IESTI01 - TinyML

The Building Blocks of Deep Learning – Part A

Prof. Marcelo Rovai

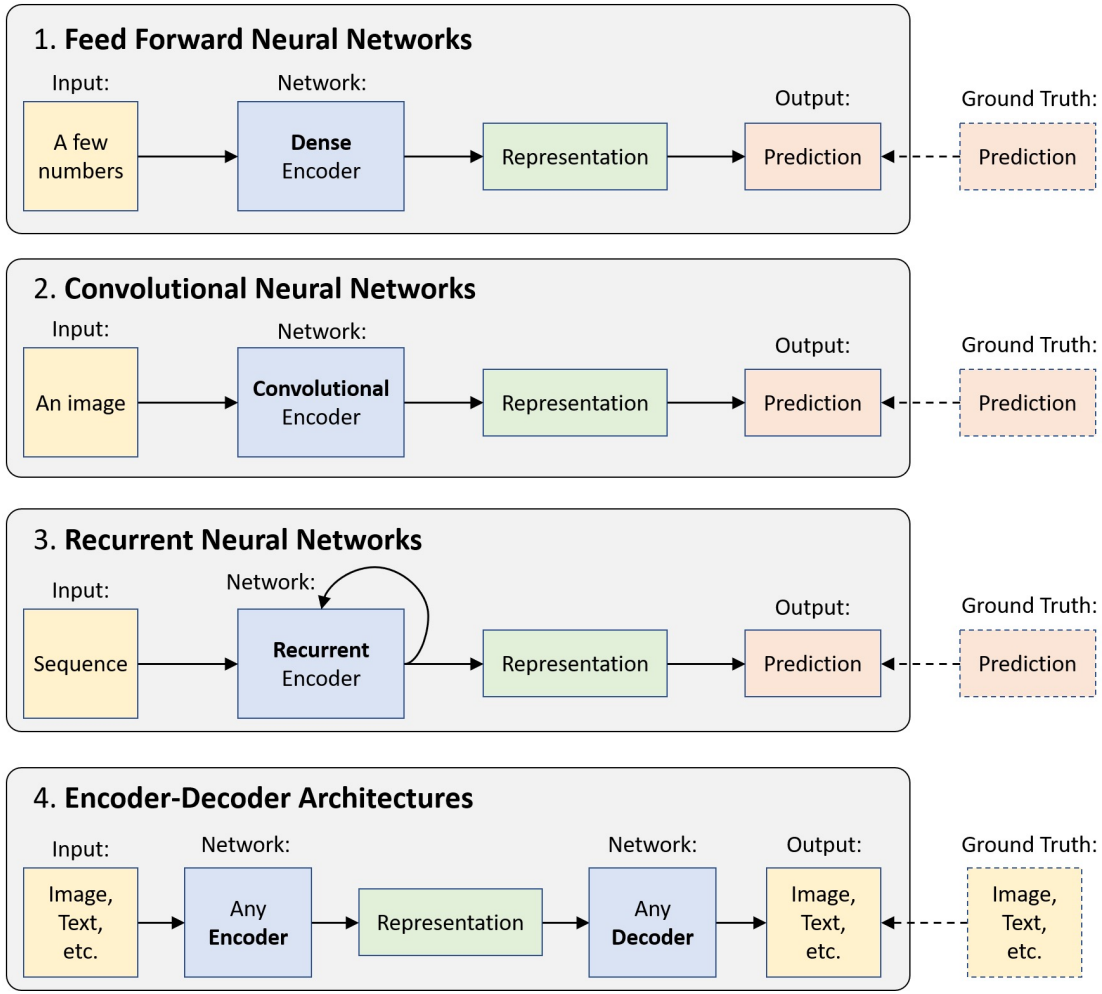
May 19th, 2021

Machine Learning

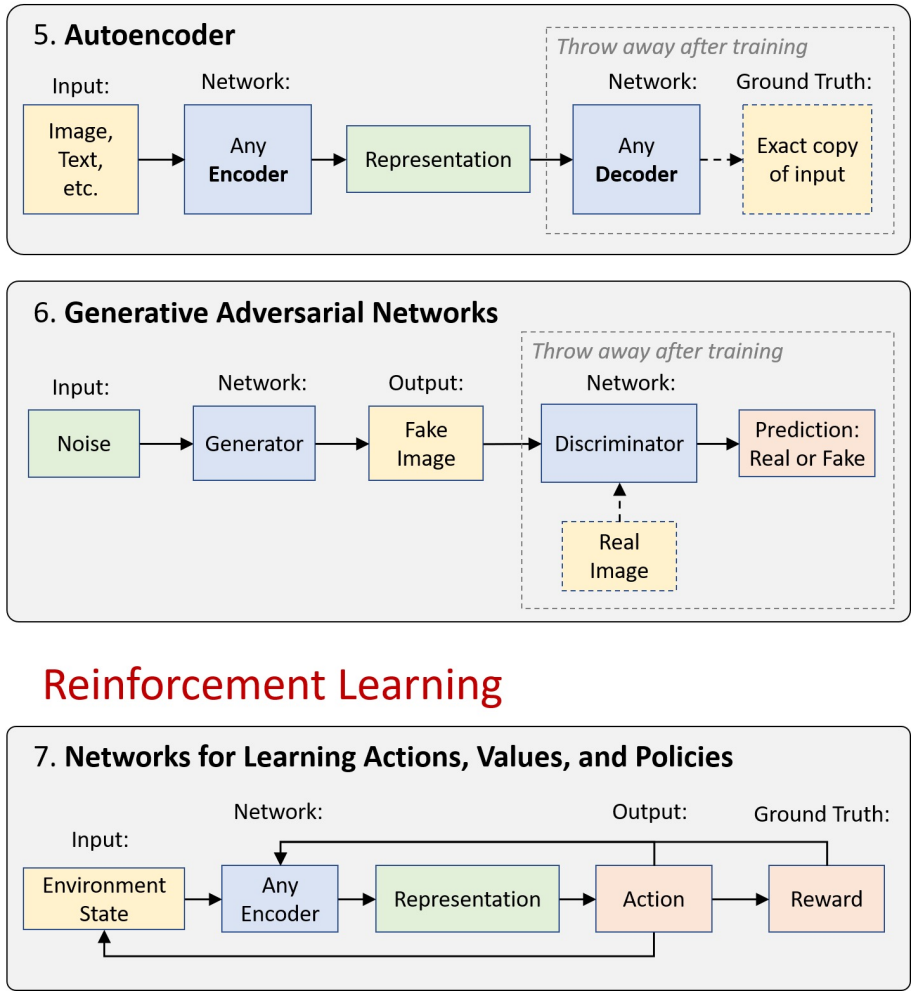
Models

Machine Learning types and arquitectures

Supervised Learning



Unsupervised Learning



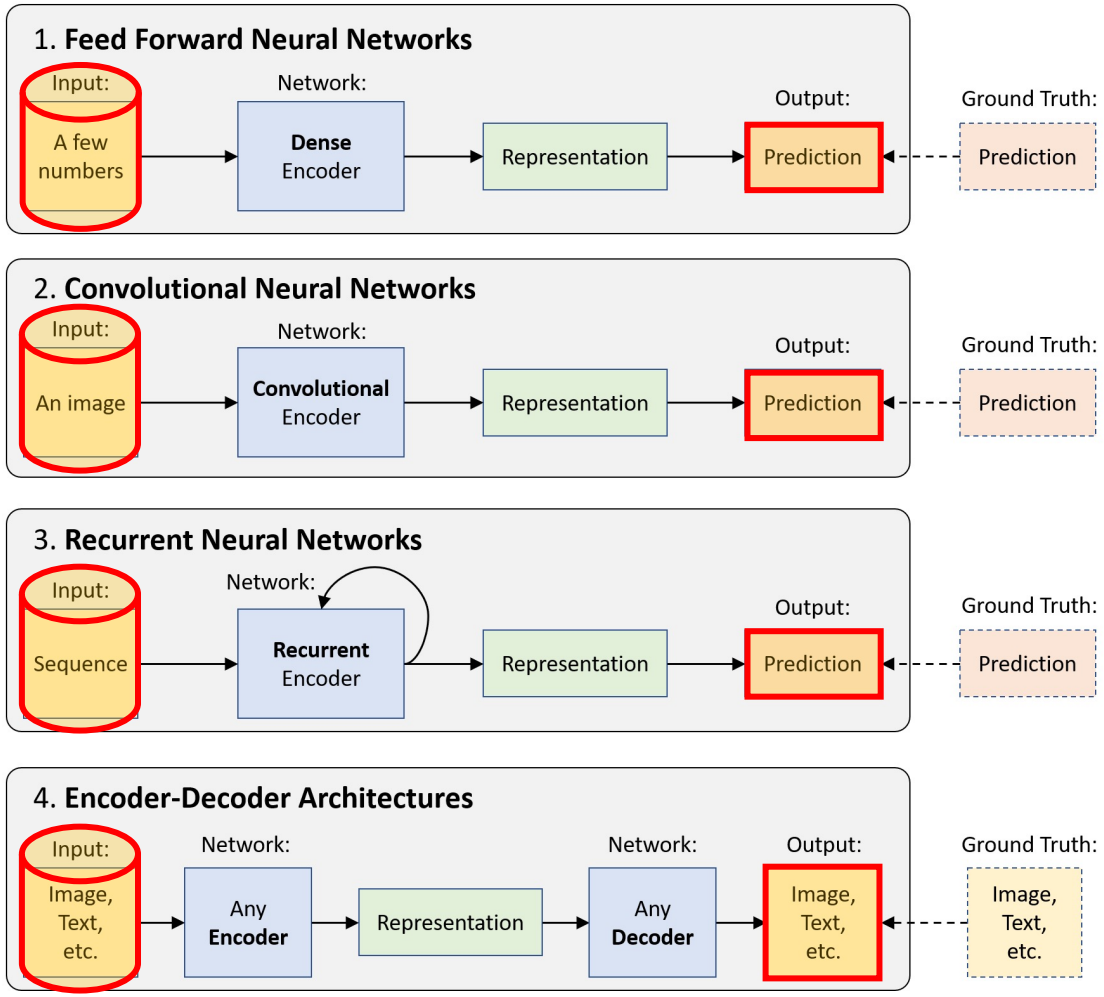
Reinforcement Learning

Deep Learning Basics: An introductory lecture for MIT course 6.S094 by Prof. Lex Fridman

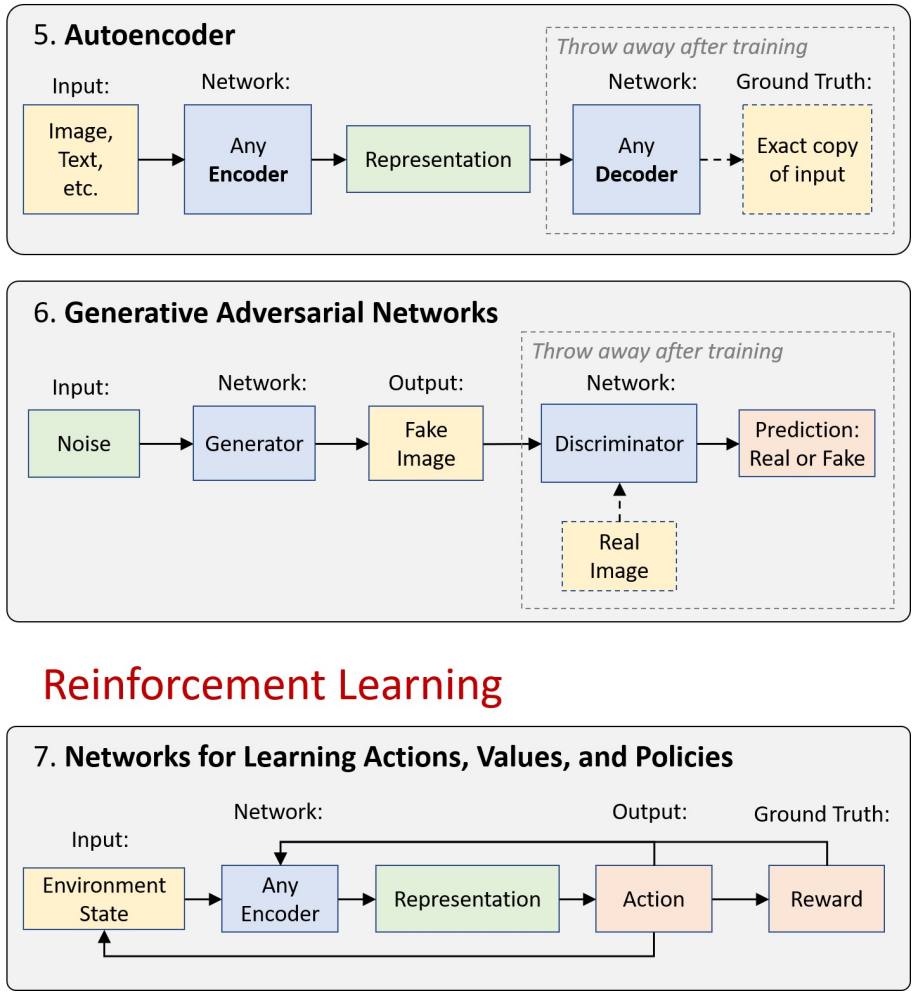
Machine Learning

Supervised Learning

Training Inference



Unsupervised Learning



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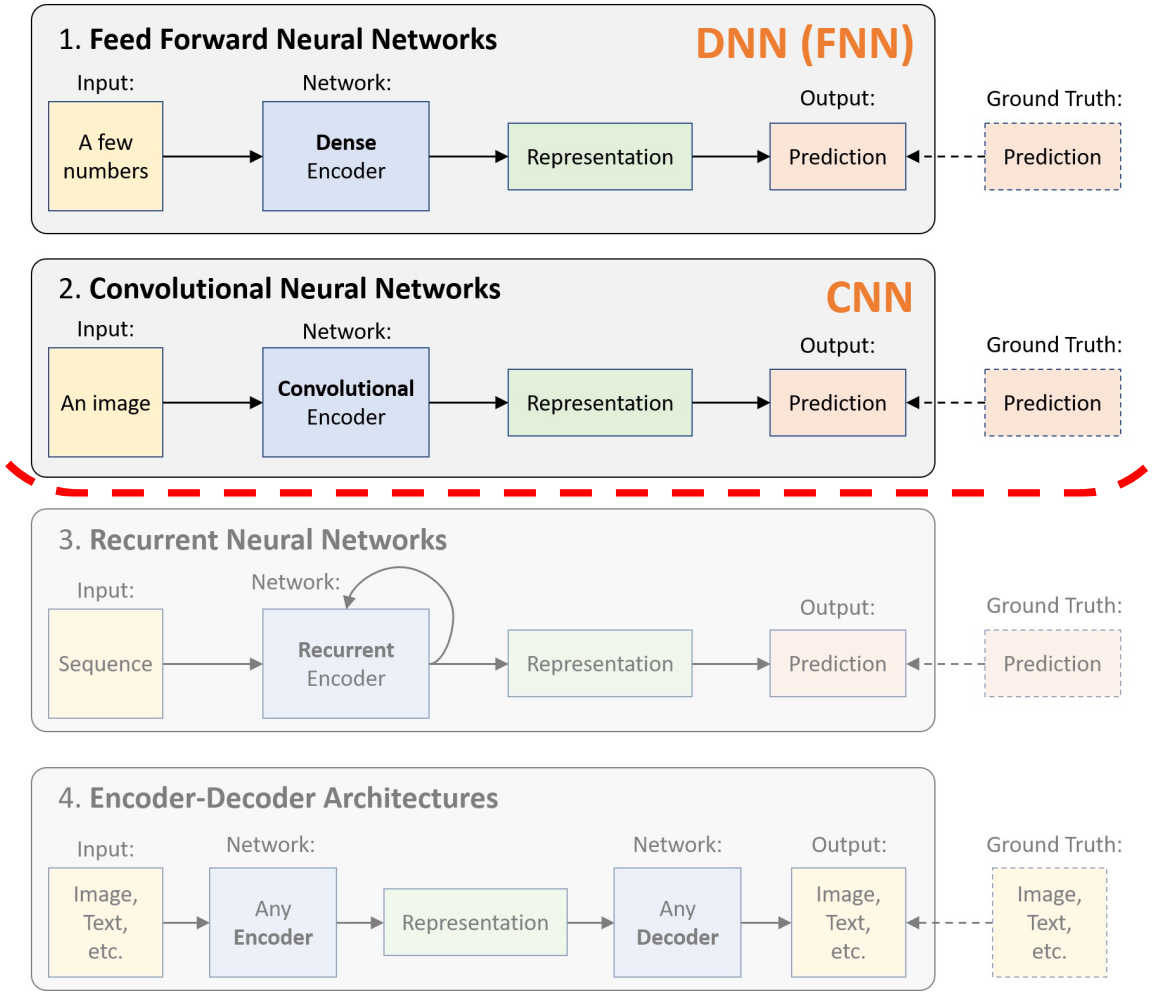
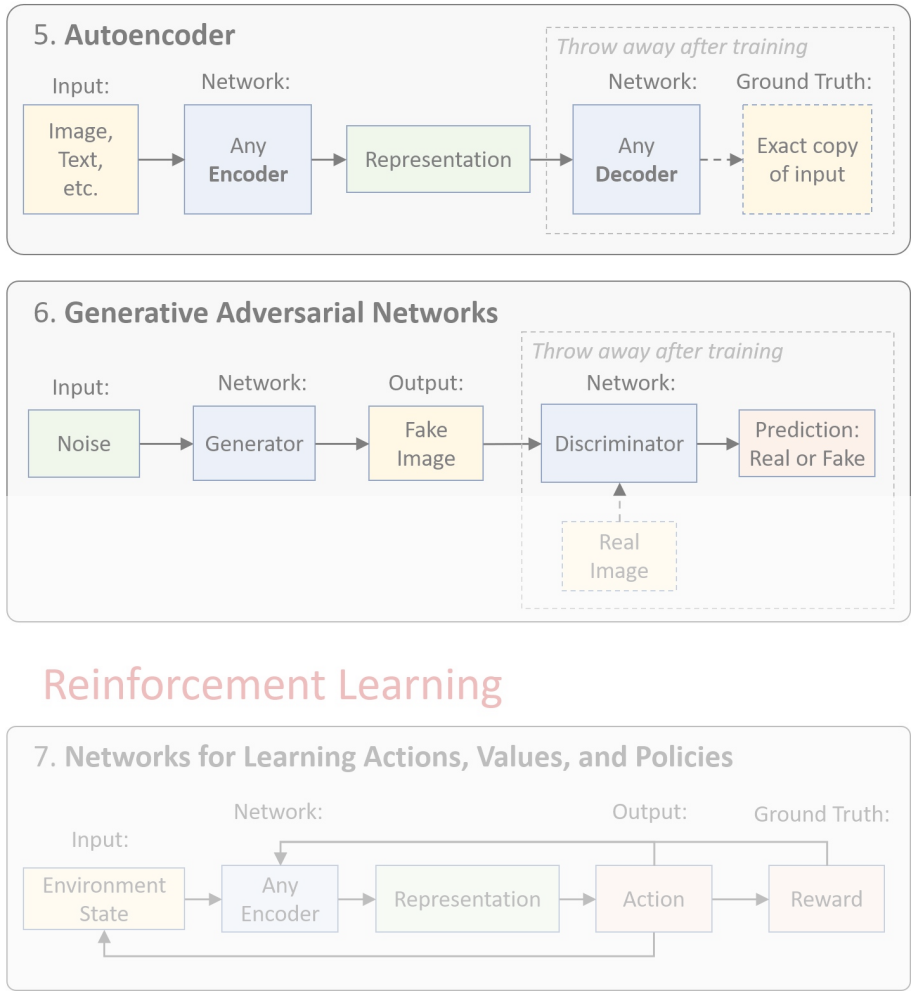
Supervised Learning



Unsupervised Learning



Reinforcement Learning

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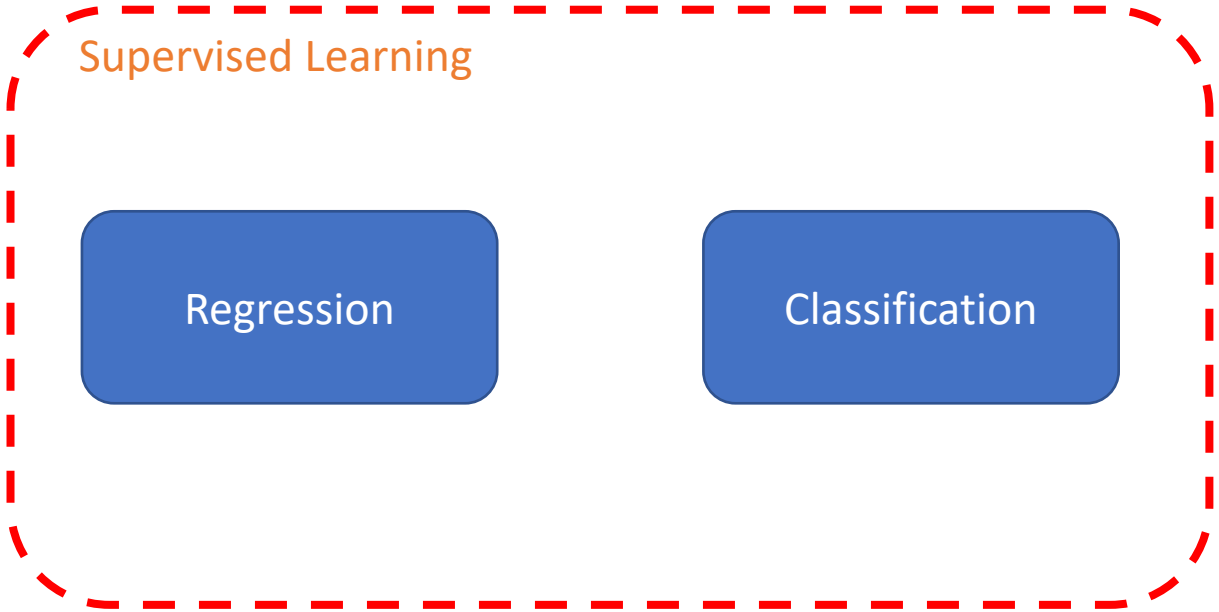
Tiny Machine Learning

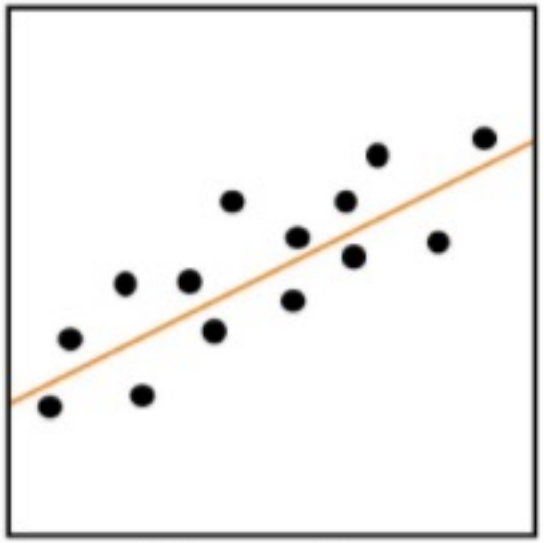


Tiny Machine Learning

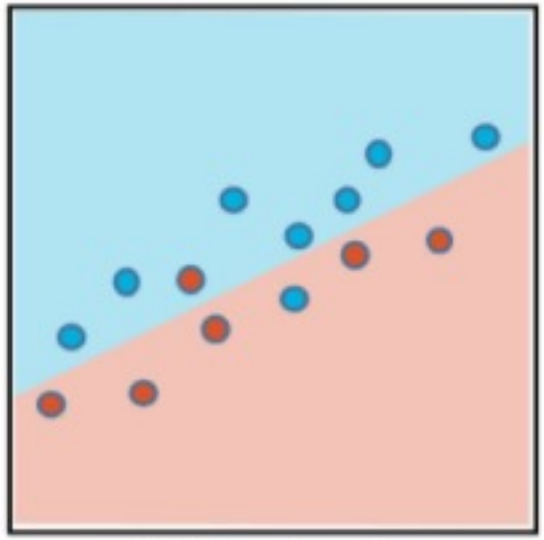
Supervised Learning

Regression

Classification



a) Regression

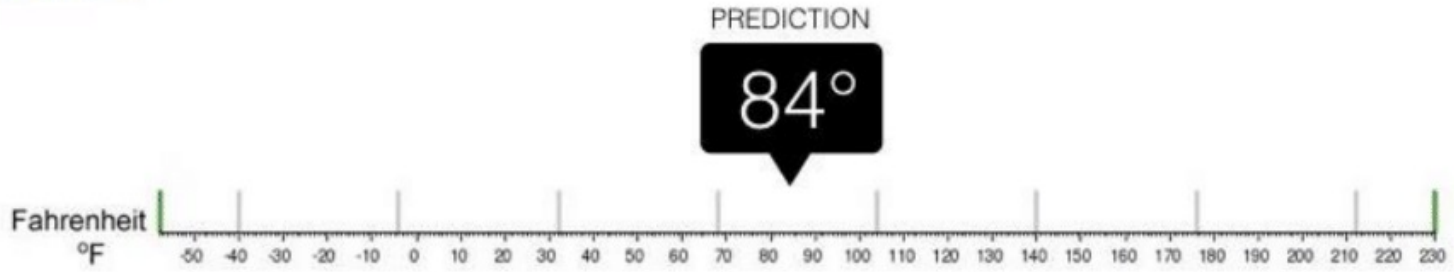


b) Classification

Regression

Regression

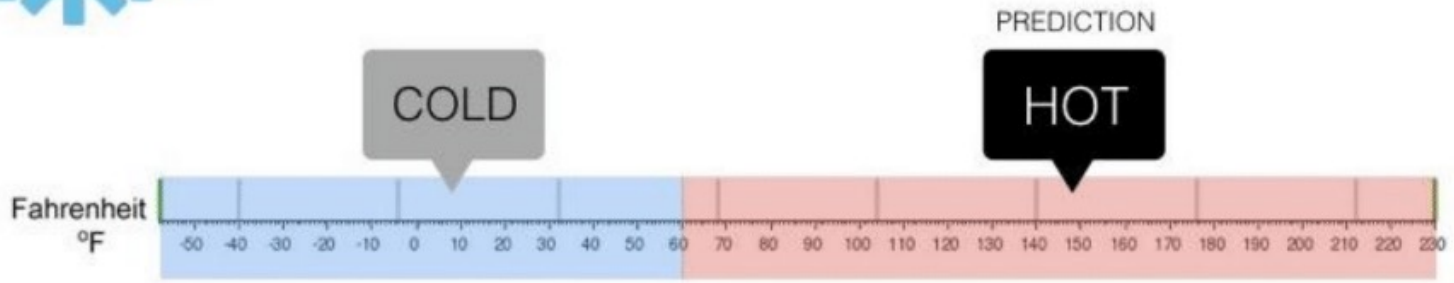
What is the temperature going to be tomorrow?



Classification

Classification

Will it be Cold or Hot tomorrow?



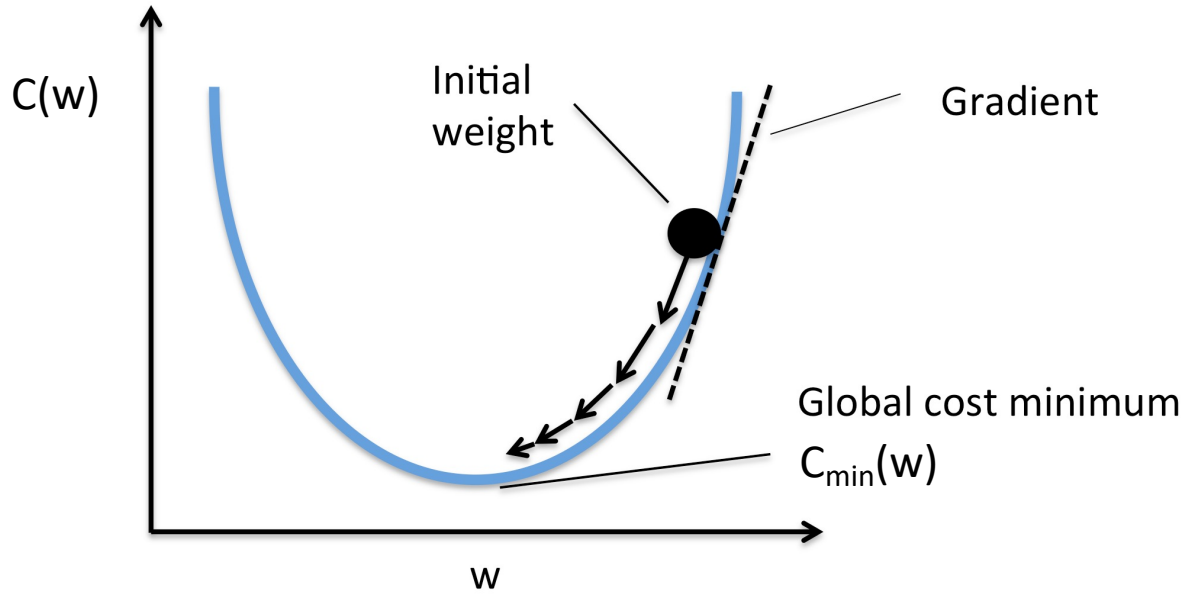
Machine Learning

Supervised models - Regression

X ➡ -1, 0, 1, 2, 3, 4

Y ➡ -3, -1, 1, 3, 5, 7

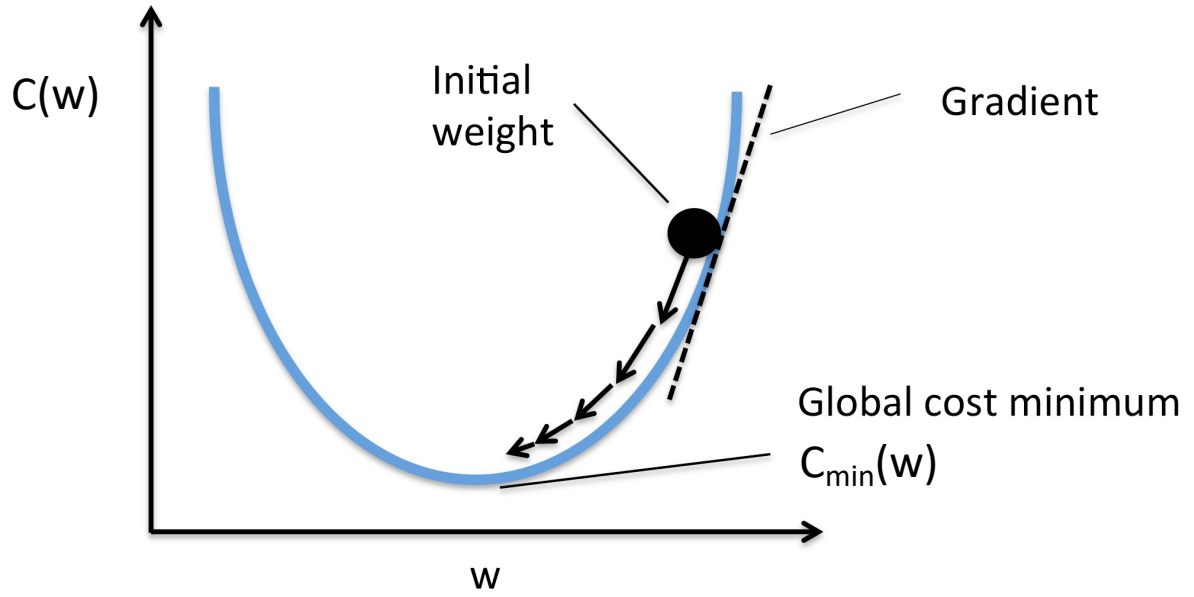
X	Y
-1	-3
0	-1
1	1
2	3
3	5
4	7



$$Y = w_{*}X + b$$

Cost Function

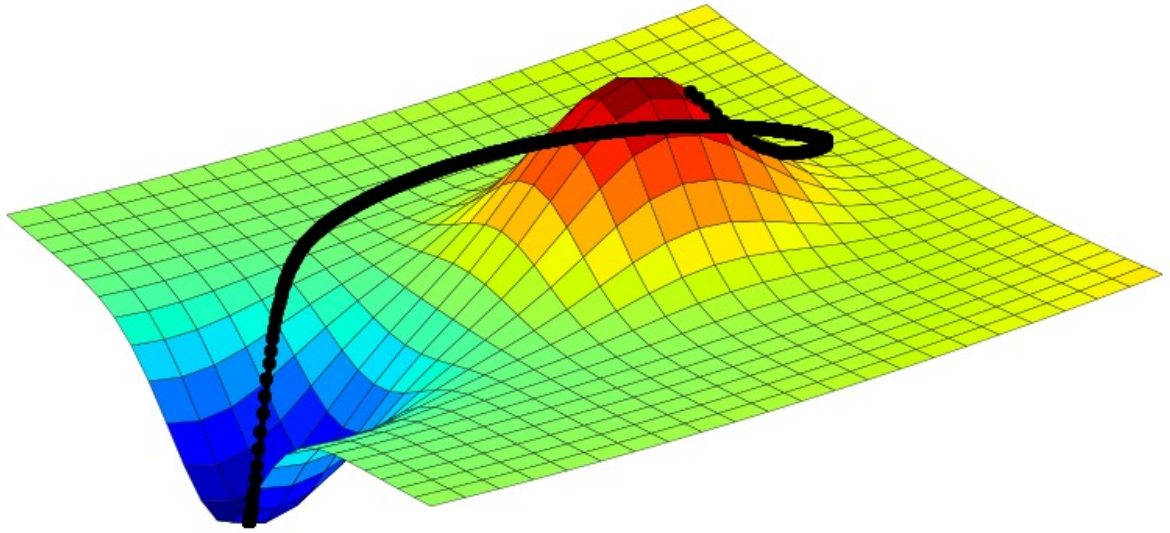
X_1	Y
-1	-3
0	-1
1	1
2	3
3	5
4	7



$$Y = w_1 * X_1 + b_0$$

Cost Function

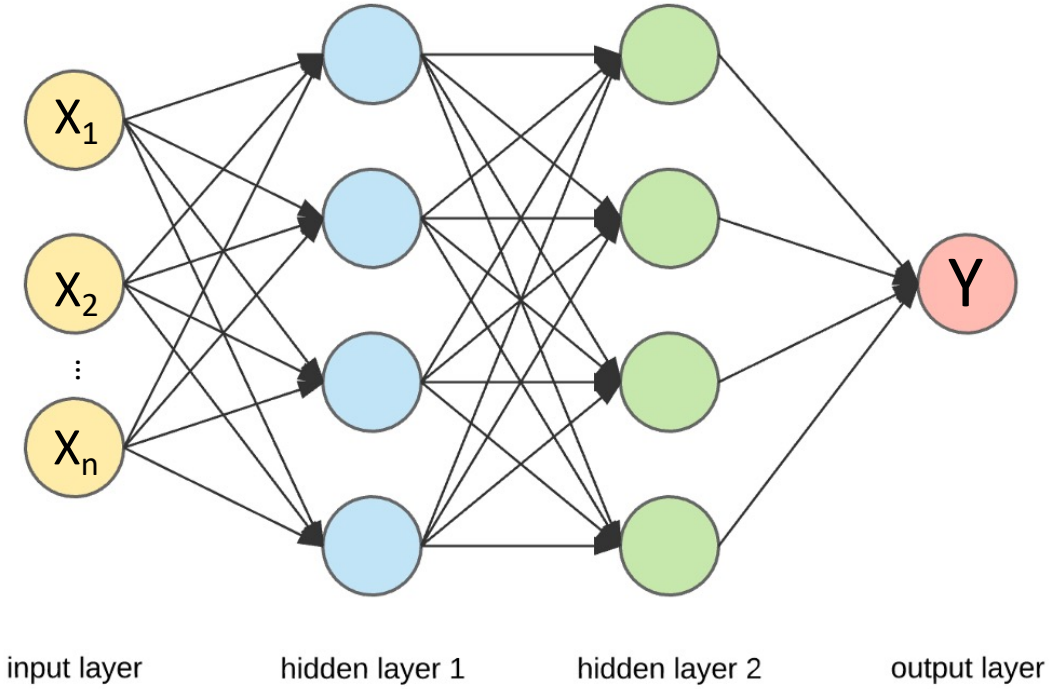
X_1	X_2	Y
-1	-8	-8
0	1	0
1	3	7
2	7	1
3	0	2
4	2	3



$$Y = w_1 * X_1 + w_2 * X_2 + b_0$$

Cost Function

X_1	X_2	…	X_n	Y
-1	-8		-81	-8
0	1		10	0
1	3		3	7
2	7		7	1
3	0		0	2
4	2		-7	3



$$Y = w_1 * X_1 + w_2 * X_2 + \ldots + w_n * X_n + b_0$$

Regression using DNN with TF2

Code Time!

TF_Boston_Housing_Regression.ipynb

Reading Material

Main references

- Harvard School of Engineering and Applied Sciences - CS249r: Tiny Machine Learning
- Professional Certificate in Tiny Machine Learning (TinyML) – edX/Harvard
- Introduction to Embedded Machine Learning (Coursera)
- Text Book: "TinyML" by Pete Warden, Daniel Situnayake

I want to thank Laurence Moroney from Google, Harvard professor Vijay Janapa Reddi, Ph.D. student Brian Plancher and their staff for preparing the excellent material on TinyML that is the basis of this course at UNIFEI.

The IESTI01 course is part of the TinyML4D, an initiative to make TinyML education available to everyone globally.

Thanks

And stay safe!