Statistics Cafe
Pytorch Introduction

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Programming Langueges:

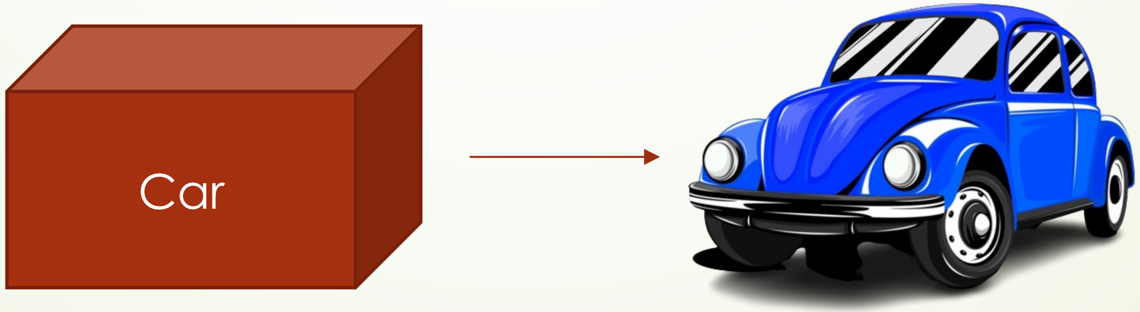
- Object Oriented Programming (OOP):
  - Partially: C++, Java
  - Fully: Python, C# → Everything is an object of a class
- [Total] Functional Programming (FP): Lua, Erlang
- Niether OOP nor FP: Golang

Class:

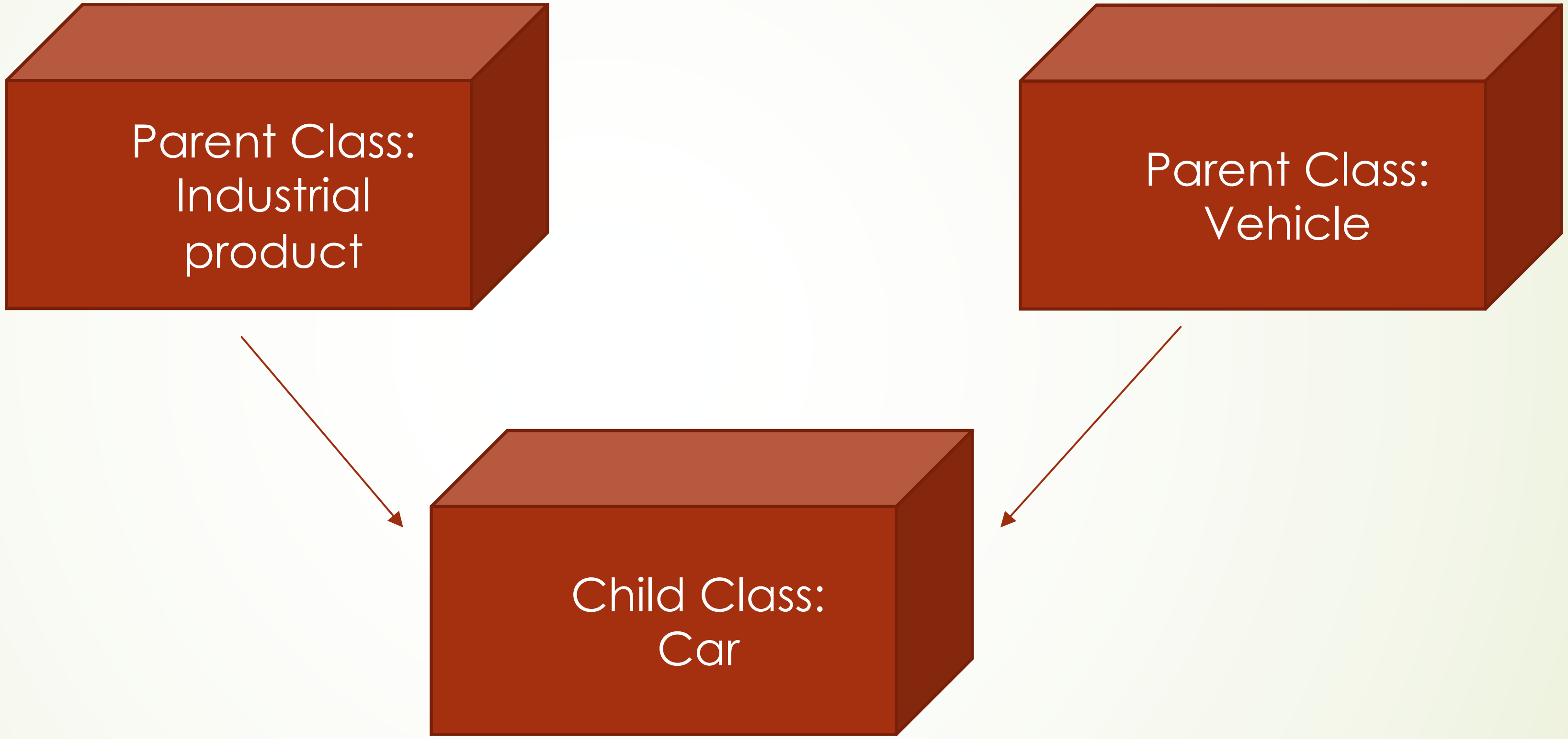
- **Class:** Car
  - Properties: Color, Company , Number of wheels, etc.
  - Methods: Braking, Throttling, Turning to left or right, etc.

We can have many objects from a specific class

- **Object:**
  - Color: Blue, Company: VW, Number of wheels: 4
  - Methods: …



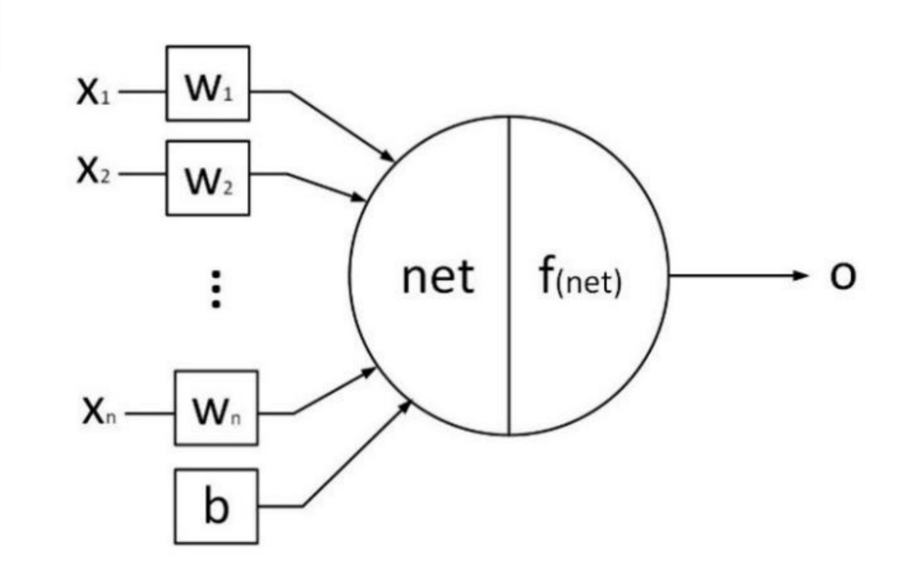
Inheritance:



Access modifiers in OOP:

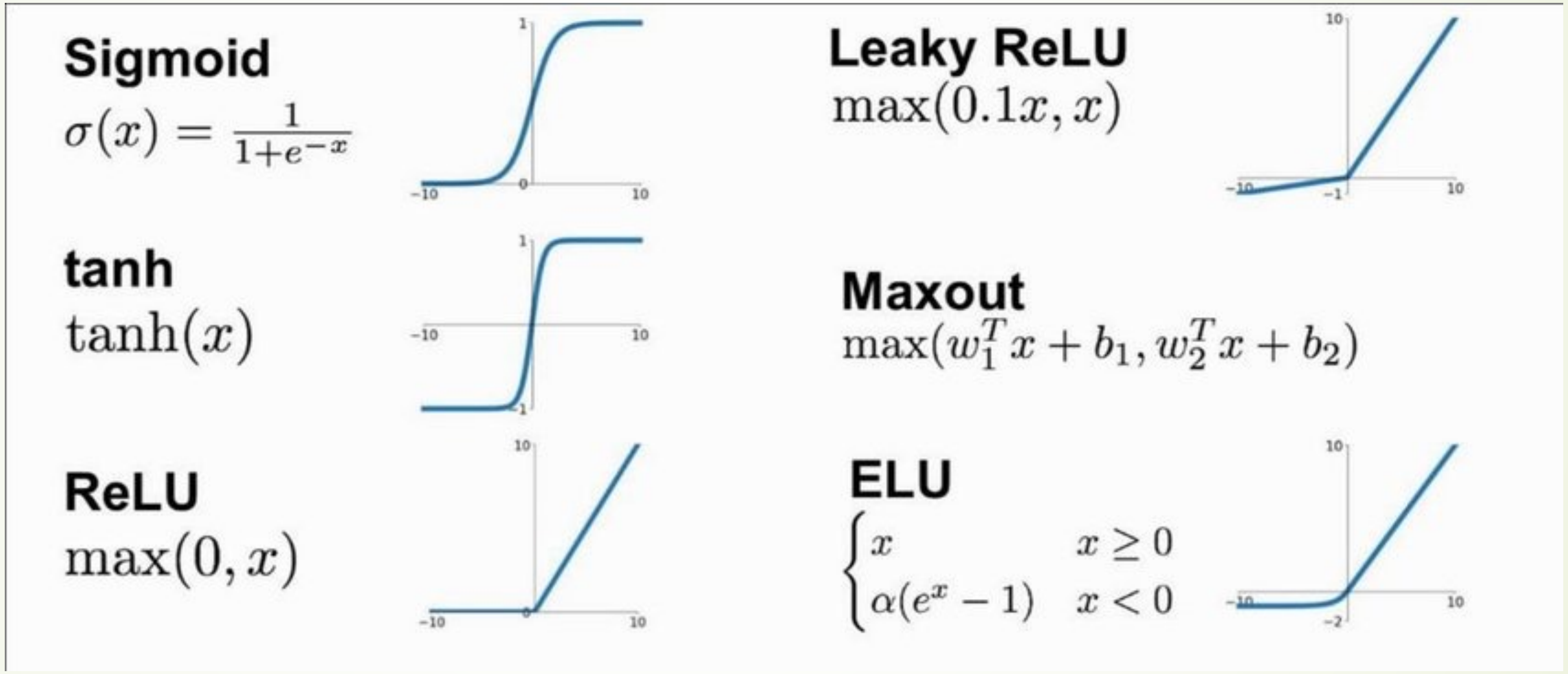
- **Public:** Can be accessed from anywhere.
- **Protected:** Can be accessed within the class and from the class that inherits the protected class.
- **Private:** Can only be accessed within the class.

Neural Networks: (Neuron)



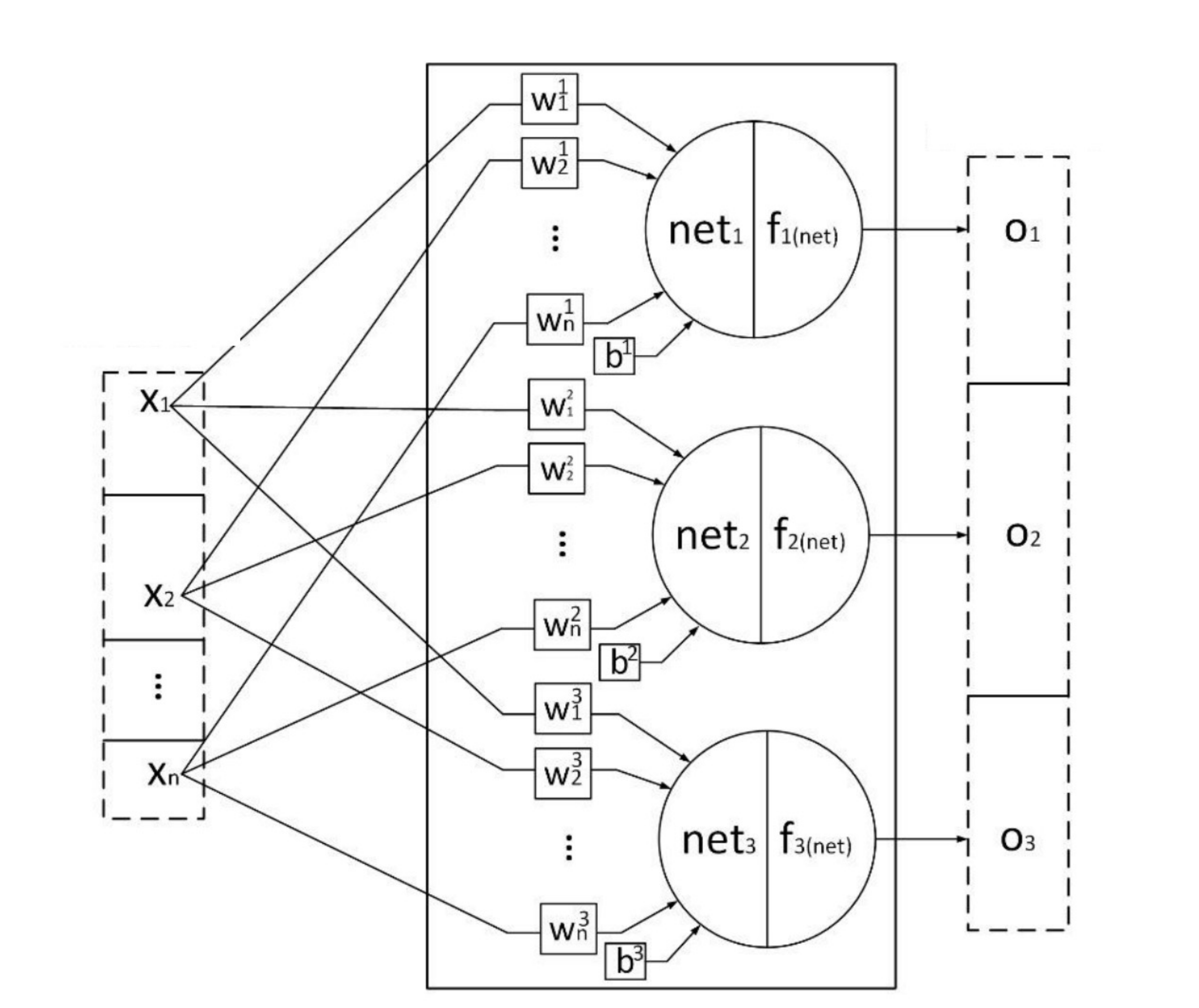
$$o_{(\mathbf{x})} = f(w_1x_1 + w_2x_2 + \ldots + w_nx_n + b)$$

Activatoion Fucntions:

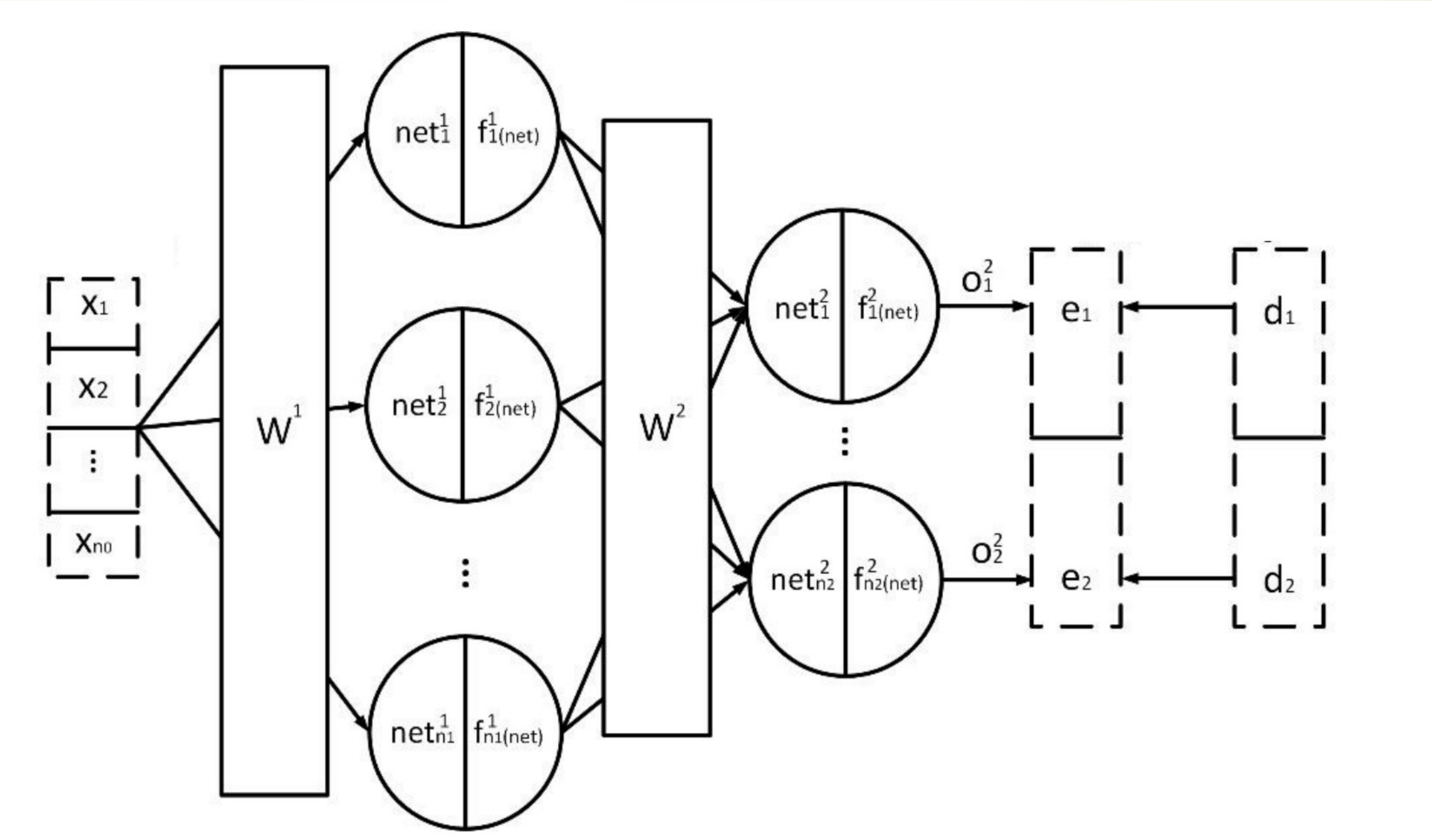


https://www.researchgate.net/publication/350567223_ANALYSIS_OF_OPTIMIZING_NEURAL_NETWORKS_AND_ARTIFICIAL_INTELLIGENT_MODELS_FOR_GUIDANCE_CONTROL_AND_NAVIGATION_aa

Neural Networks: (Layer)

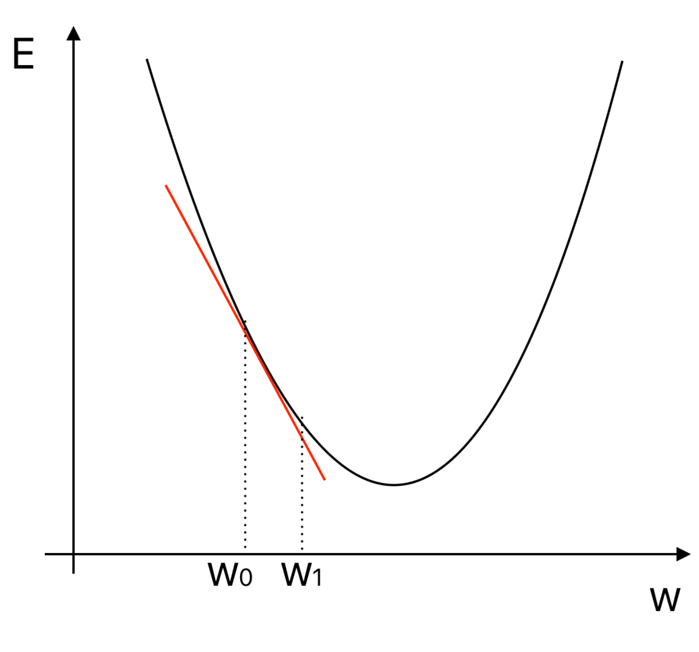


Neural Networks: (Multilayer [perceptron] network) MLP



Neural Networks: (Training)

- Gradient Descent
  - Stochastic
  - Batch
  - Mini batch



$$E_{(\mathbf{o}^2)} = \frac{1}{2}\left\|\mathbf{e}_{1\times n_2}\right\|_2 = \frac{1}{2}\left\|\mathbf{d}_{1\times n_2} - \mathbf{o}_{1\times n_2}\right\|_2$$

$$W^2_{(k+1)} = W^2_{(k)} - \eta \frac{\partial E}{\partial W^2}_{(k)} \quad ,k = 1,\ldots N$$

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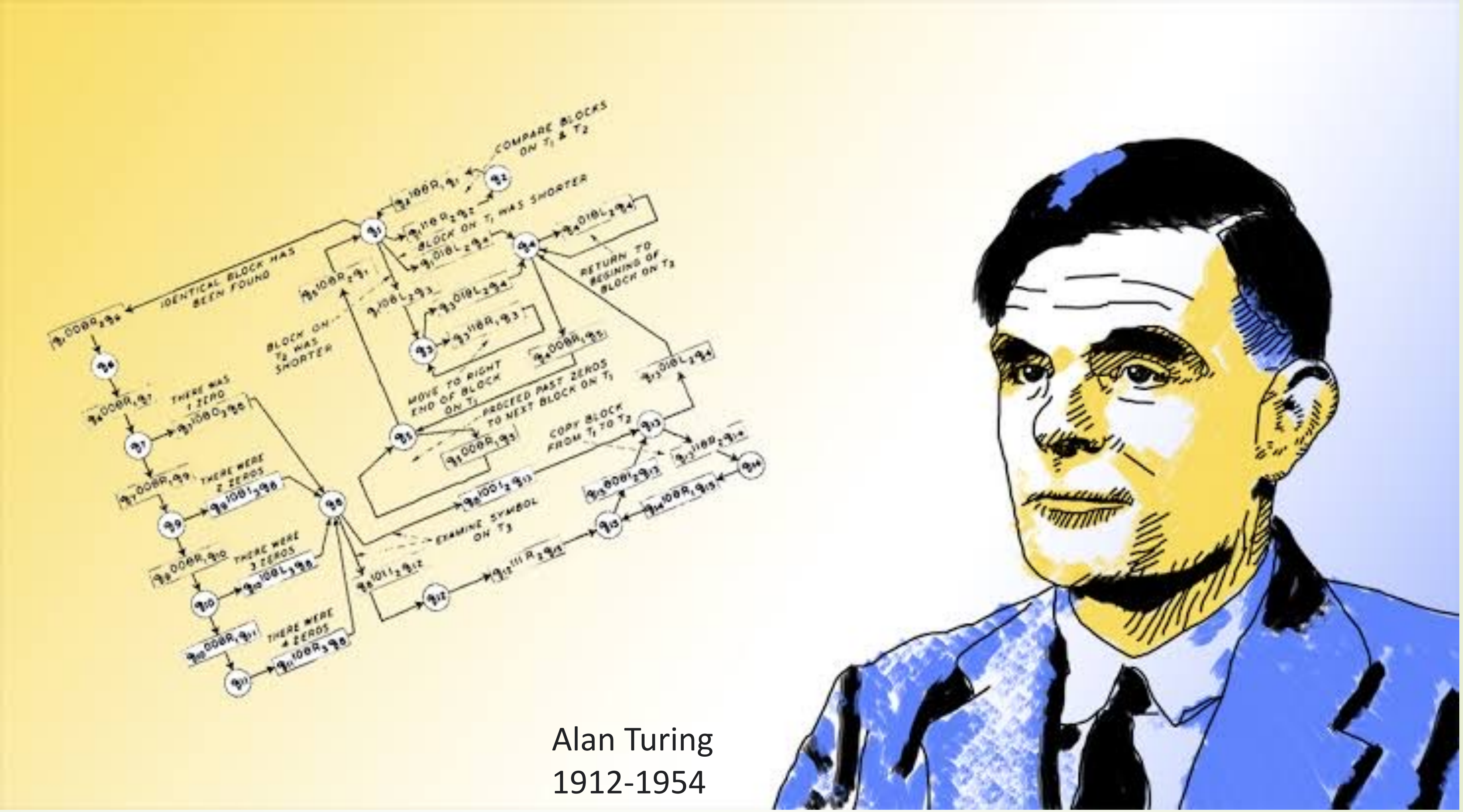
$$\frac{\partial E}{\partial W^2_{n_1 \times n_2}} = \underset{\mathbf{e}_{1\times n_2}}{\frac{\partial E}{\partial \mathbf{e}}} \; \underset{-1}{\frac{\partial \mathbf{e}}{\partial \mathbf{o}^2}} \; \underset{f'_{(\mathbf{net}^2)_{n_2\times n_2}}}{\frac{\partial \mathbf{o}^2}{\partial \mathbf{net}^2}} \; \underset{\mathbf{o}^1_{1\times n_1}}{\frac{\partial \mathbf{net}^2}{\partial W^2}}$$

$$W^1_{(k+1)} = W^1_{(k)} - \eta \frac{\partial E}{\partial W^1}_{(k)} \quad , k = 1,\ldots N$$

$$\frac{\partial E}{\partial W^1_{n_0 \times n_1}} = \underset{\mathbf{e}_{1\times n_2}}{\frac{\partial E}{\partial \mathbf{e}}} \; \underset{-1}{\frac{\partial \mathbf{e}}{\partial \mathbf{o}^2}} \; \underset{f'_{(\mathbf{net})_{n_2\times n_2}}}{\frac{\partial \mathbf{o}^2}{\partial \mathbf{net}^2}} \; \underset{W^2_{n_1\times n_2}}{\frac{\partial \mathbf{net}^2}{\partial \mathbf{o}^1}} \; \underset{f'_{(\mathbf{net}^1)_{n_1\times n_1}}}{\frac{\partial \mathbf{o}^1}{\partial \mathbf{net}^1}} \; \underset{\mathbf{x}_{1\times n_0}}{\frac{\partial \mathbf{net}^1}{\partial W^1}}$$



Alan Turing
1912-1954