived.

Automatic Reasoning
Use the stored information to answer questions and derive new conclusions.

Machine Learning
Learn form the environment to take decisions.

[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

The Total Turing Test

"The Total Turing Test includes a video signal so that the interrogator can test the subject's perceptual abilities"

[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

BRANCHES

ARTIFICIAL INTELLIGENCE

Based on the Total Turing Test

Computer vision
Perceive objects in the real world.

Robotics.
To manipulate objects and move about

[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

MACHINE LEARNING

MACHINE LEARNING

Field of study that grants computers the ability to learn without any explicit programming [4]

Subfield of AI that allows computers to adapt to new circumstances, detect and extrapolate patterns. [3].

[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

[4] A. L. Samuel, "Some studies in machine learning using the game of checkers. II-Recent progress," Annu. Rev. Autom. Program., vol. 6, no. PART 1, pp. 1–36, 1969.

TYPES OF MACHINE LEARNING

MACHINE LEARNING

SUPERVISED LEARNING

NON-SUPERVISED LEARNING

REINFORCEMENT LEARNING

DEEP LEARNING

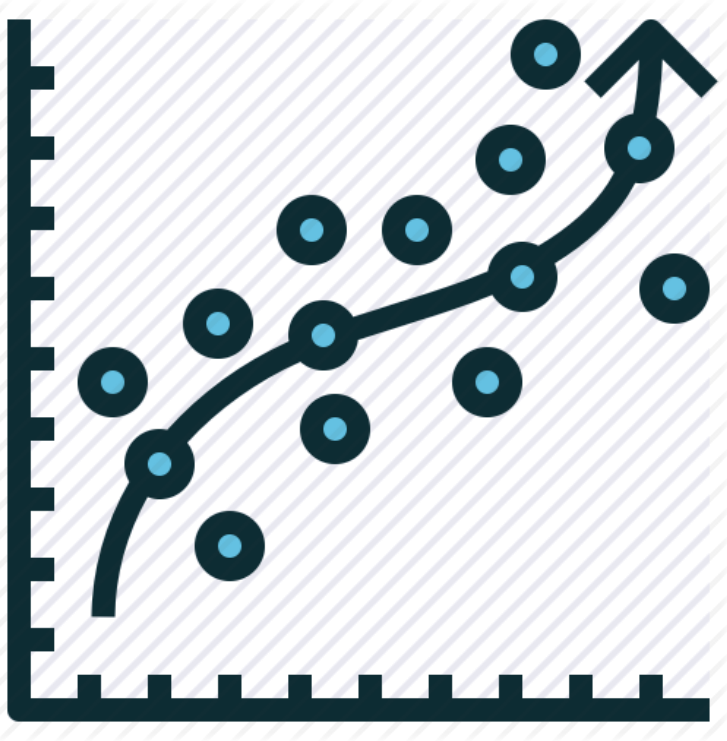
[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

[5] R. M. Neal, “Pattern Recognition and Machine Learning,” Technometrics, vol. 49, no. 3, pp. 366–366, Aug. 2007.

SUPERVISED LEARNING

Given a training set comprised by N pairs of inputs and outputs $(x_1, y_1)\ (x_2, y_2), \ldots (x_N, y_N)$ where every y_i was generated by an **unknown function** $y = f(x)$ **,** the objective consists in finding a **function** h that approximates the true function f.

x and **y** could represent any numeric or qualitative value, while **h** represents a hypothesis.

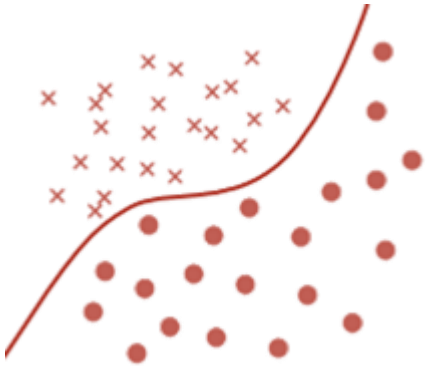


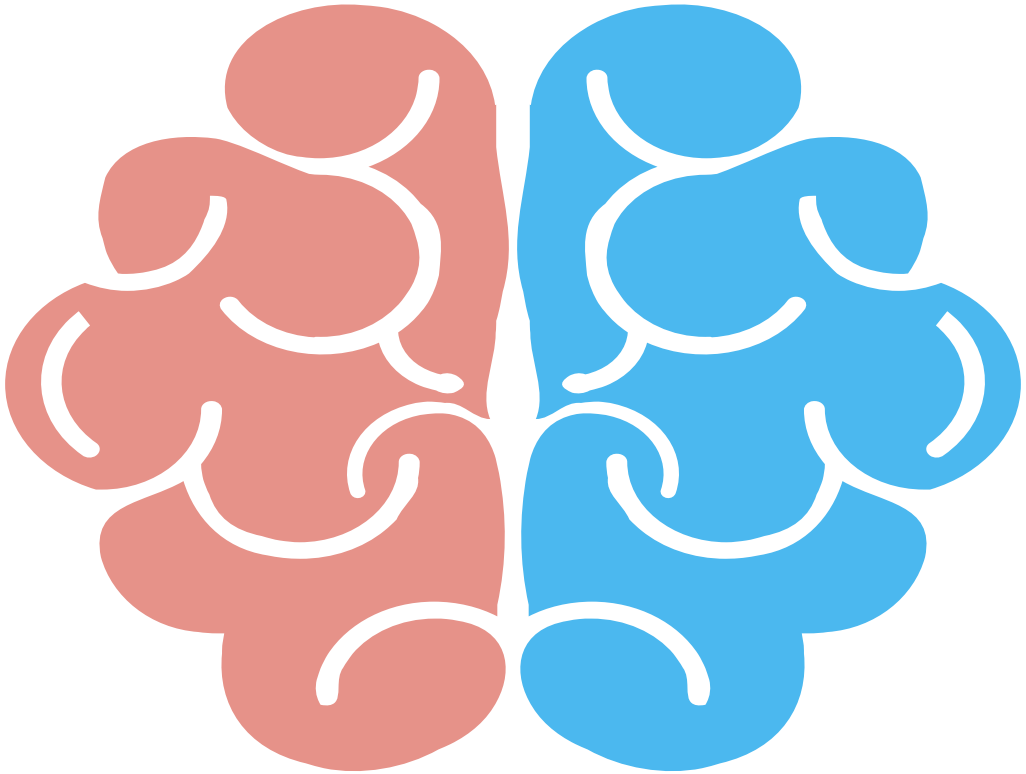
[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

SUPERVISED LEARNING

CLASSIFICATION

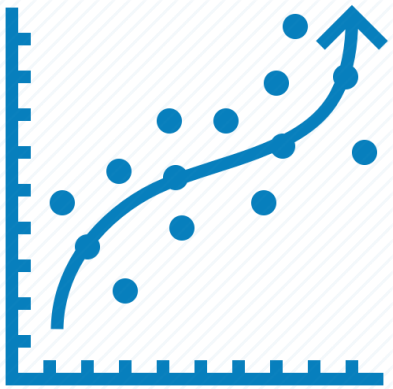
The output y, of the approximated function comprises a set of finite values.





REGRESSION

The output y, of the approximated function comprises a set of continuous values.



[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

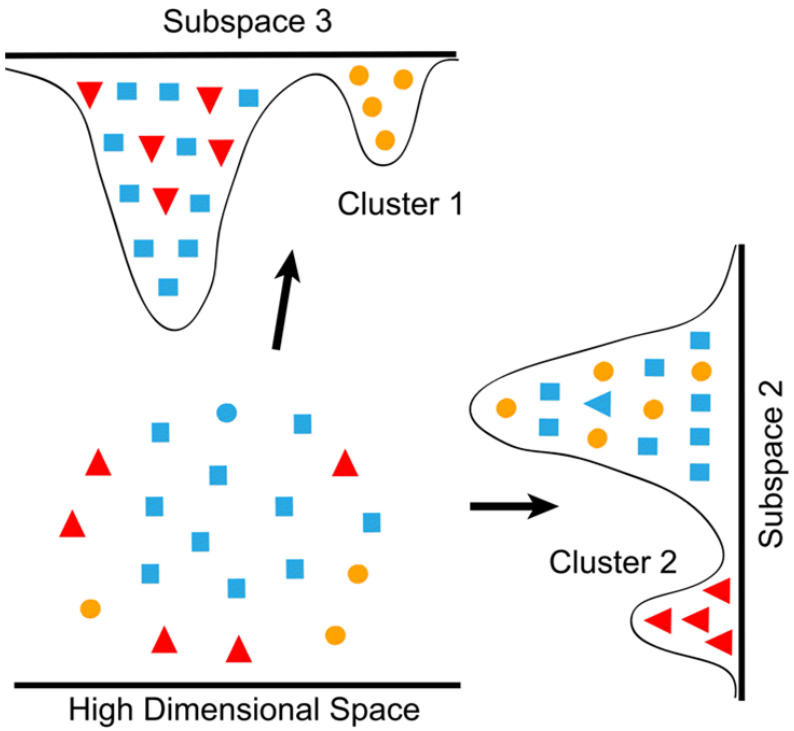
[5] R. M. Neal, "Pattern Recognition and Machine Learning," Technometrics, vol. 49, no. 3, pp. 366–366, Aug. 2007.

NON-SUPERVISED
L E A R N I N G

“

Machine learning field whose objective resides in finding patterns within the training data set $(x_1, x_2, \ldots, x_N)$ without specifying the system outputs.

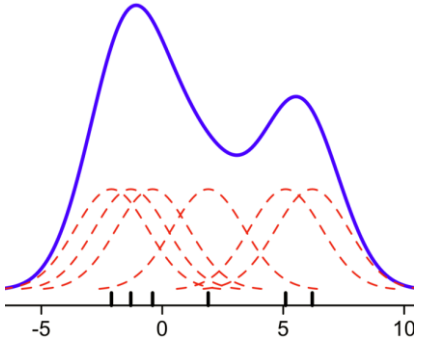
”

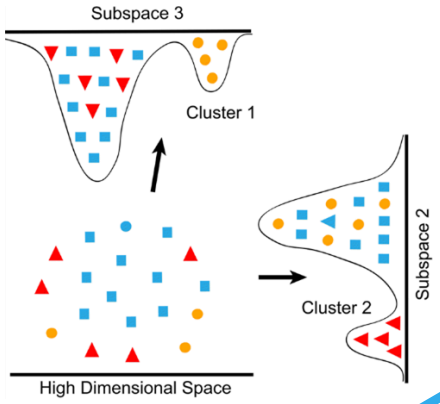


[3] S. Russel and P. Norvig, Artificial intelligence—a modern approach 3rd Edition, vol. 11, no. 01. 2012.

[5] R. M. Neal, “Pattern Recognition and Machine Learning,” Technometrics, vol. 49, no. 3, pp. 366–366, Aug. 2007.

NON-SUPERVISED LEARNING





VISUALIZATION

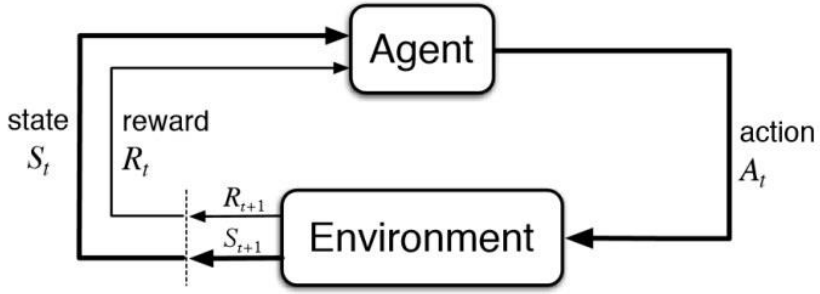
DISTRIBUTION ESTIMATION

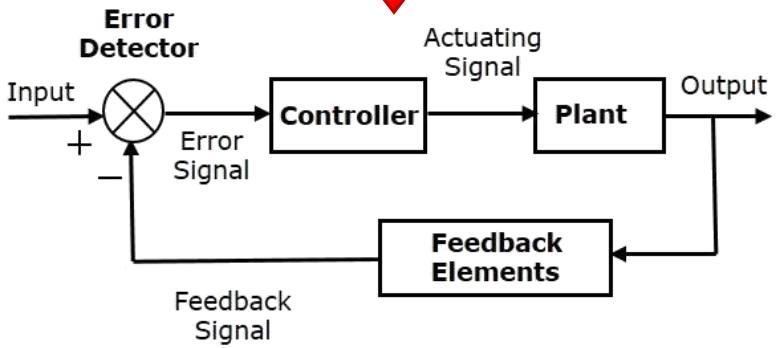
CLUSTERING

[5] R. M. Neal, “Pattern Recognition and Machine Learning,” Technometrics, vol. 49, no. 3, pp. 366–366, Aug. 2007.

REINFORCEMENT
L E A R N I N G

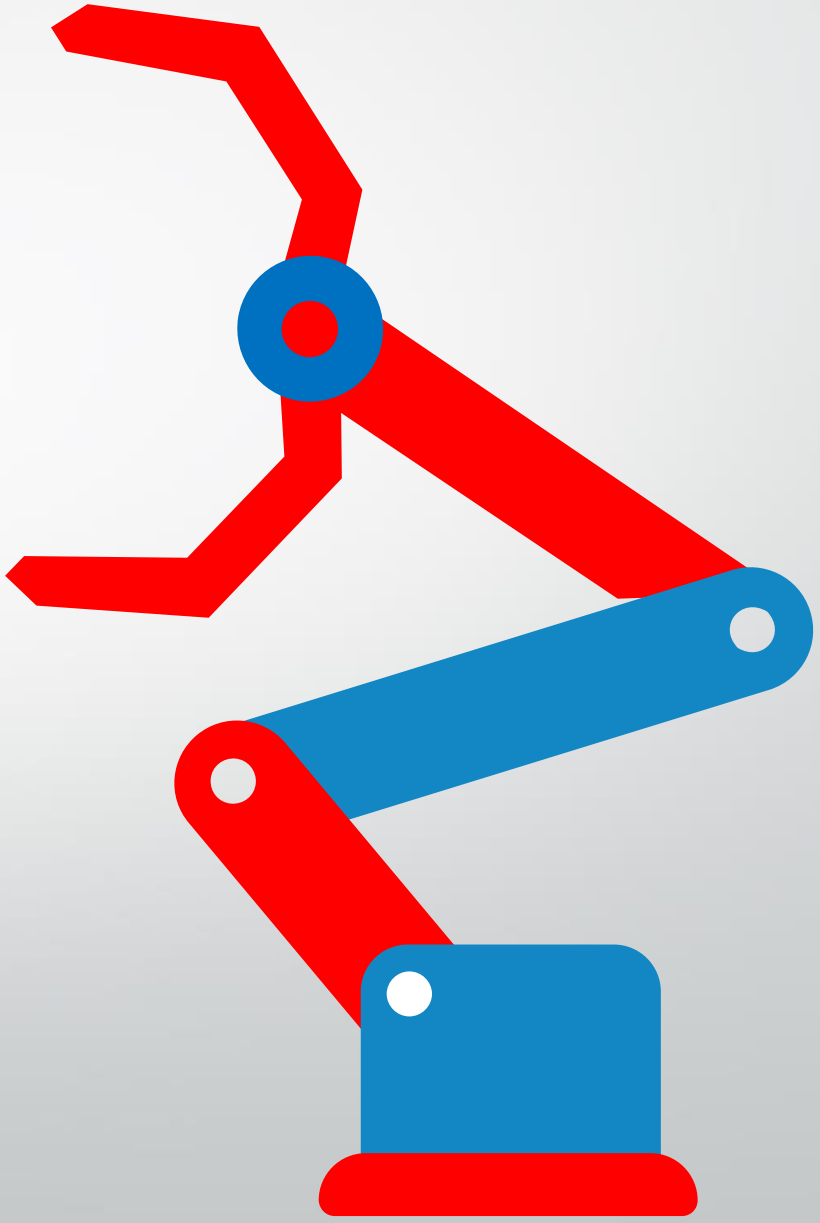
Area of machine learning whose objective consists in finding the most appropiate set of actions to a specific situation to maximize a reward.





[5] R. M. Neal, “Pattern Recognition and Machine Learning,” Technometrics, vol. 49, no. 3, pp. 366–366, Aug. 2007.

APPLICATIONS



MEDICINE

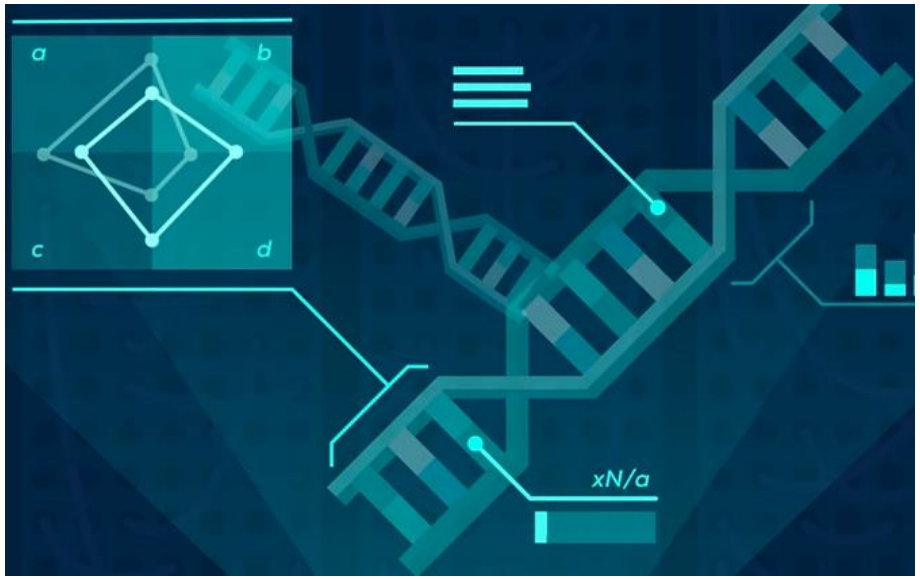
ReviveMed

Discovery of new medicines.

> The core of our technology is based on a network-based machine learning algorithm for integrative analysis of untargeted metabolomic data with other large-scale molecular information such as data from genes, proteins, drugs and diseases.

IBM Watson Health

Diagnosis of new dieases using radiomics, genomics and proteomics.



[6] ReviveMed, "Technology - ReviveMed Technologies." [Online]. Available: http://www.revivemed.io/technology/. [Accessed: 05-May-2019].

[7] C. B. Clish, F. M. White, A. Saghatelian, and E. Fraenkel, "Revealing disease-associated pathways by network integration of untargeted metabolomics," vol. 13, no. 9, pp. 770–776, 2017.

CHEMISTRY

Toxicity prediction of chemical compounds.

[8] T. Unterthiner, A. Mayr, G. Klambauer, and S. Hochreiter, “Toxicity Prediction using Deep Learning,” 2015.

NATURAL LANGUAGE

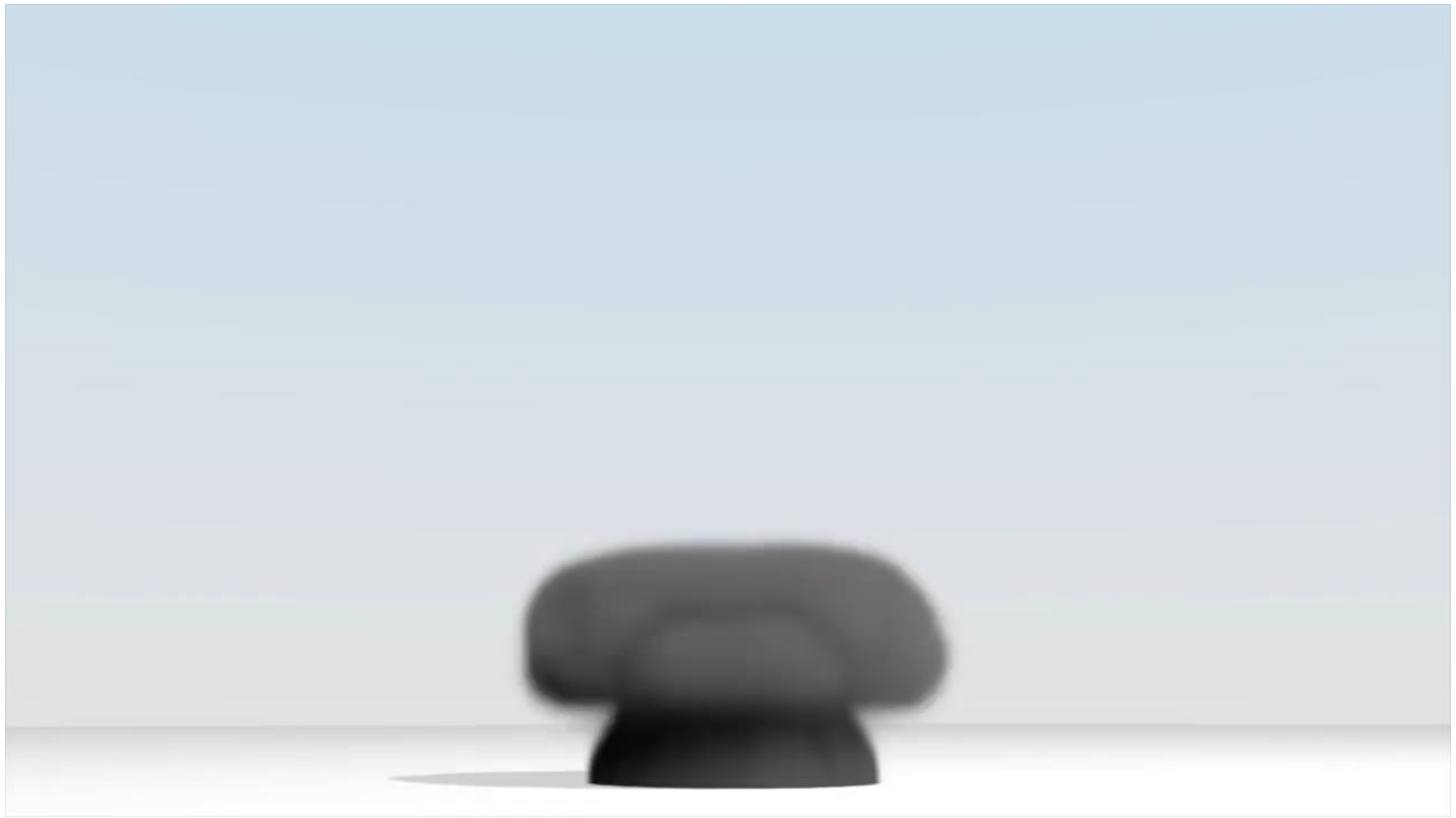
[8] T. Unterthiner, A. Mayr, G. Klambauer, and S. Hochreiter, “Toxicity Prediction using Deep Learning,” 2015.

RATIONAL AGENTS

[8] T. Unterthiner, A. Mayr, G. Klambauer, and S. Hochreiter, “Toxicity Prediction using Deep Learning,” 2015.

SIMULATION

Fluid dynamic prediction in milliseconds.

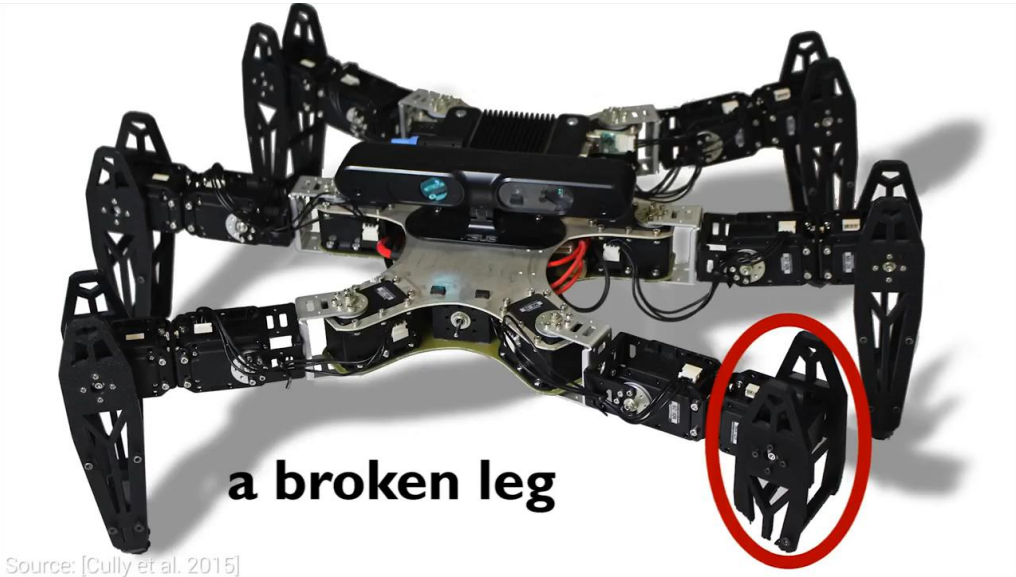


https://www.youtube.com/watch?v=iOWamCtnwTc&t=54s

[9] J. Tompson, K. Schlachter, P. Sprechmann, and K. Perlin, “Accelerating Eulerian Fluid Simulation With Convolutional Networks Jonathan,” Text. Netw., vol. 2, no. 7–8, pp. 60–61, 2004.

ROBOTICS AND CONTROL

Robots that adapt to new situations like animals.



Source: [Cully et al. 2015]

https://www.youtube.com/watch?v=UMSNBLAfC7o

Autonomous vehicles.

[10] A. Cully, J. Clune, D. Tarapore, and J.-B. Mouret, "Robots that can adapt like animals," Nature, vol. 521, no. 7553, pp. 503–507, May 2015.

PSYCHOLOGY

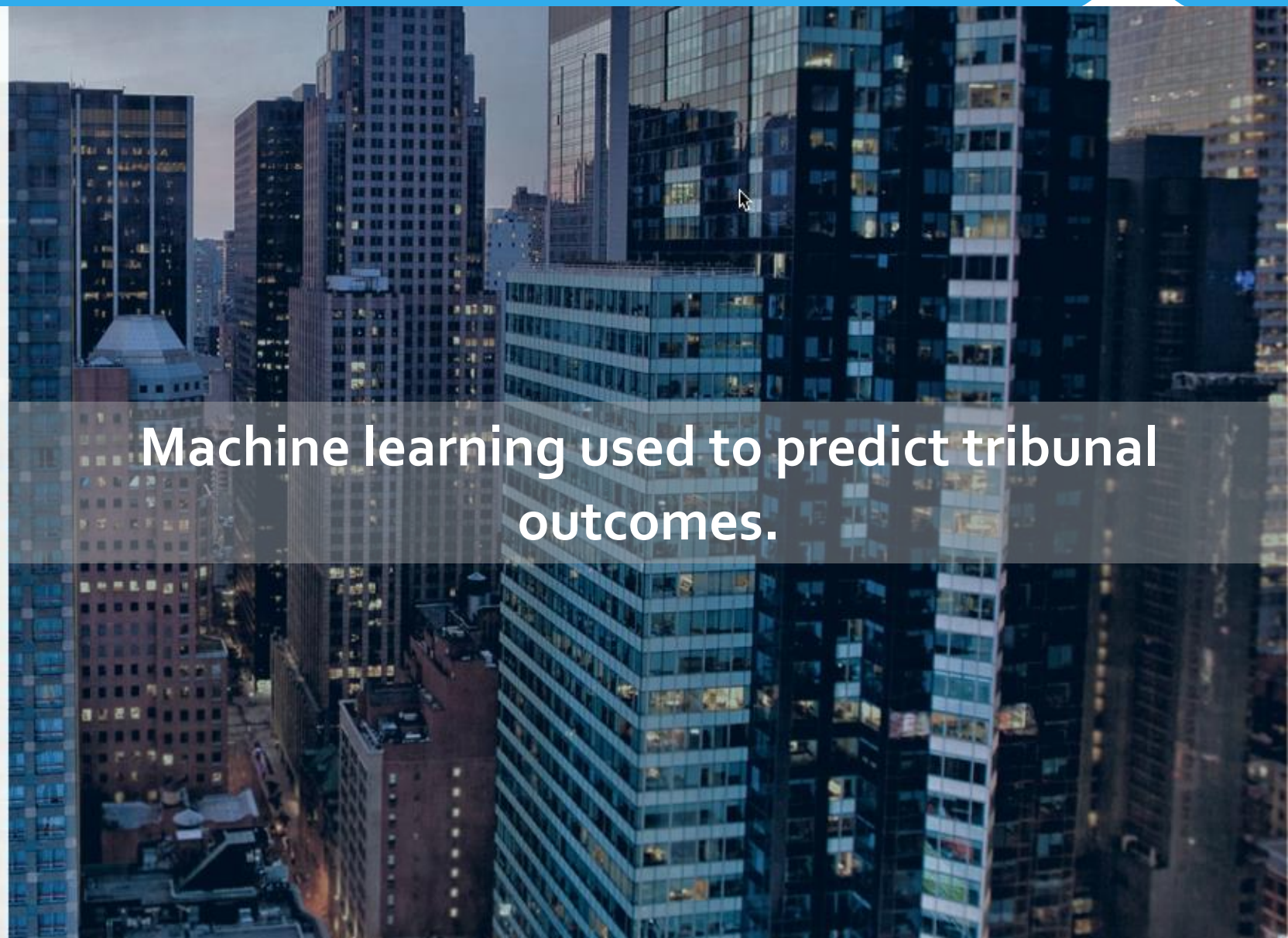
“Chatbot” that helps with depression and anxiety.

Woebot®

LAWS

blue J
LEGAL

making professionals better



Machine learning used to predict tribunal outcomes.

FINANCES

[11] X. Li et al., “Empirical analysis: stock market prediction via extreme learning machine,” Neural Comput. Appl., vol. 27, no. 1, pp. 67–78, Jan. 2016.

FACIAL RECOGNITION

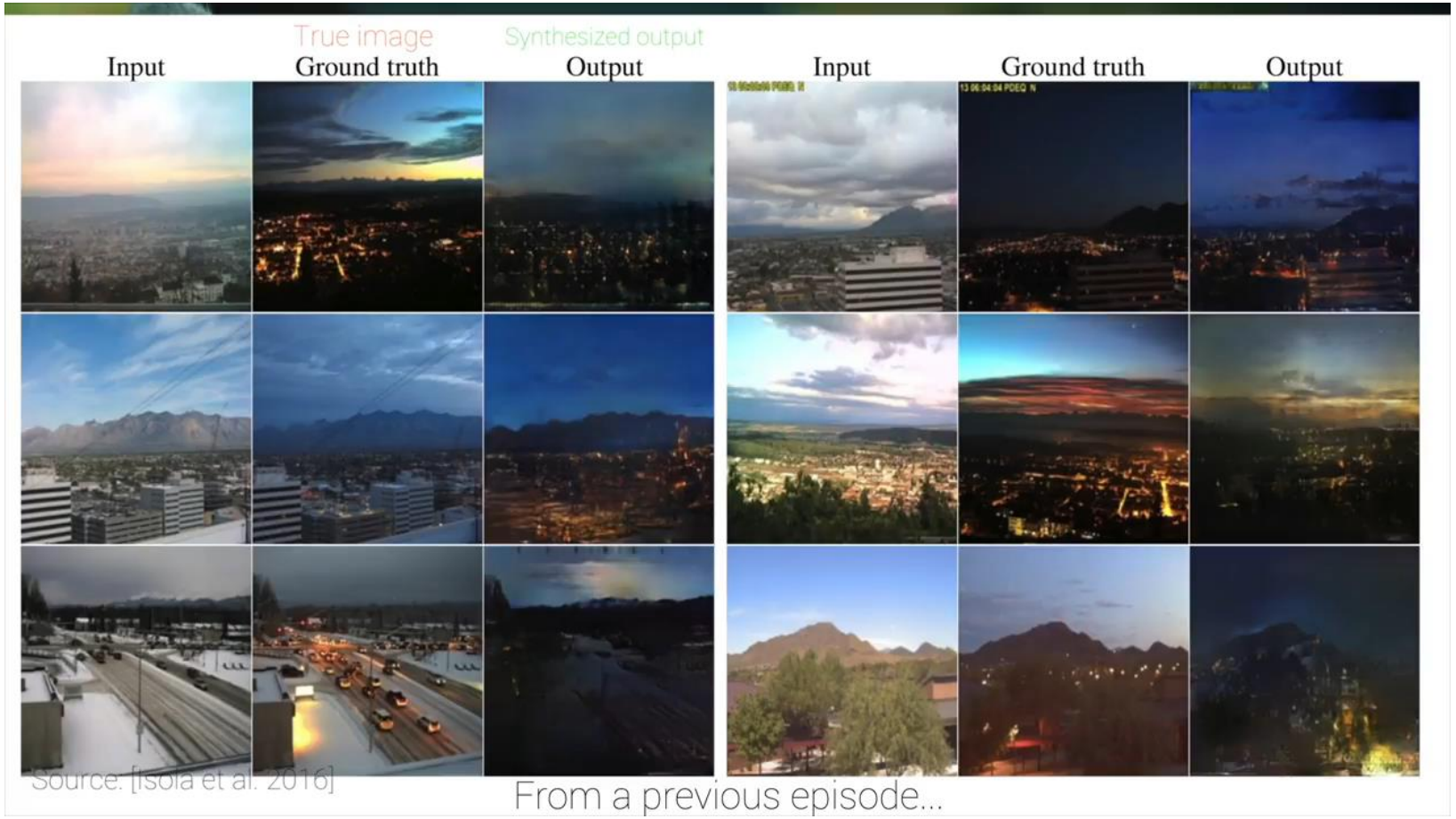
RECOMMENDER SYSTEMS

amazon

DIGITAL ANIMATION

Scenery generation based on sketches.

https://www.youtube.com/watch?v=hW1_Sidq3m8



[12] T. Park, M.-Y. Liu, T.-C. Wang, and J.-Y. Zhu, "Semantic Image Synthesis with Spatially-Adaptive Normalization," Mar. 2019.

COMPUTER GRAPHICS

Generating fictional faces of celebrities.

https://thispersondoesnotexist.com/

https://www.youtube.com/watch?v=XOxxPcy5Gr4

[13] T. Karras, T. Aila, S. Laine, and J. Lehtinen, "Progressive Growing of GANs for Improved Quality, Stability, and Variation," Oct. 2017.

ART

Application of art styles to images and videos.

https://www.youtube.com/watch?v=Khuj4ASldmU

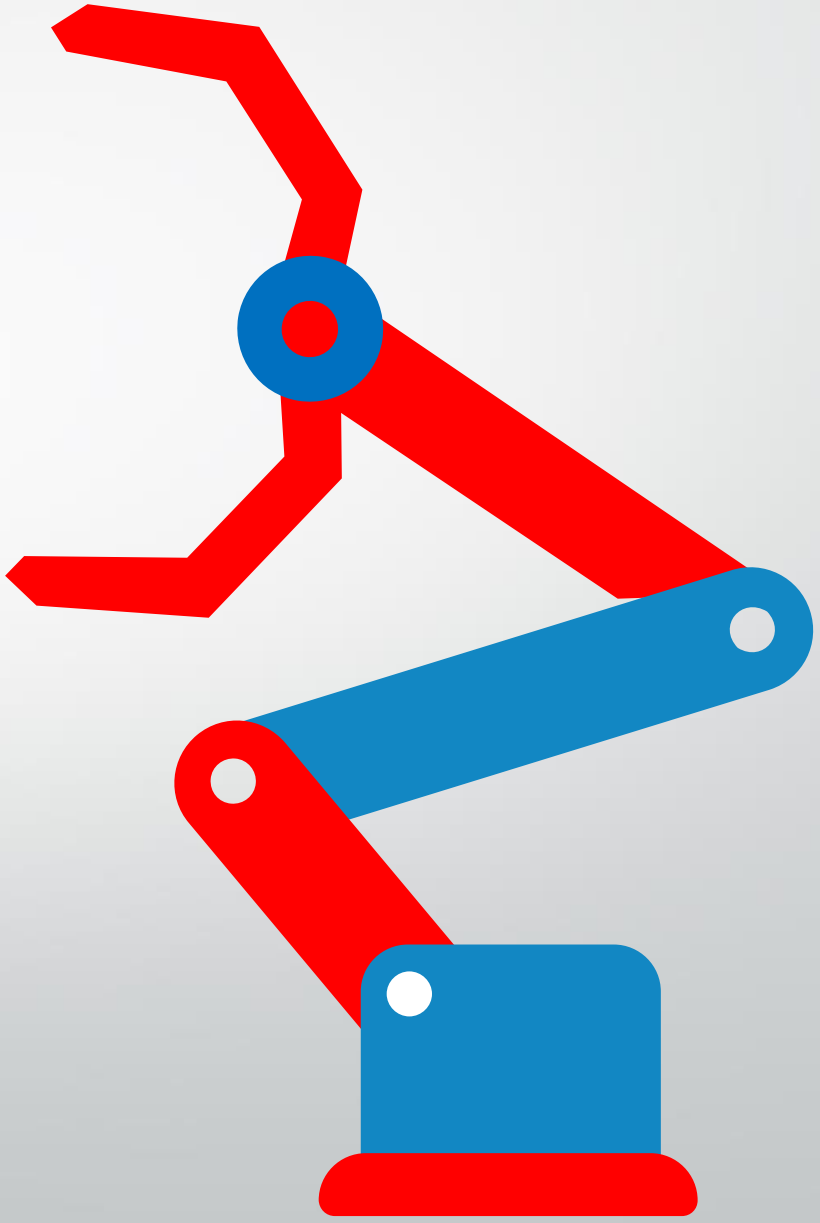
[14] M. Ruder, A. Dosovitskiy, and T. Brox, "Artistic style transfer for videos," Apr. 2016.

AIVA

The Artificial Intelligence who composes classical music

https://www.aiva.ai/

PYTHON



PYTHON LANGUAGE

ANACONDA INSTALLATION

HOMEWORK

https://www.youtube.com/watch?v=5mDYijMfSzs

WINDOWS 10

https://www.youtube.com/watch?v=nVlrpNf3EdM

MacOS

NOTE: INSTALL PYTHON 3.7 VERSION

PYTHON LANGUAGE

VIRTUAL ENVIRONMENTS

HOMEWORK

https://www.youtube.com/watch?v=mIB7IZFCE_k

PYTHON LANGUAGE

PYCHARM INSTALLATION

HOMEWORK

https://www.youtube.com/watch?v=SZUNUB6nz3g

WINDOWS 10

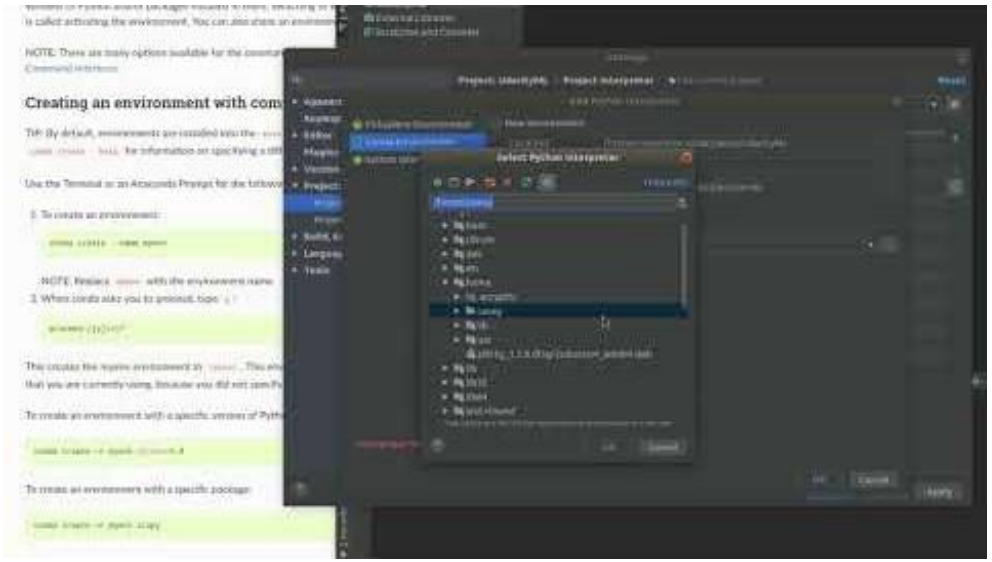
https://www.youtube.com/watch?v=mDqxeCqVsOg

MacOS

PYTHON LANGUAGE

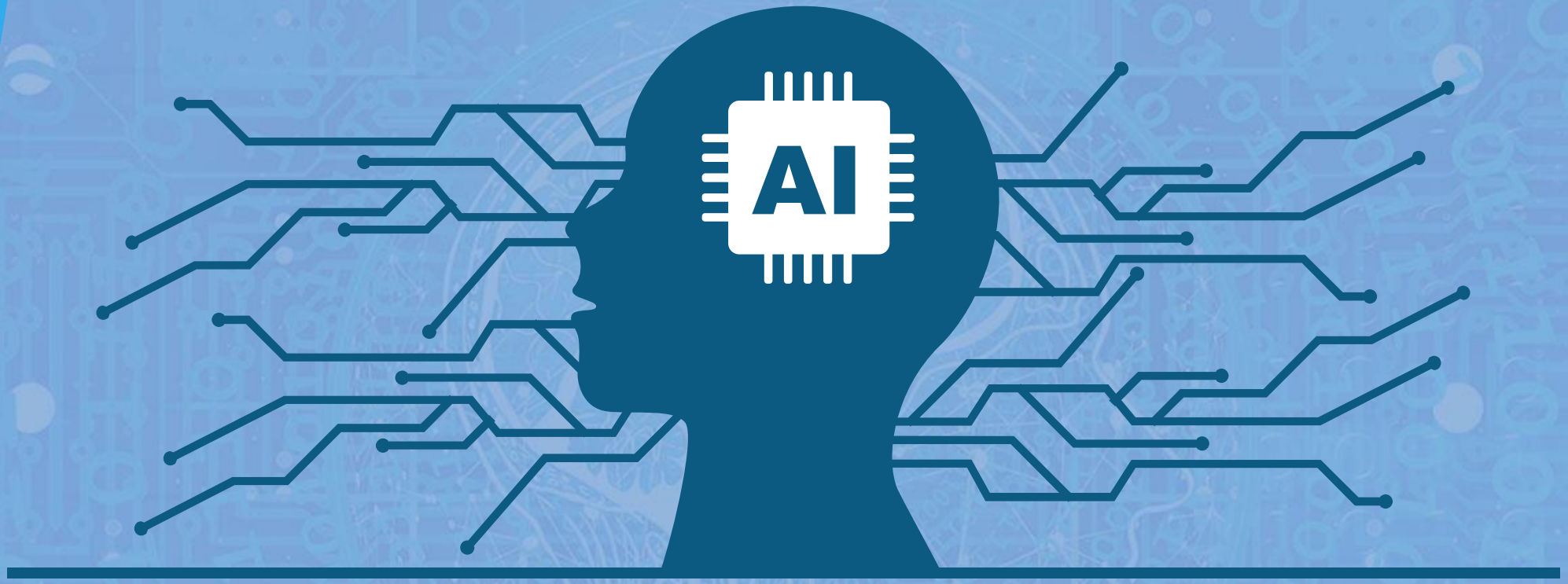
ANACONDA AS INTERPRETER

HOMEWORK



https://www.youtube.com/watch?v=ur3q_YoA-eY

NOTE: TO SEE THE WINDOW THAT APPEARS ON THE VIDEO GO TO "FILE" → "SETTINGS"



THANK YOU!

REFERENCES

[1] M. Minsky and P. Rosenbloom, “History of Artificial Intelligence,” pp. 1759–1762, 2009.

[2] J. Mccarthy and P. J. Hayes, “SOME PHILOSOPHICAL PROBLEMS FROM THE STANDPOINT OF ARTIFICIAL INTELLIGENCE,” pp. 1–51, 1969.

[3] S. Russel and P. Norvig, *Artificial intelligence—a modern approach 3rd Edition*, vol. 11, no. 01. 2012.

[4] A. L. Samuel, “Some studies in machine learning using the game of checkers. II-Recent progress,” *Annu. Rev. Autom. Program.*, vol. 6, no. PART 1, pp. 1–36, 1969.

[5] R. M. Neal, “Pattern Recognition and Machine Learning,” *Technometrics*, vol. 49, no. 3, pp. 366–366, Aug. 2007.

[6] ReviveMed, “Technology - ReviveMed Technologies.” [Online]. Available: http://www.revivemed.io/technology/. [Accessed: 05-May-2019].

[7] C. B. Clish, F. M. White, A. Saghatelian, and E. Fraenkel, “Revealing disease-associated pathways by network integration of untargeted metabolomics,” vol. 13, no. 9, pp. 770–776, 2017.

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REFERENCES

[10] A. Cully, J. Clune, D. Tarapore, and J.-B. Mouret, “Robots that can adapt like animals,” Nature, vol. 521, no. 7553, pp. 503–507, May 2015.

[11] X. Li et al., “Empirical analysis: stock market prediction via extreme learning machine,” Neural Comput. Appl., vol. 27, no. 1, pp. 67–78, Jan. 2016.

[12] T. Park, M.-Y. Liu, T.-C. Wang, and J.-Y. Zhu, “Semantic Image Synthesis with Spatially-Adaptive Normalization,” Mar. 2019.

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