GitHub

PyTorch Introduction

Workshop on Artificial Intelligence - 03/02/2026

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Summary

1. PyTorch, What is that ?
2. Gradient descent
3. Few examples

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Open source library (since 2017) for deep learning, initially developed by Meta and based on python programming language.

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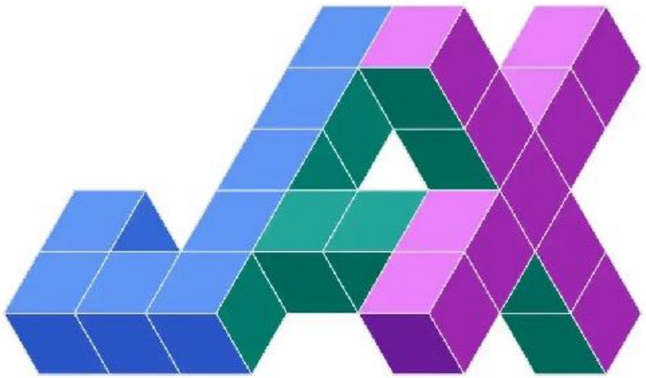
Meta

python™

PyTorch

TensorFlow

Keras



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Open Source Projet Evolution (based on commits, PR, Issues, Authors)

Rank	Label	Commits
1	Firebase	29,366
2	Linux	72,148
3	NixOS	121,407
4	React	62,173
5	Kubernetes	53,495
6	Hugging Face	45,612
7	LLVM	75,424
8	Datadog	195,792
9	pytorch	123,917
10	AMD ROCm	61,887
11	Arm Toolchain	51,094
12	Grafana Labs	124,391
13	Home Assistant	28,670
14	dotnet	97,705
15	ODOO Community Association	48,976
16	Rust	49,046

Source : Cloud Native Computing Foundation (CNCF). (2026). *Cncf/velocity* [Shell]. https://github.com/cncf/velocity (Original work published 2017)

1. PyTorch, What is that ?

Sources : *OpenAI standardizes on PyTorch*. (2024, March 13). / PyTorch (Director). (2019, November 6). *PyTorch at Tesla—Andrej Karpathy, Tesla*

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Already used in lot of private companies / projects :

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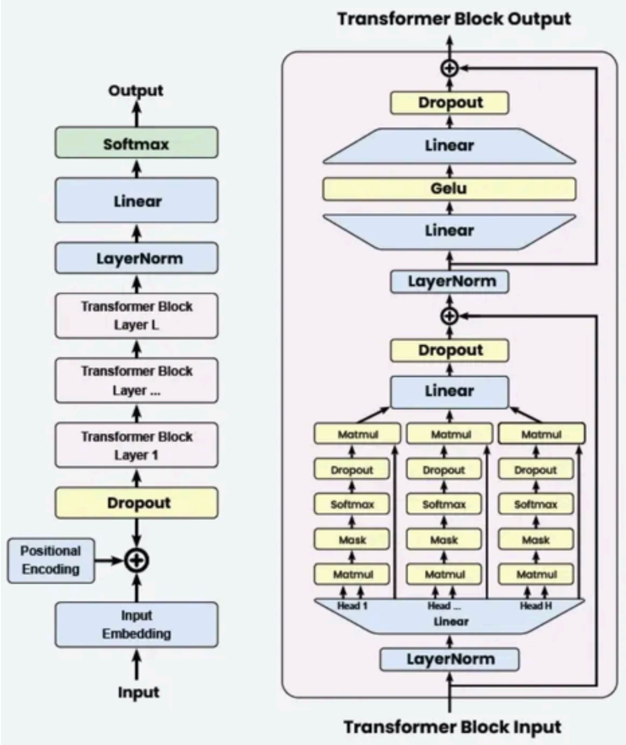
OpenAI

Generative **P**re-trained
Transformers



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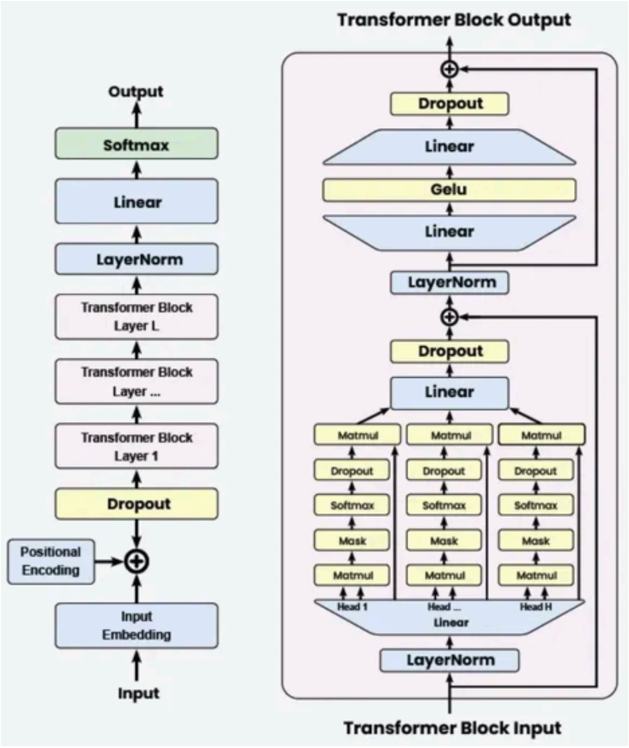
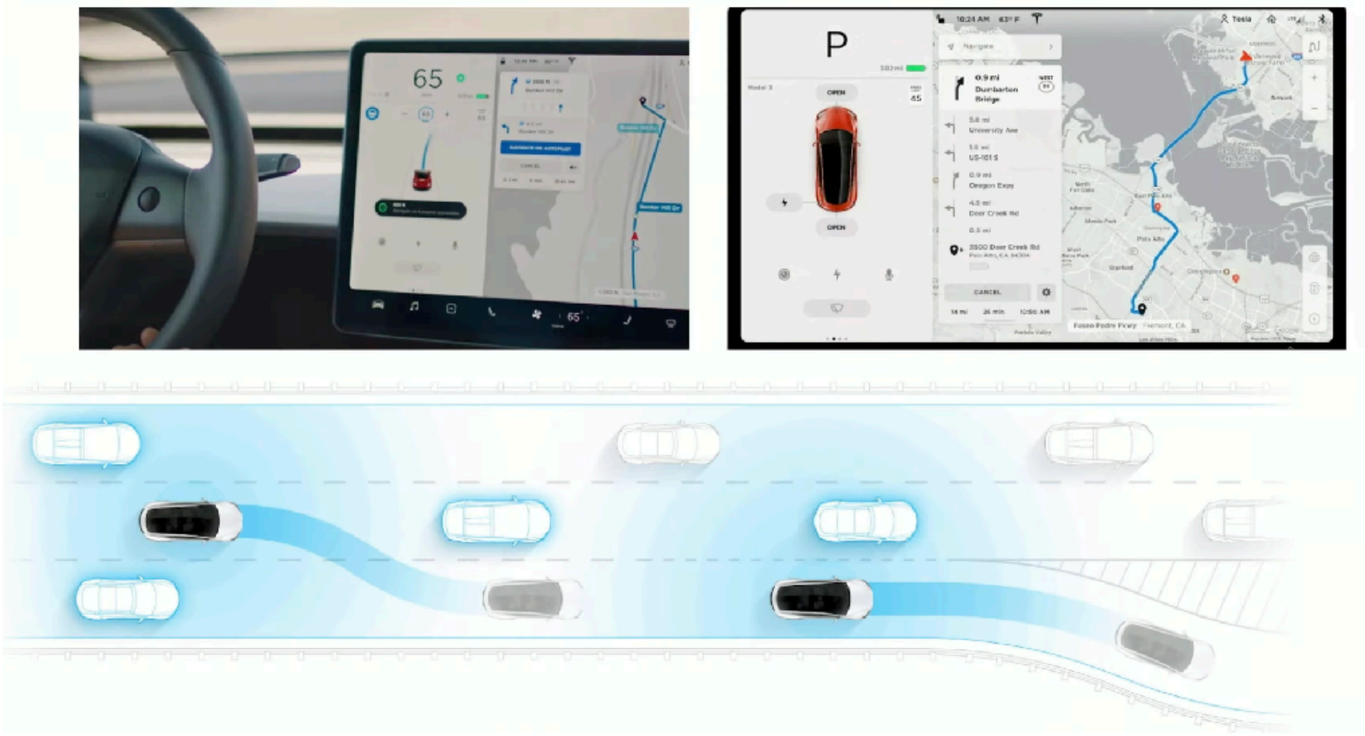


TESLA

AutoPilot algorithm training



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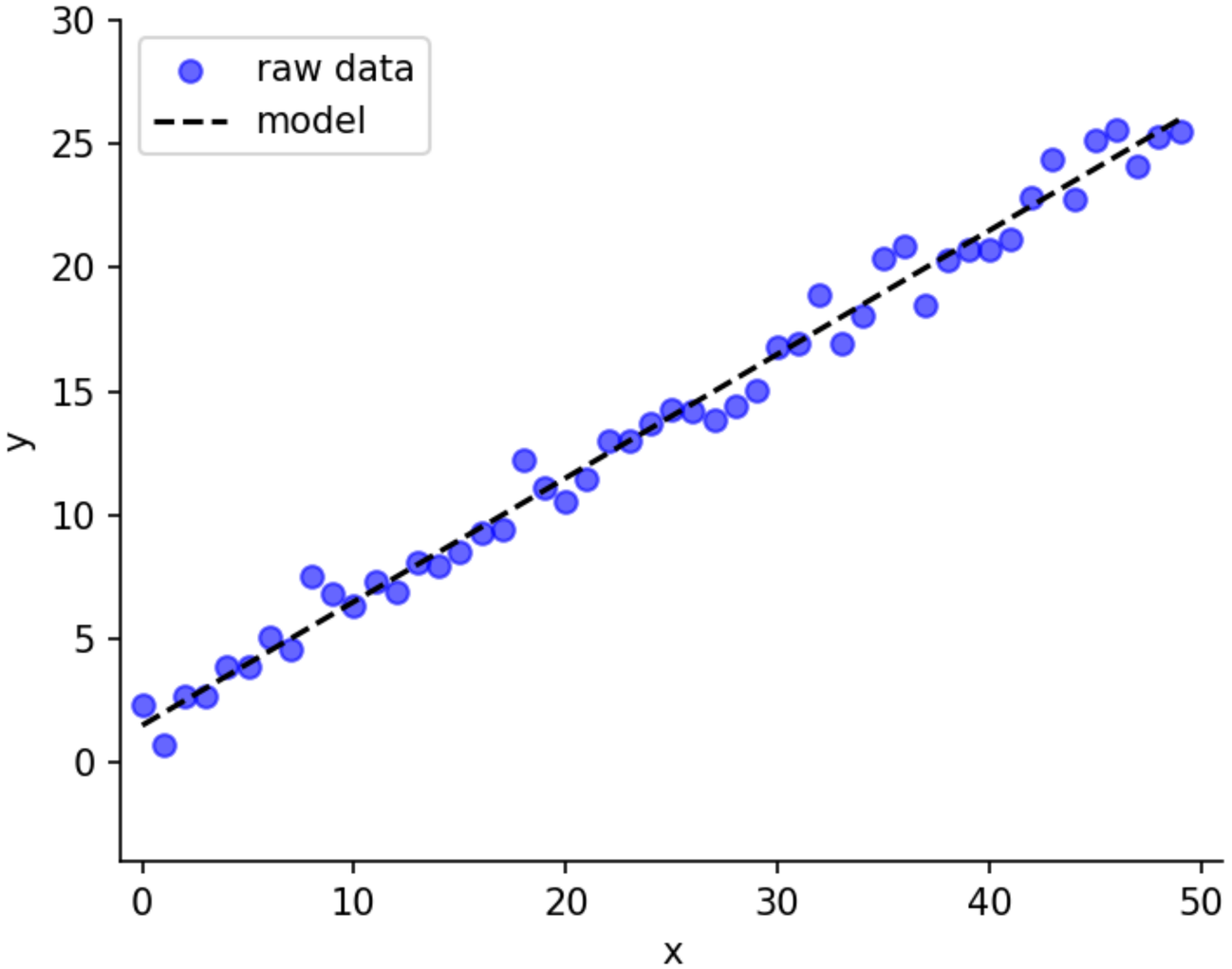

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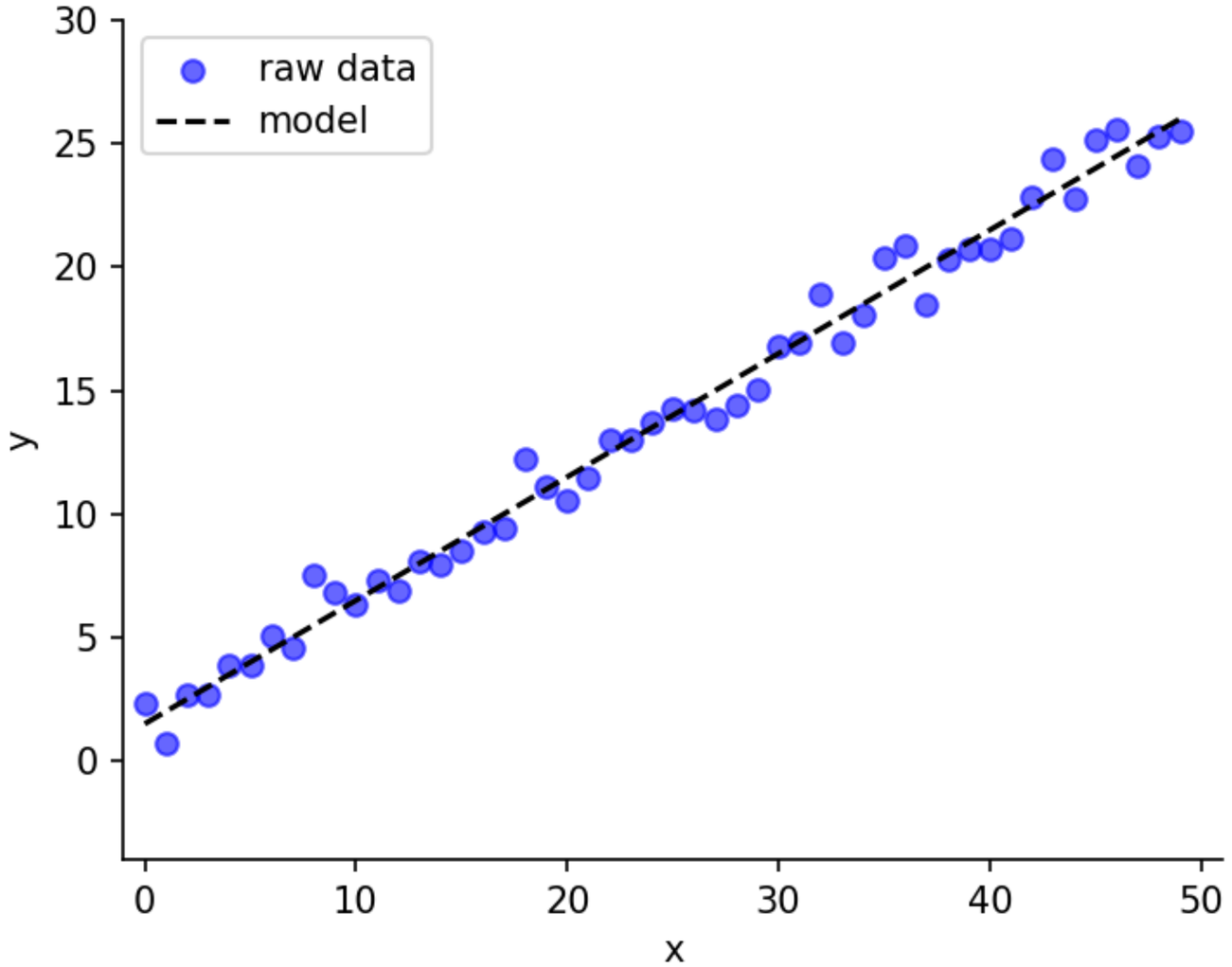

Model prediction

$$y' = a_t x + b_t$$

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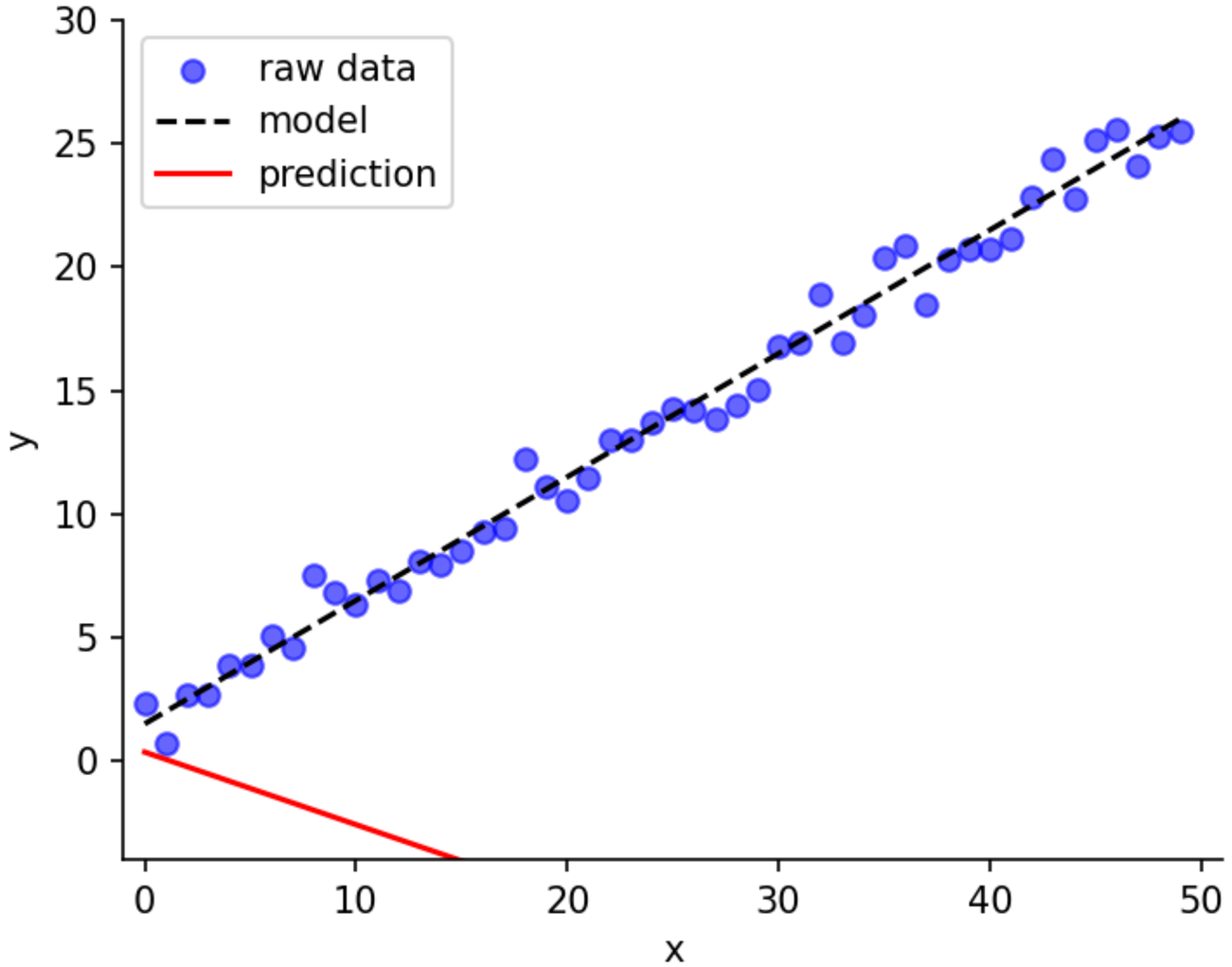

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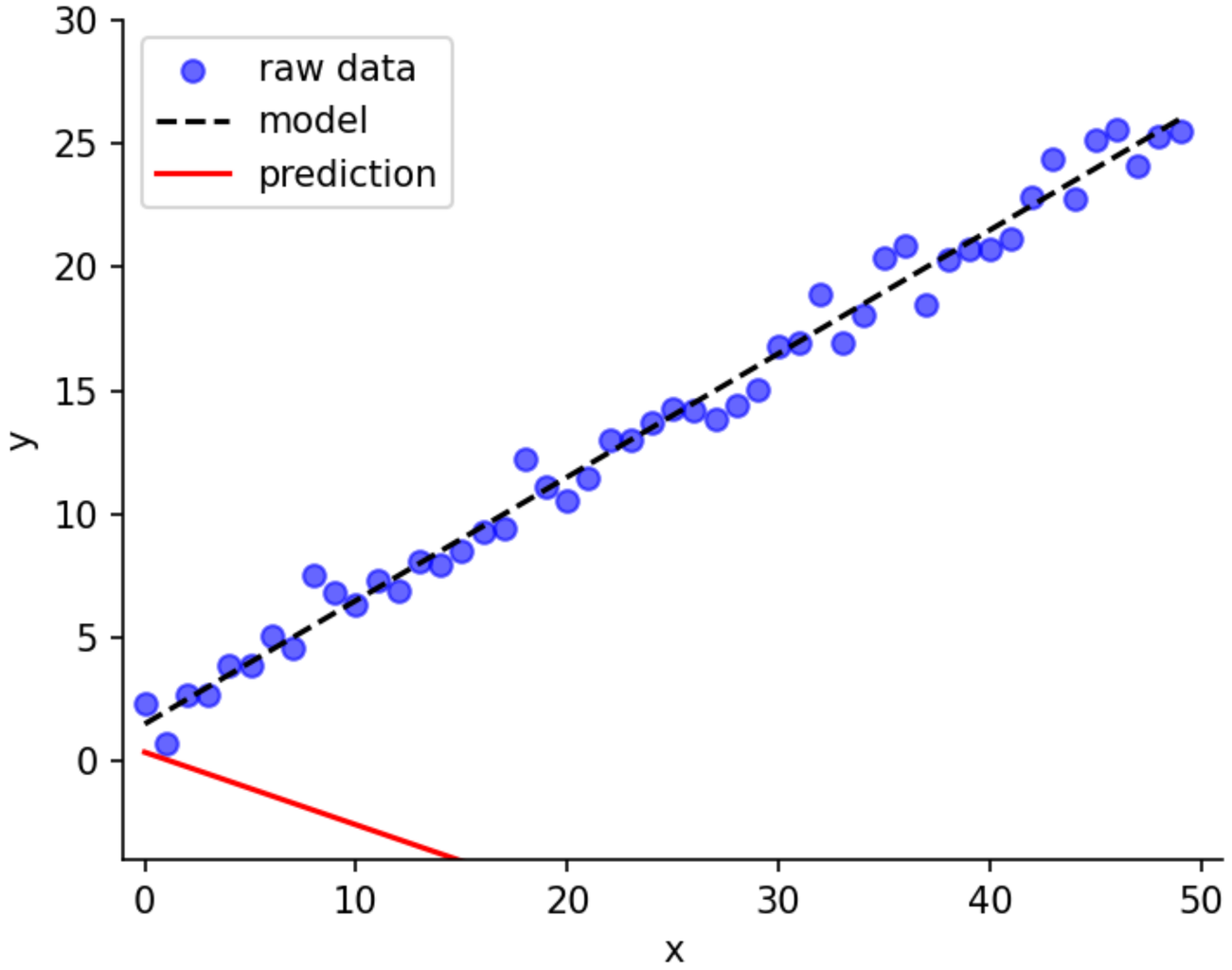

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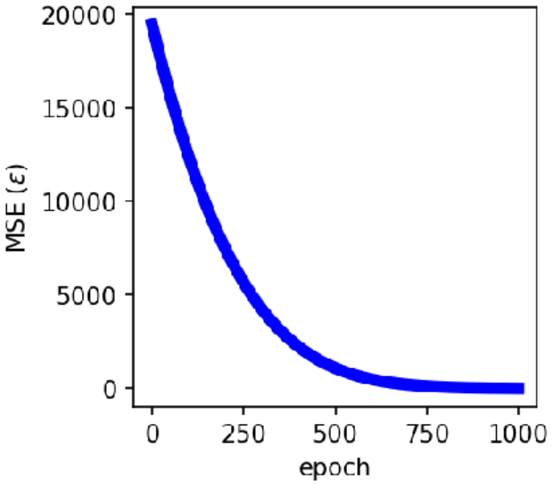

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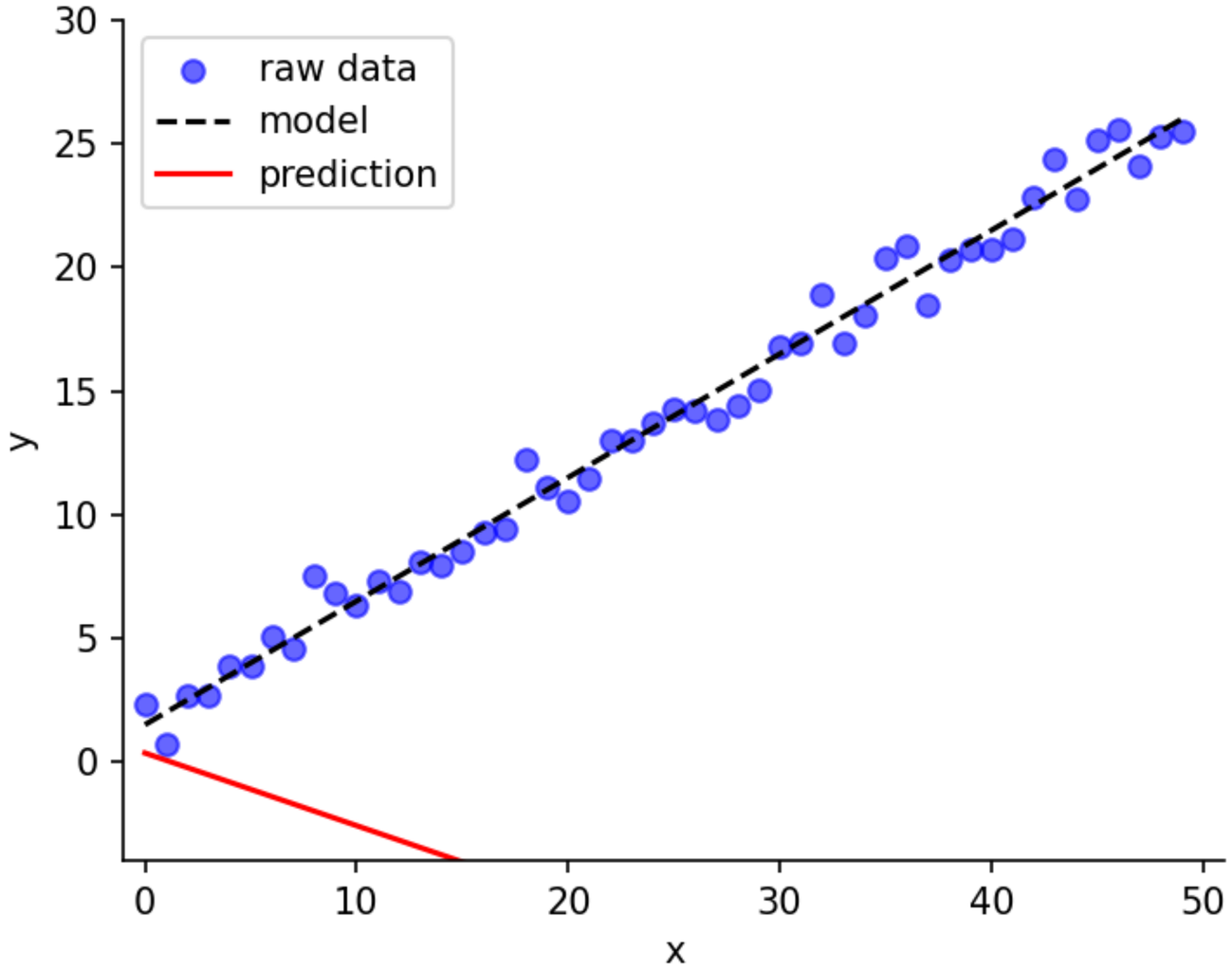

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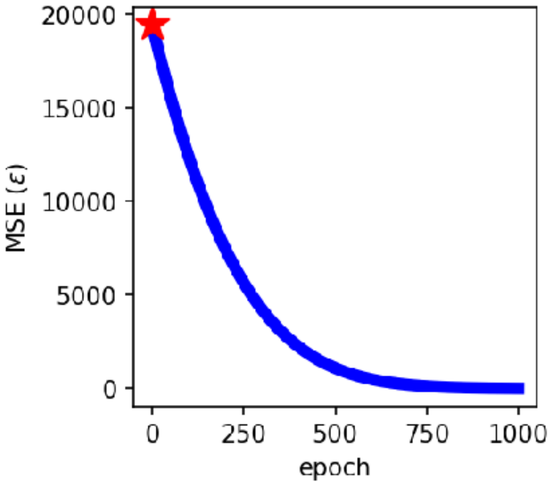

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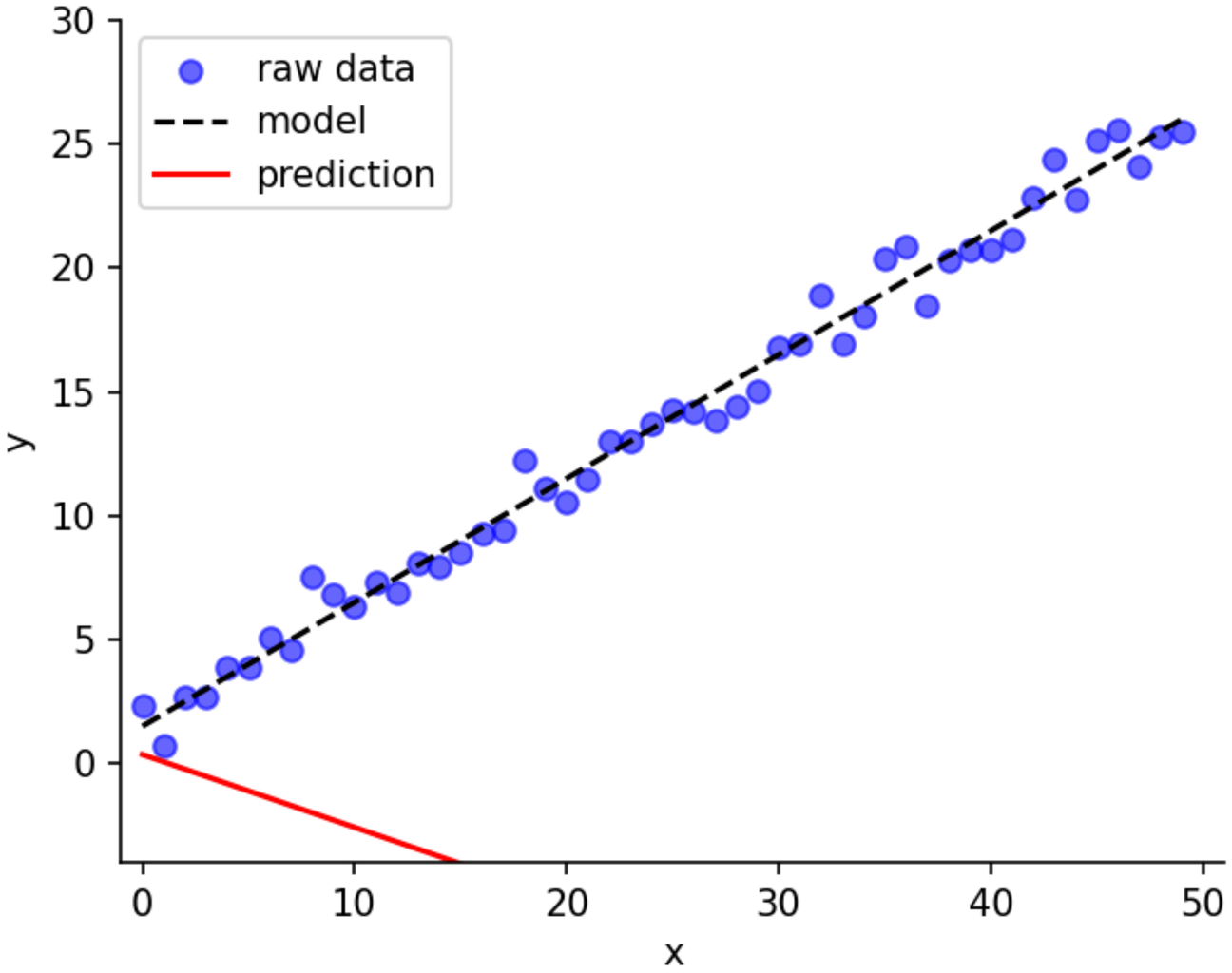

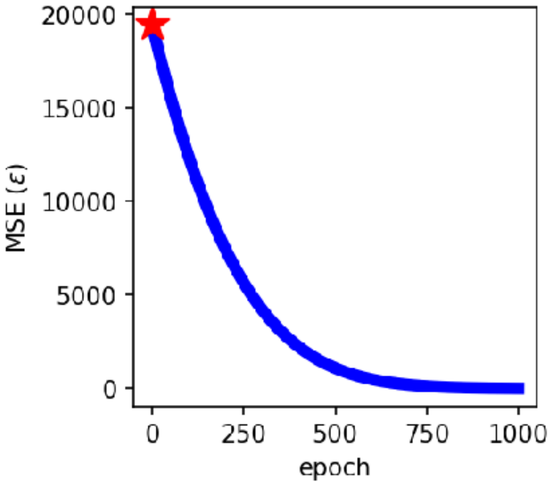

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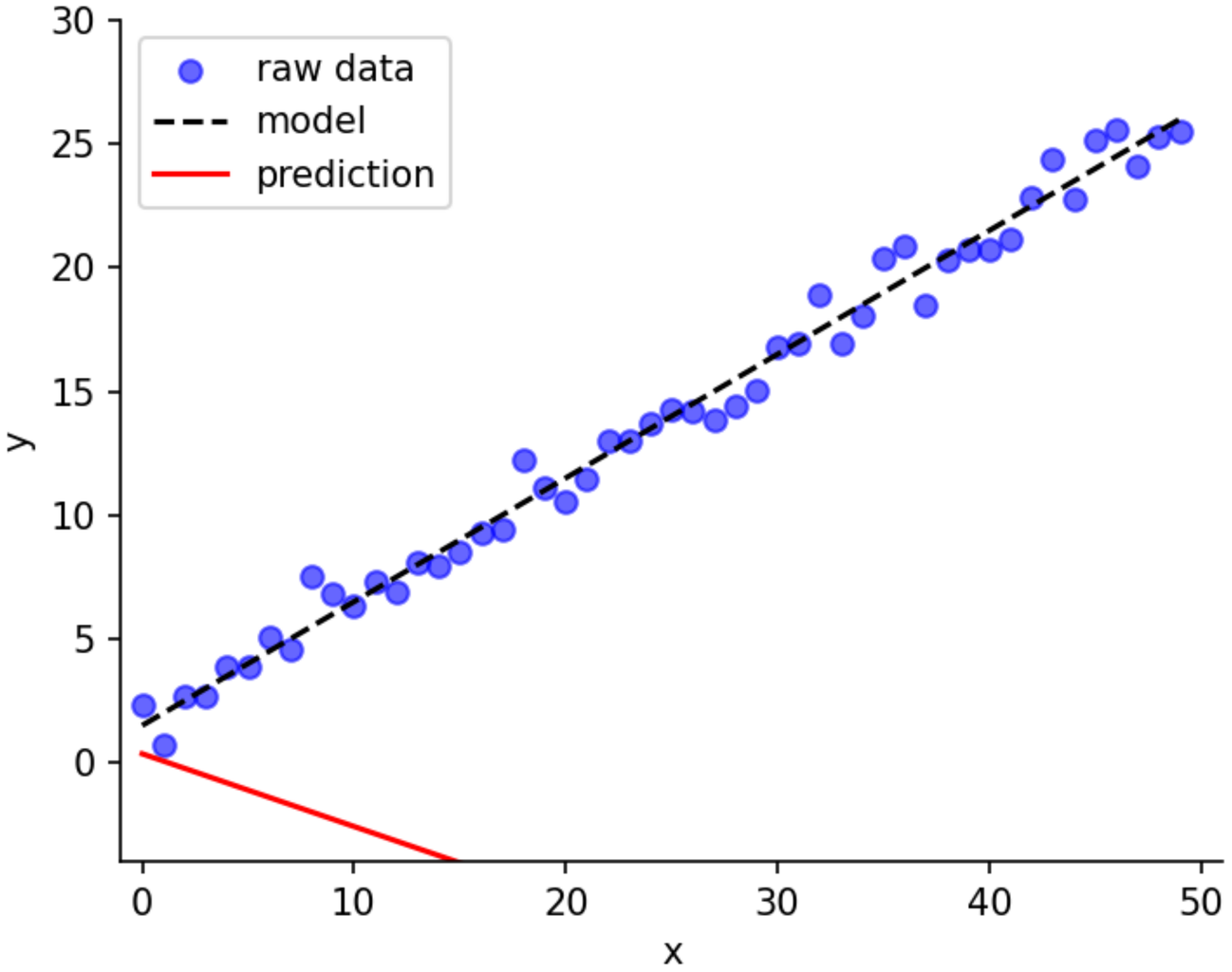

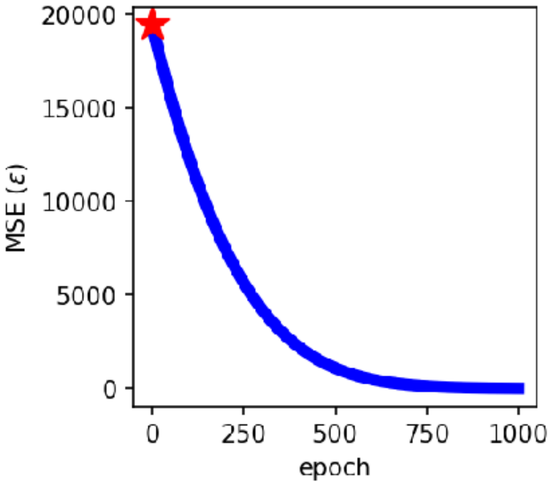

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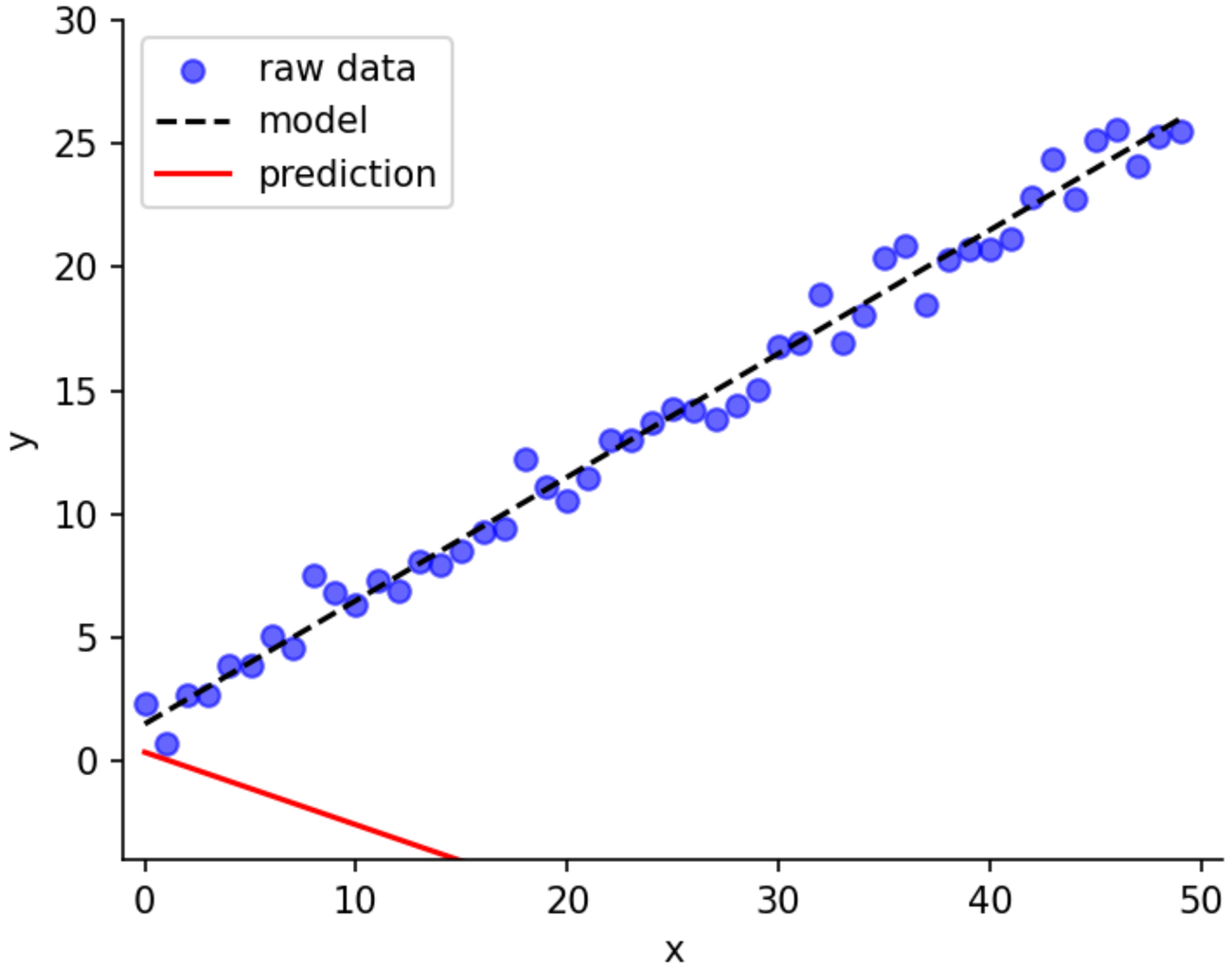

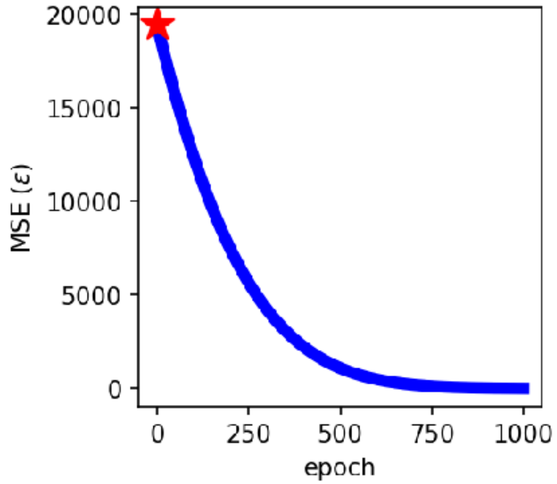

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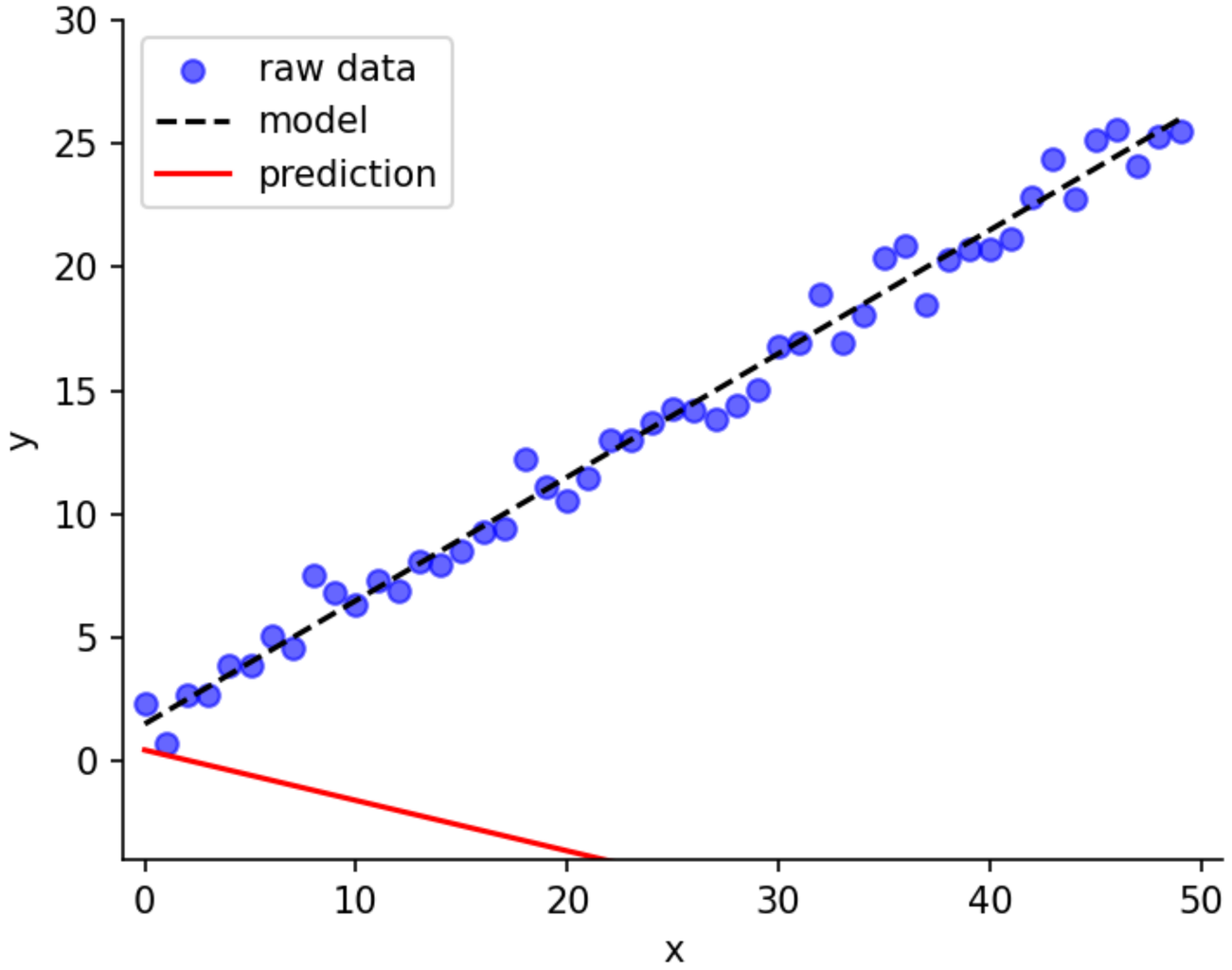

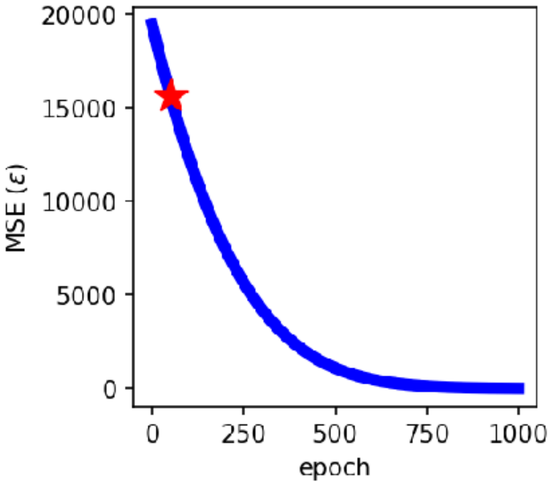

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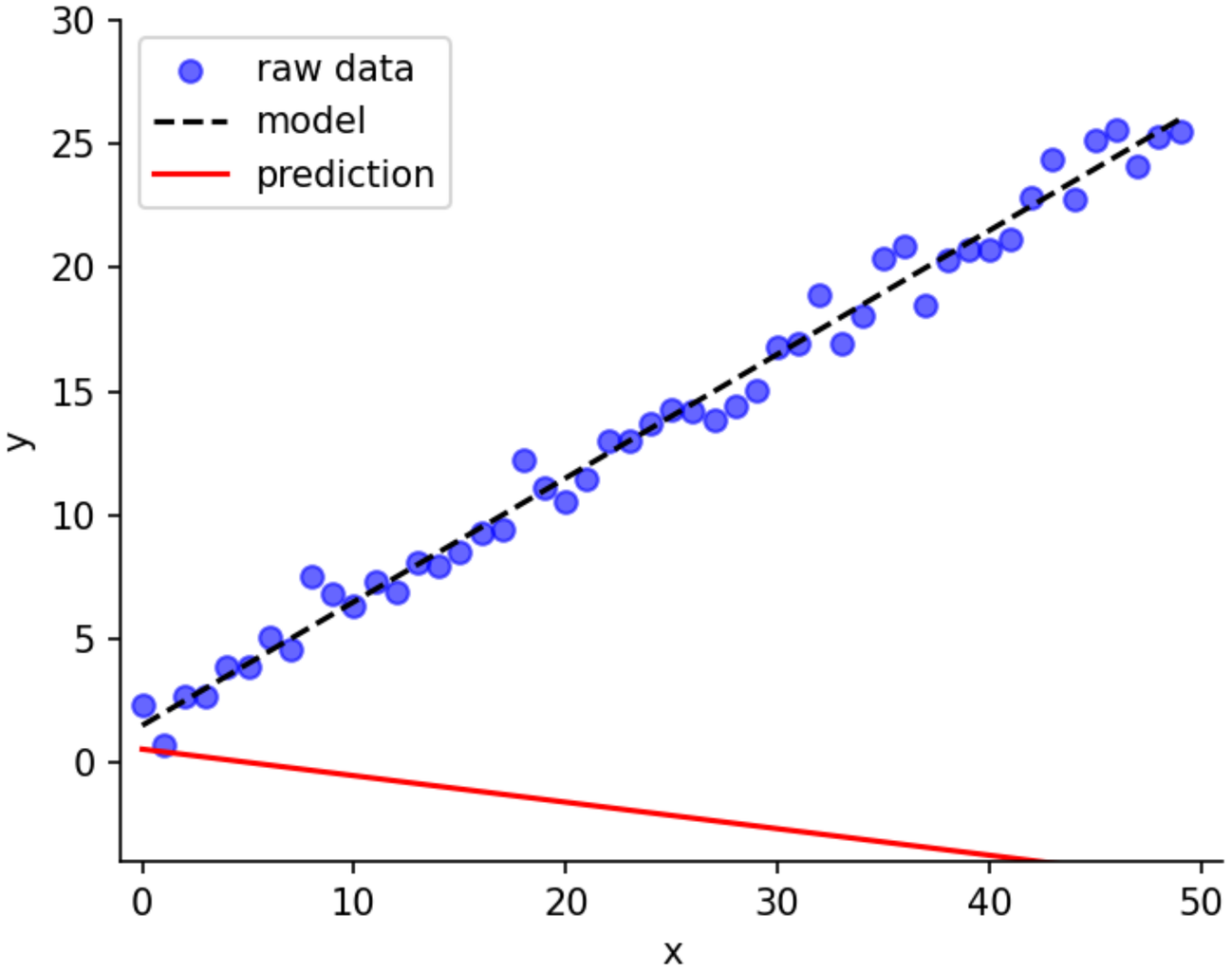

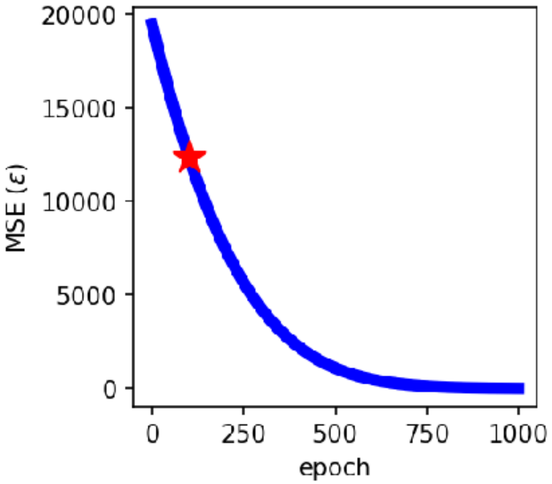

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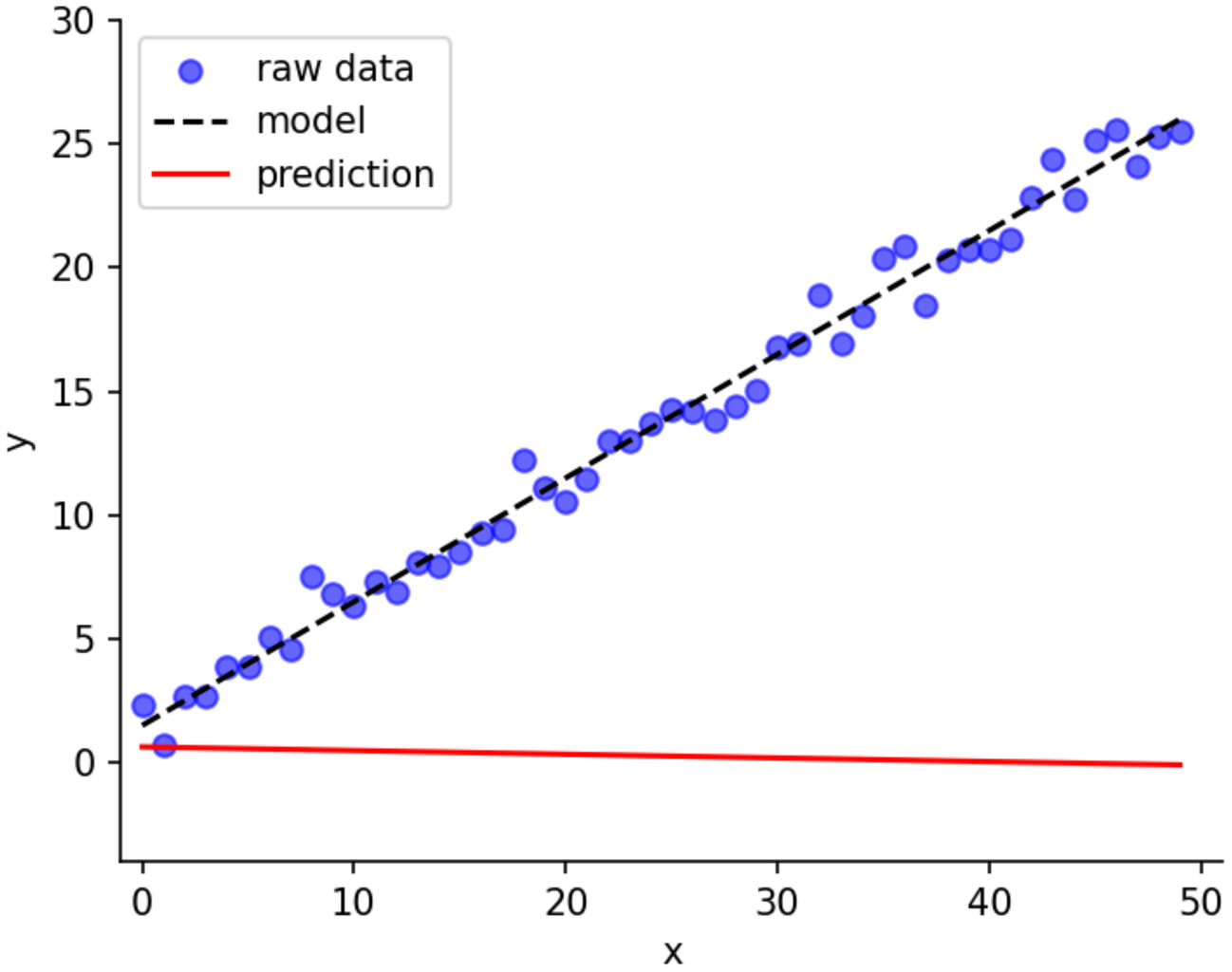

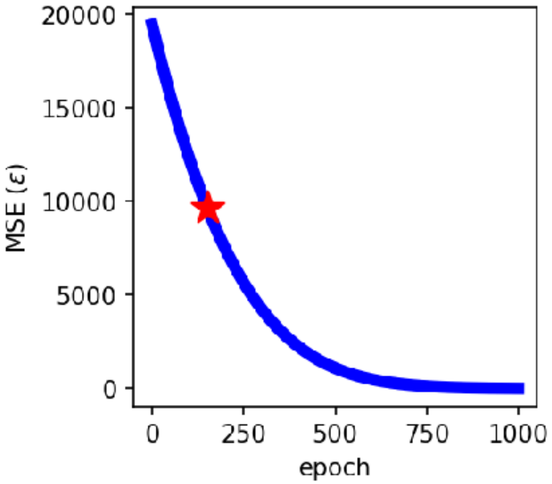

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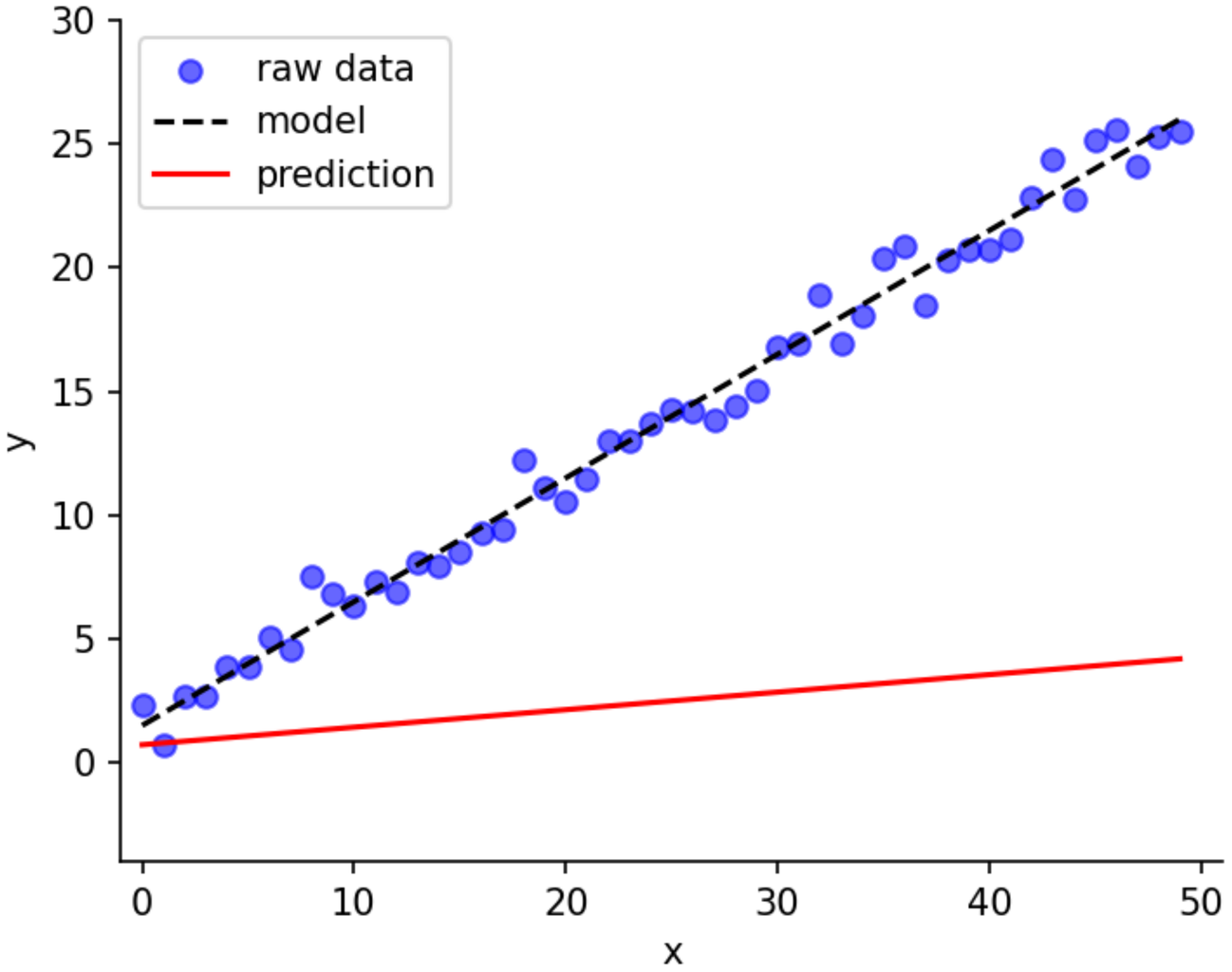

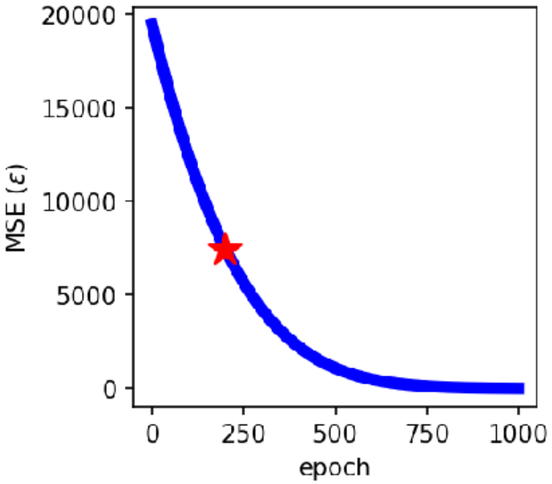

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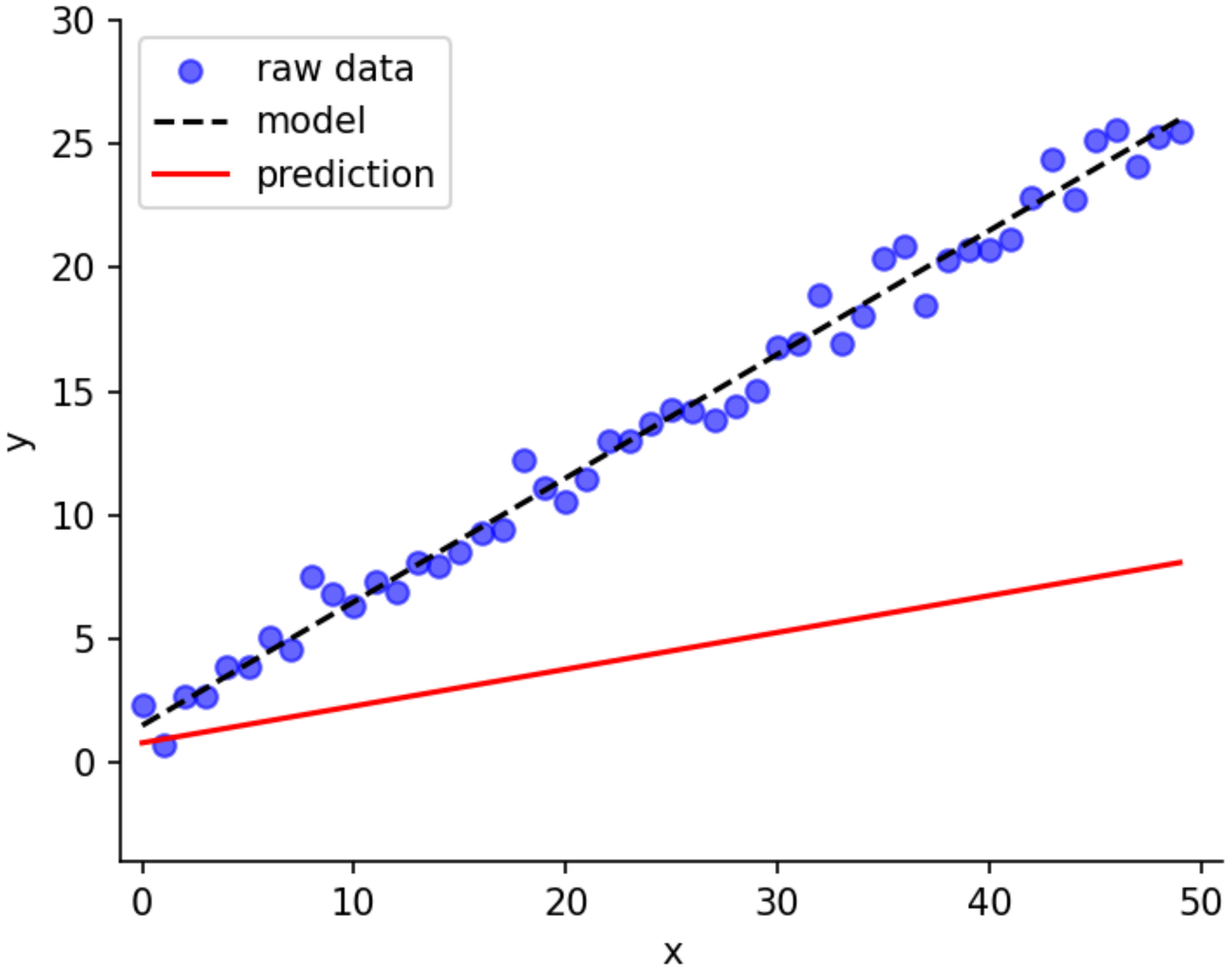

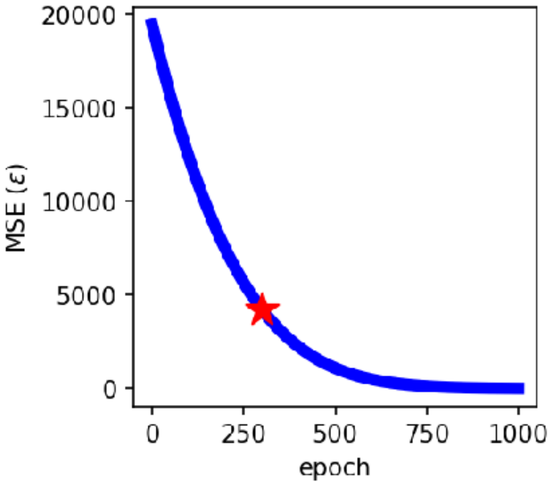

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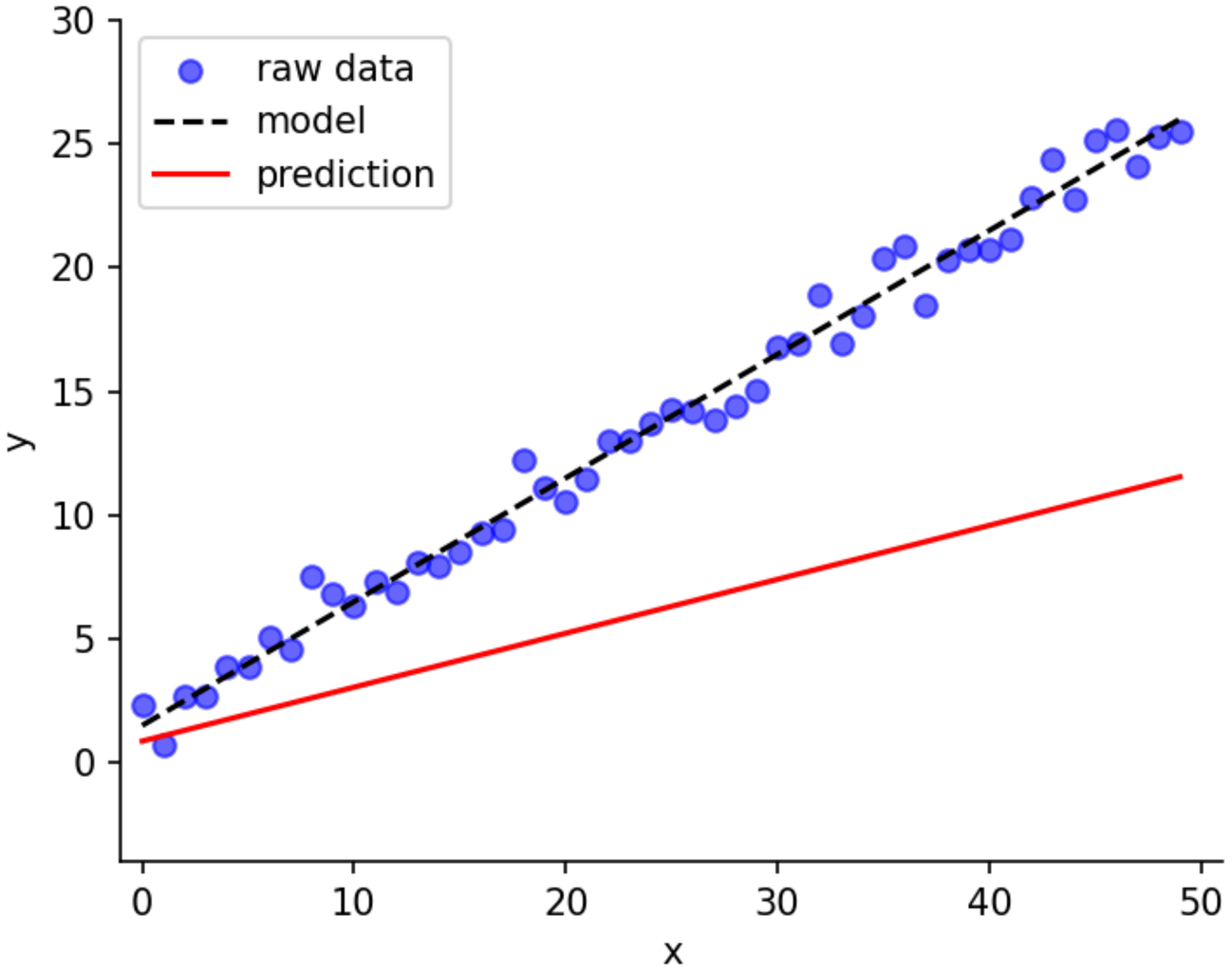

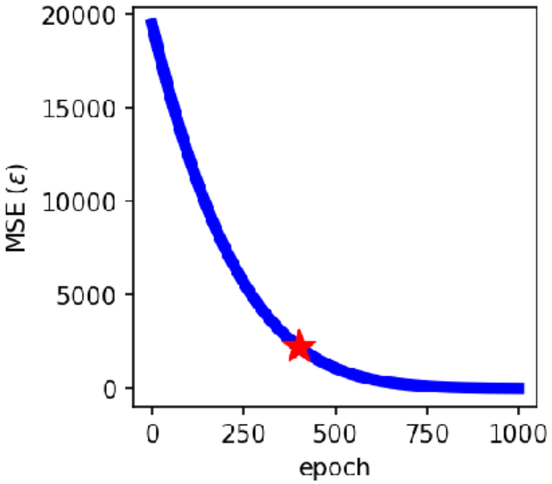

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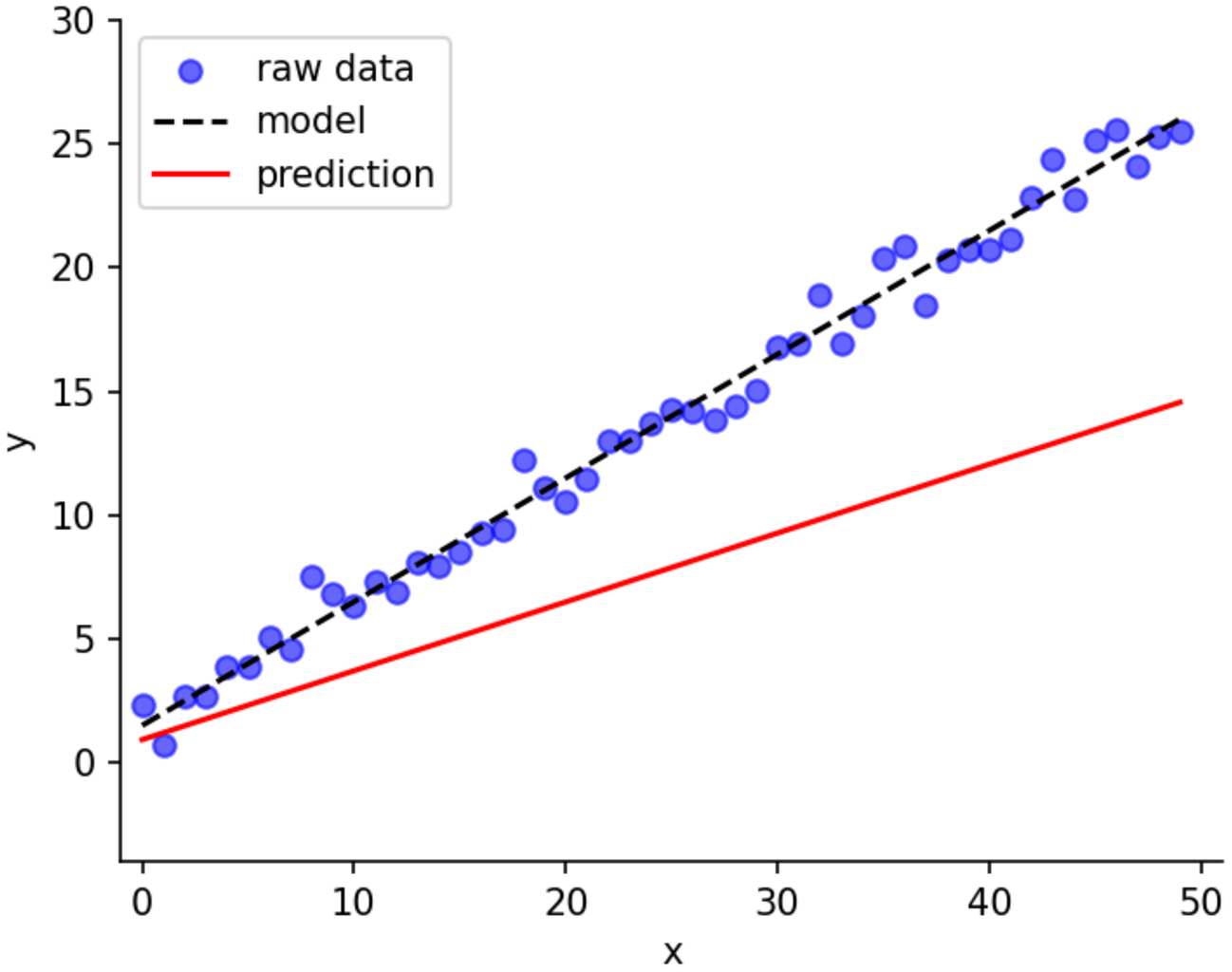

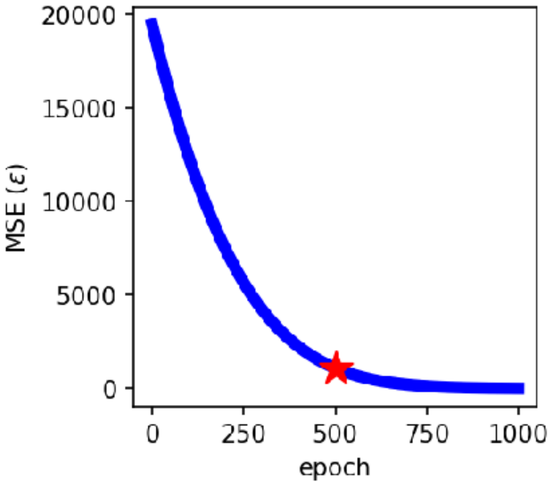

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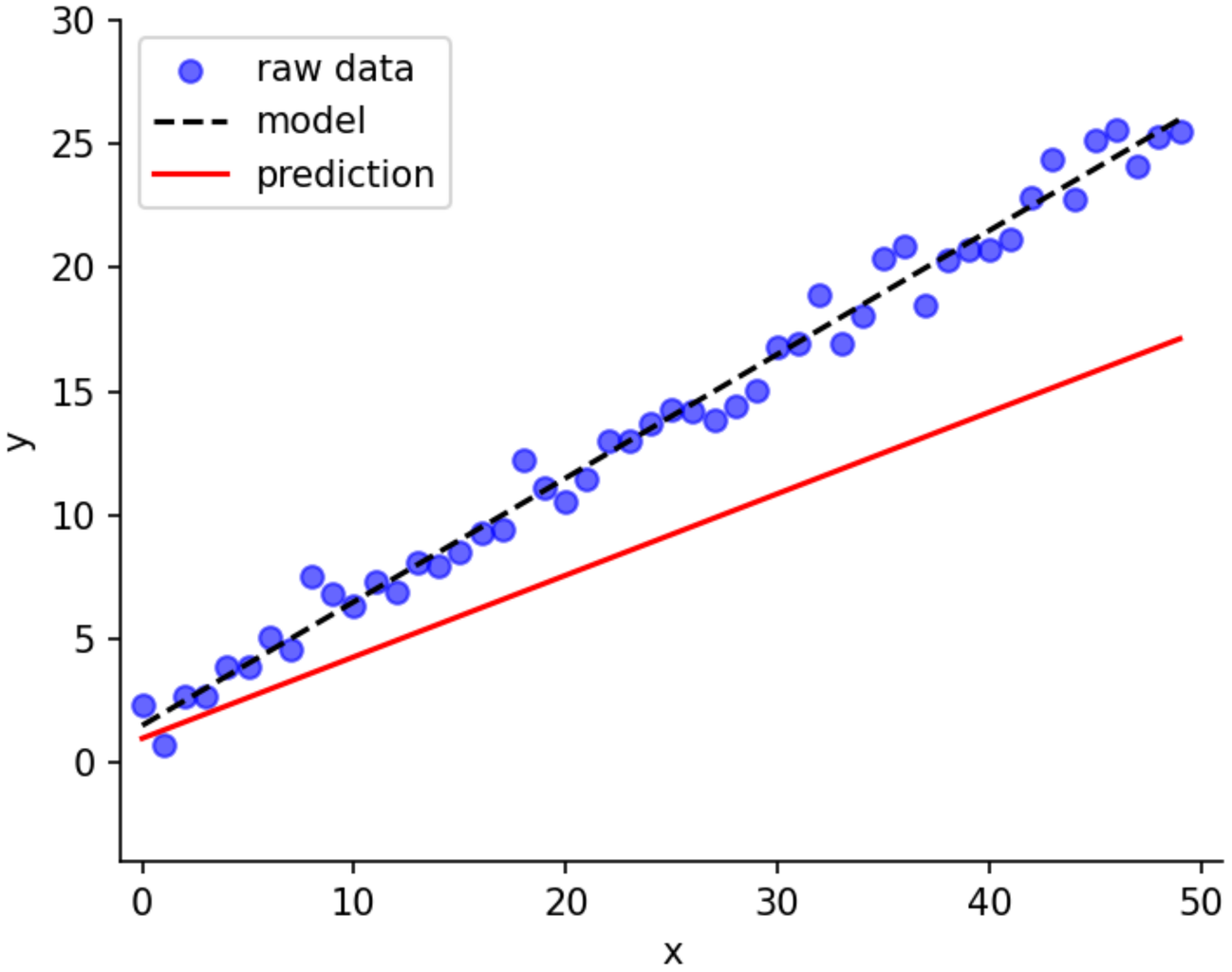

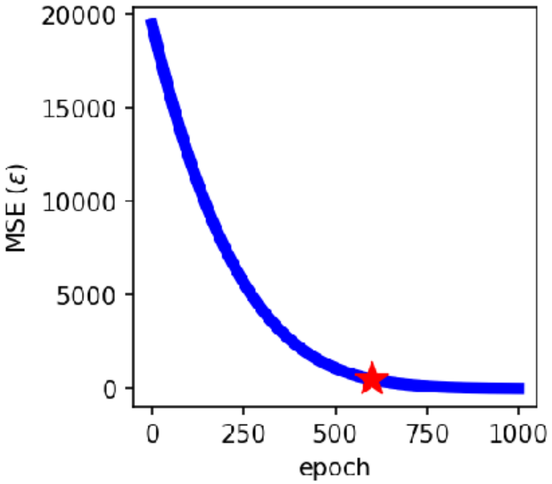

Model prediction

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Loss function (MSE)

$$\epsilon = \frac{1}{n}\sum_{i=1}^{n}(y_i - y_i')^2 = \frac{1}{n}\sum_{i=1}^{n}(a_t x + b_t - y)^2$$

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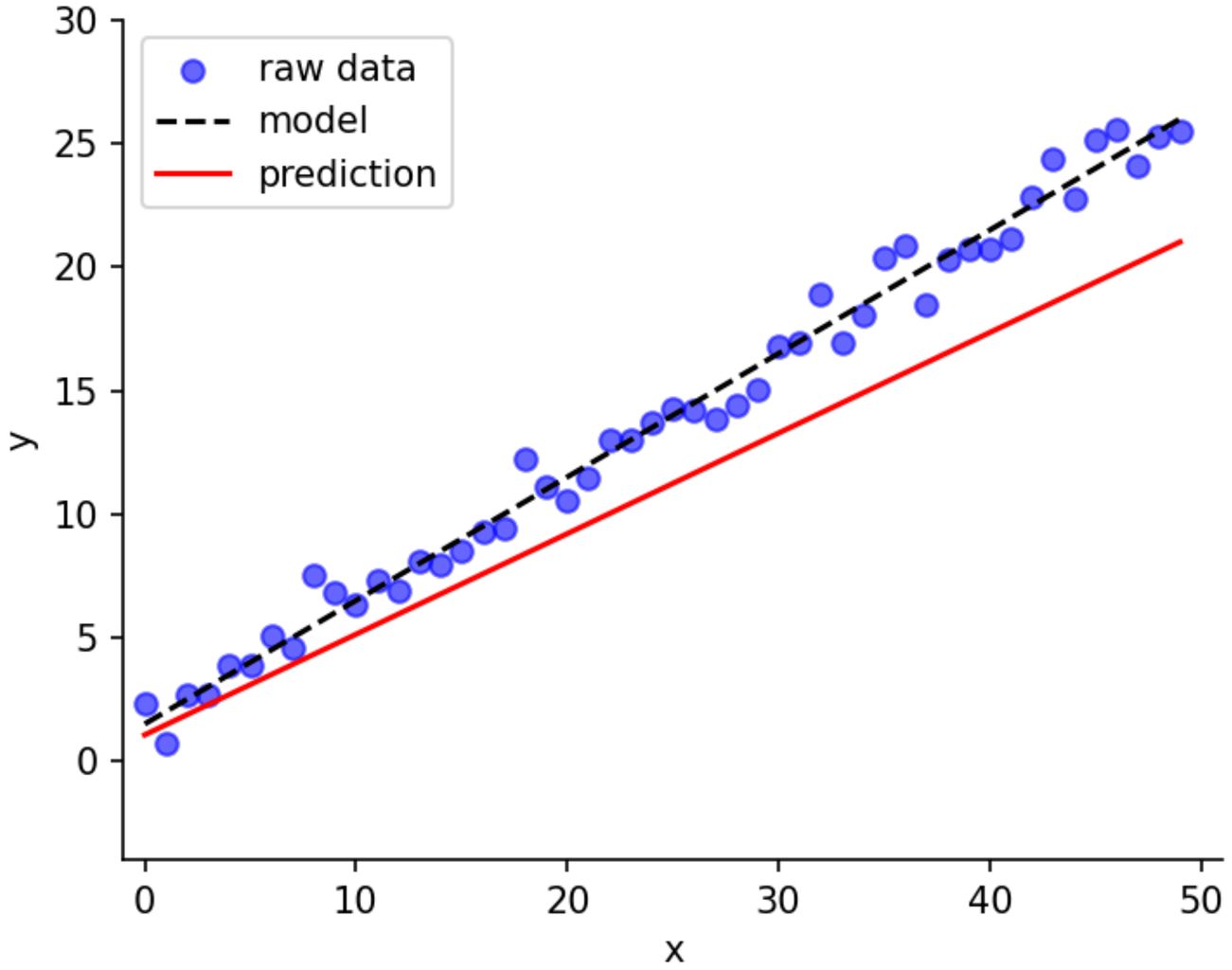

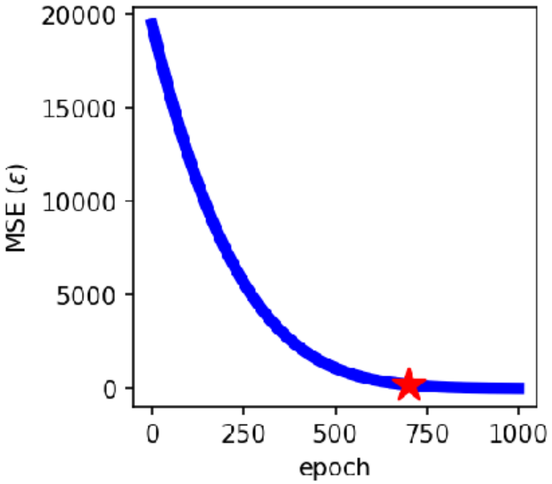

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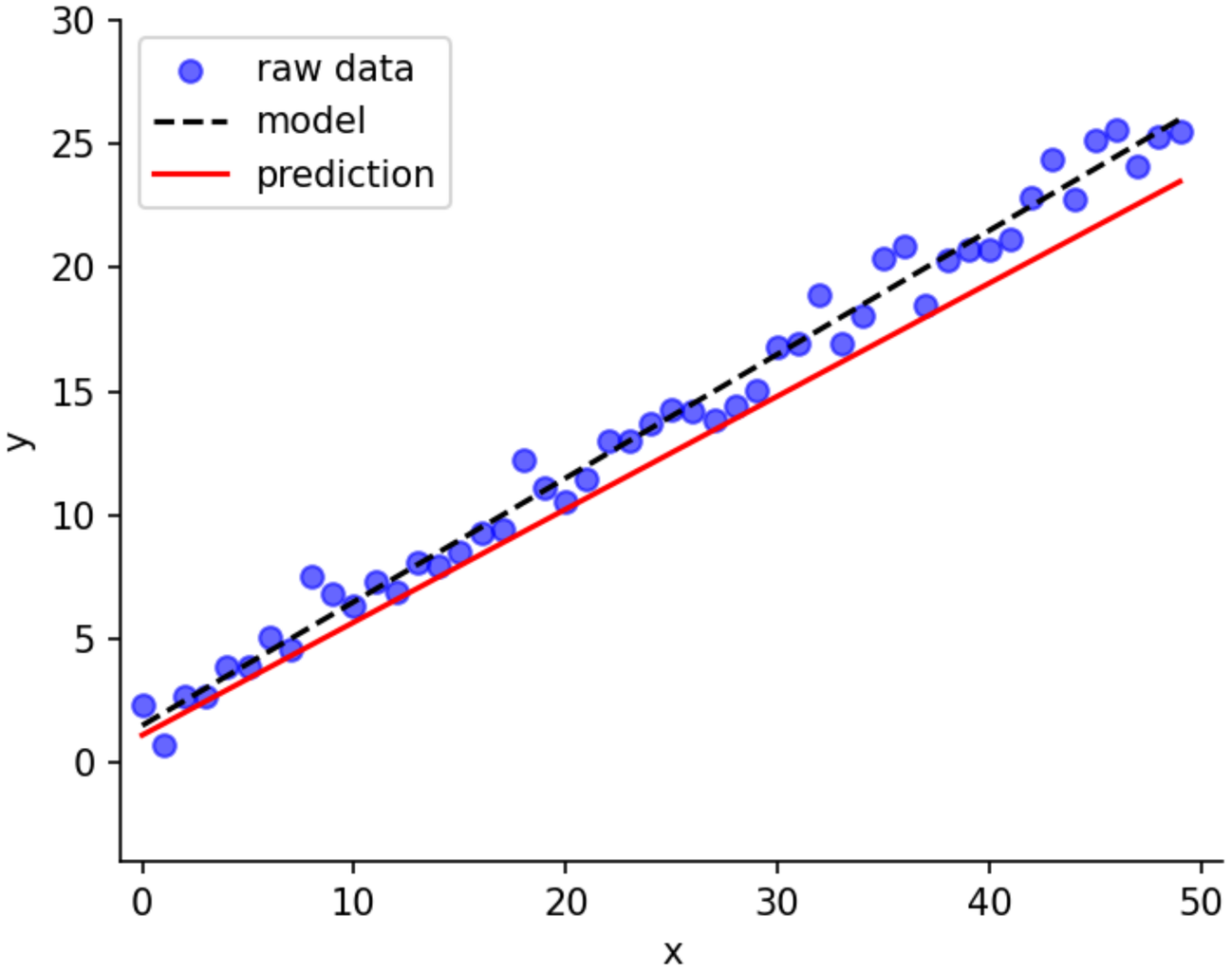

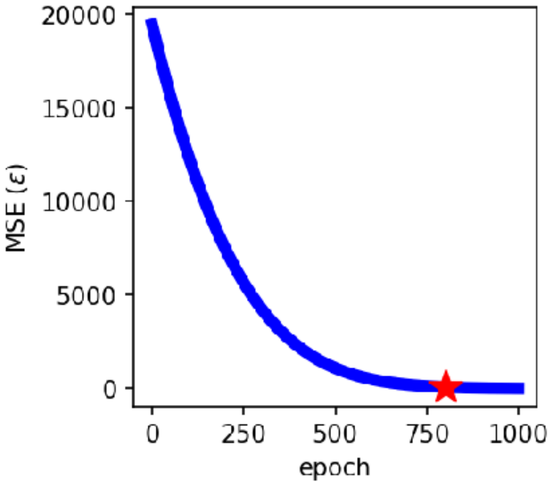

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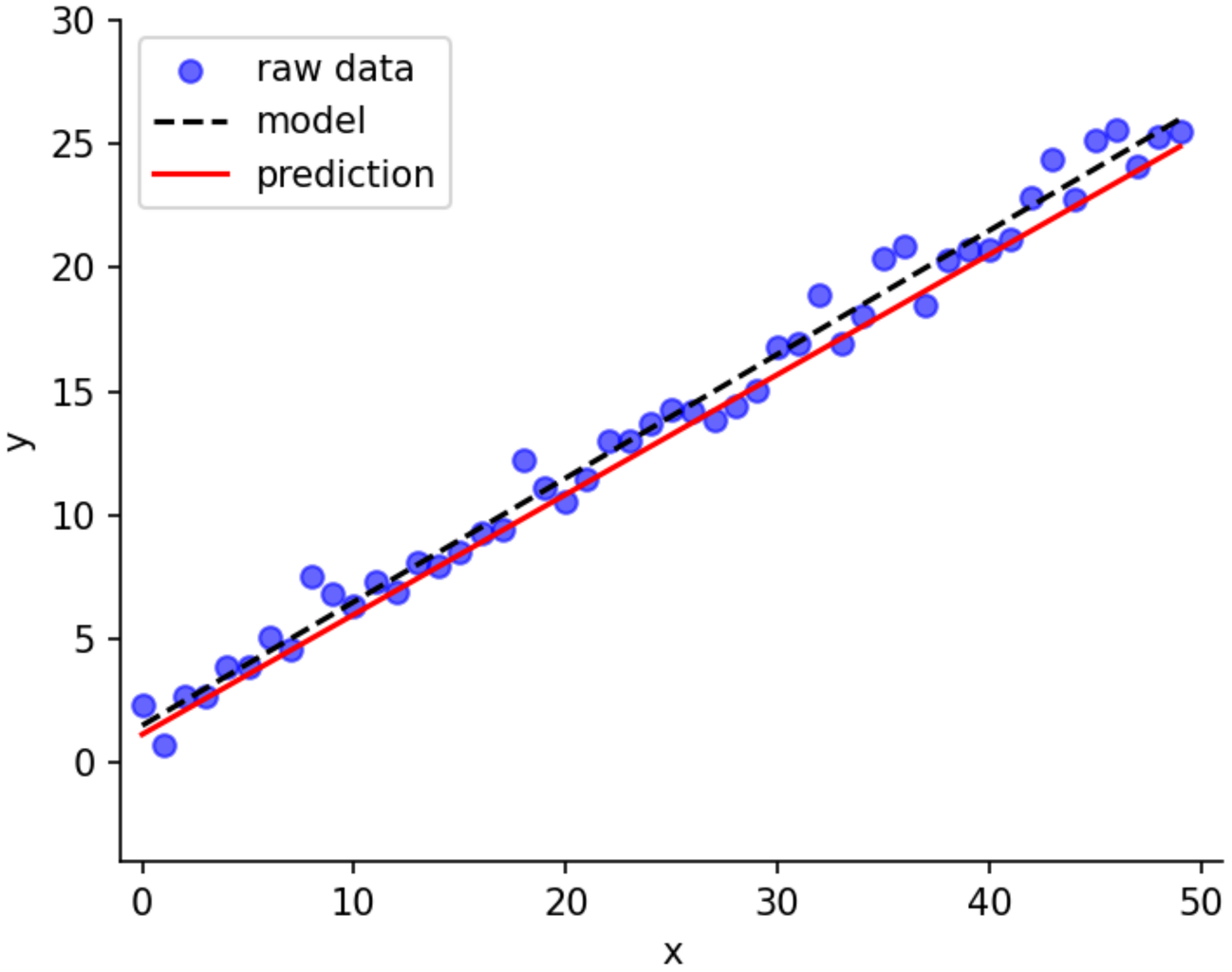

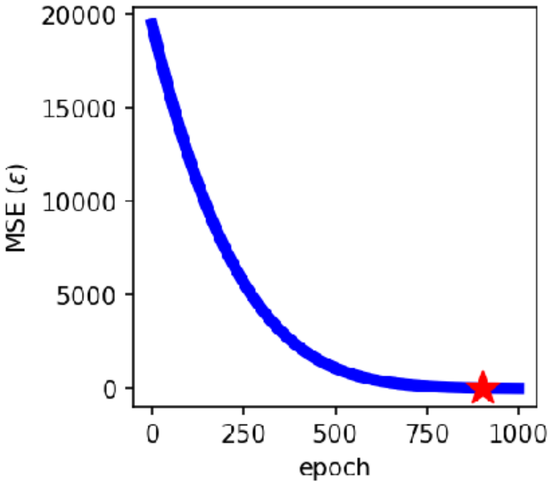

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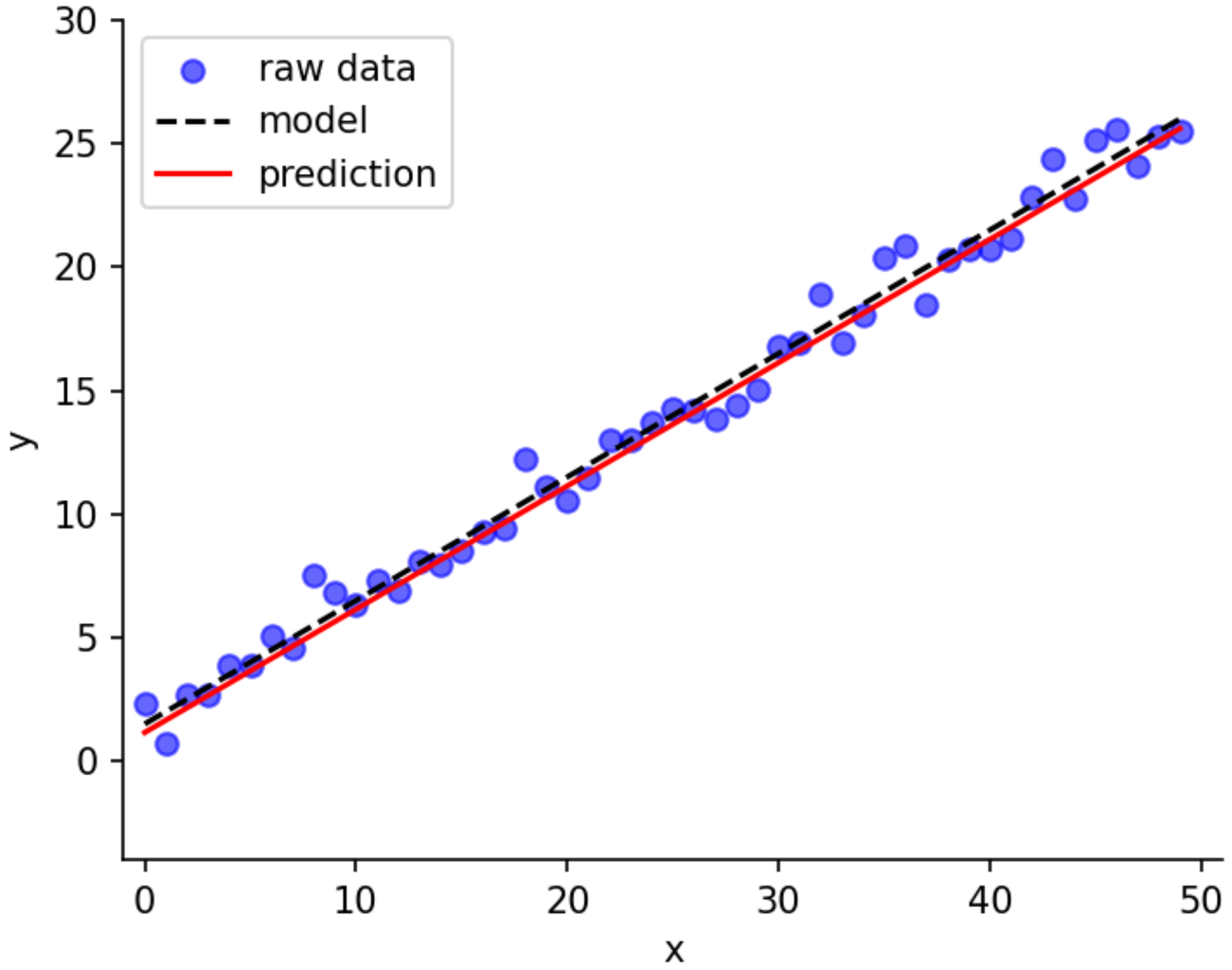

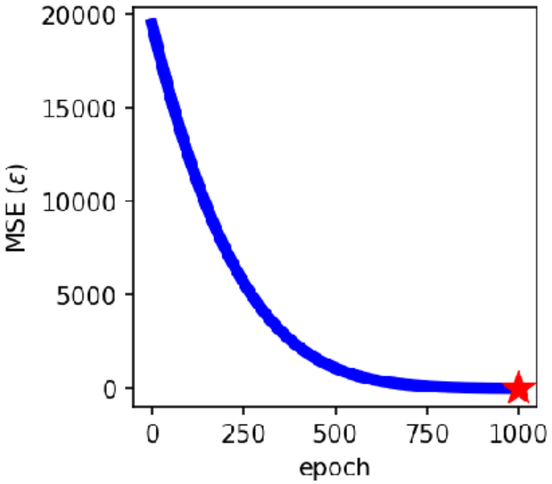

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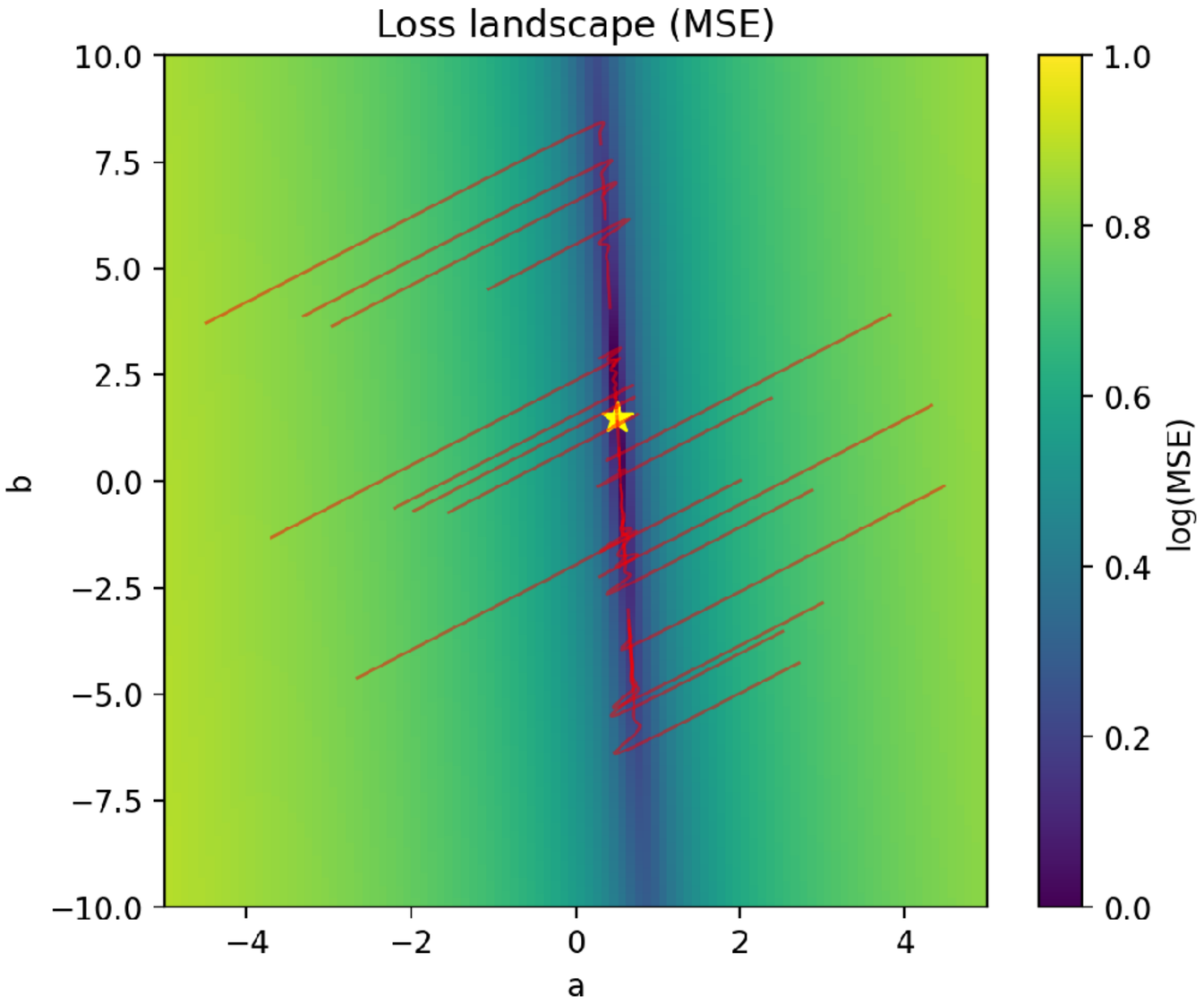

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PyTorch

- Automatic differentiation (Autograd)
- More than 25 Loss already implemented (MSE, Kullback–Leibler, L1…)
- Around 15 optimizing algorithm (SGD, Adam…)
- Easy debugging
- CPU & GPU support

3. Few examples

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Also largely used in public research :

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Fitting model parameters

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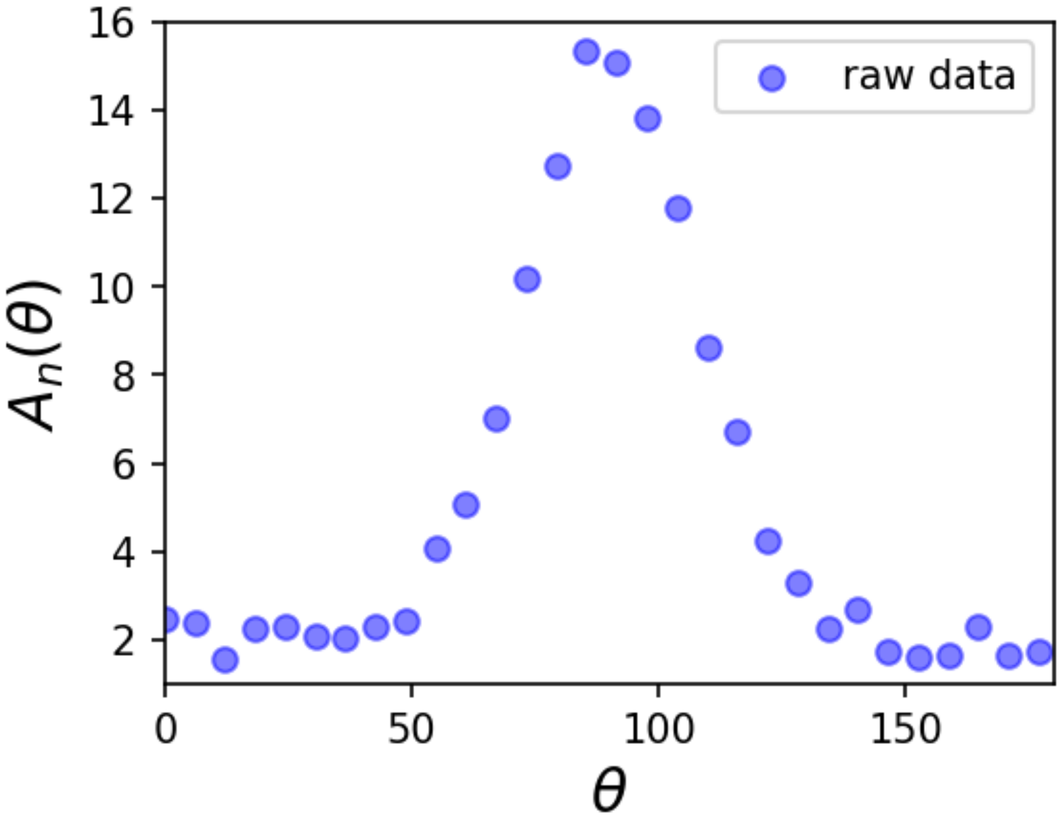

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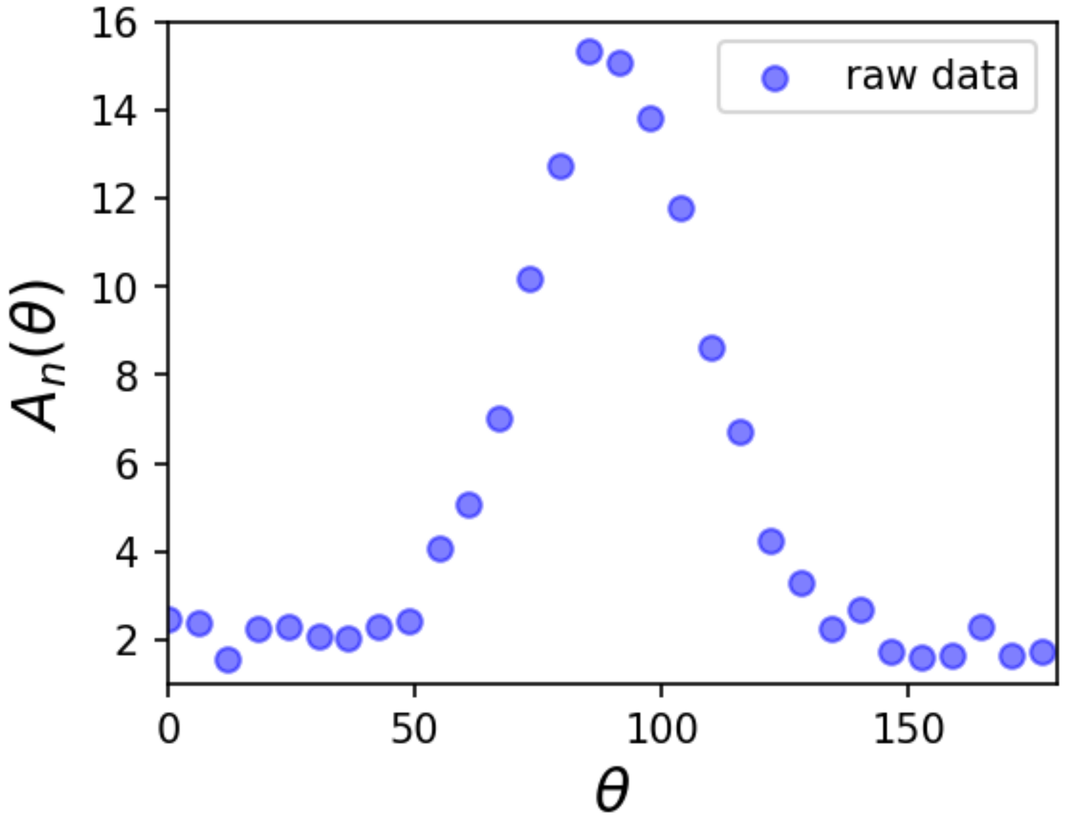

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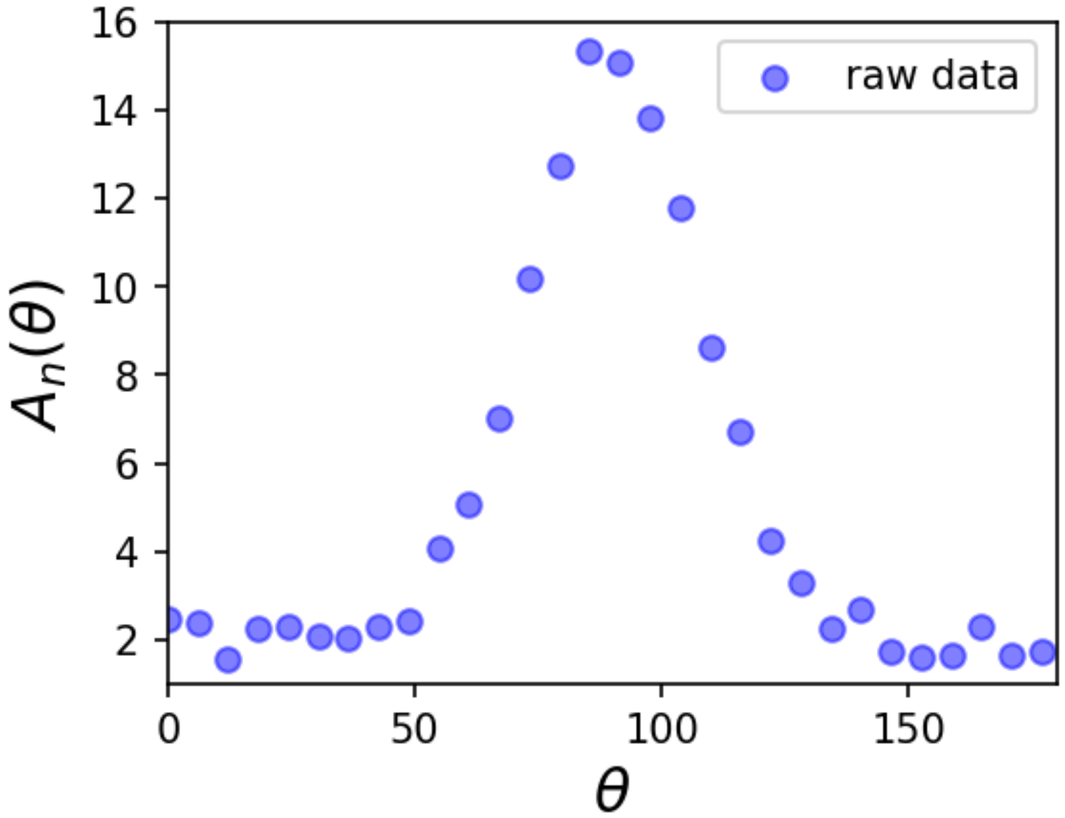

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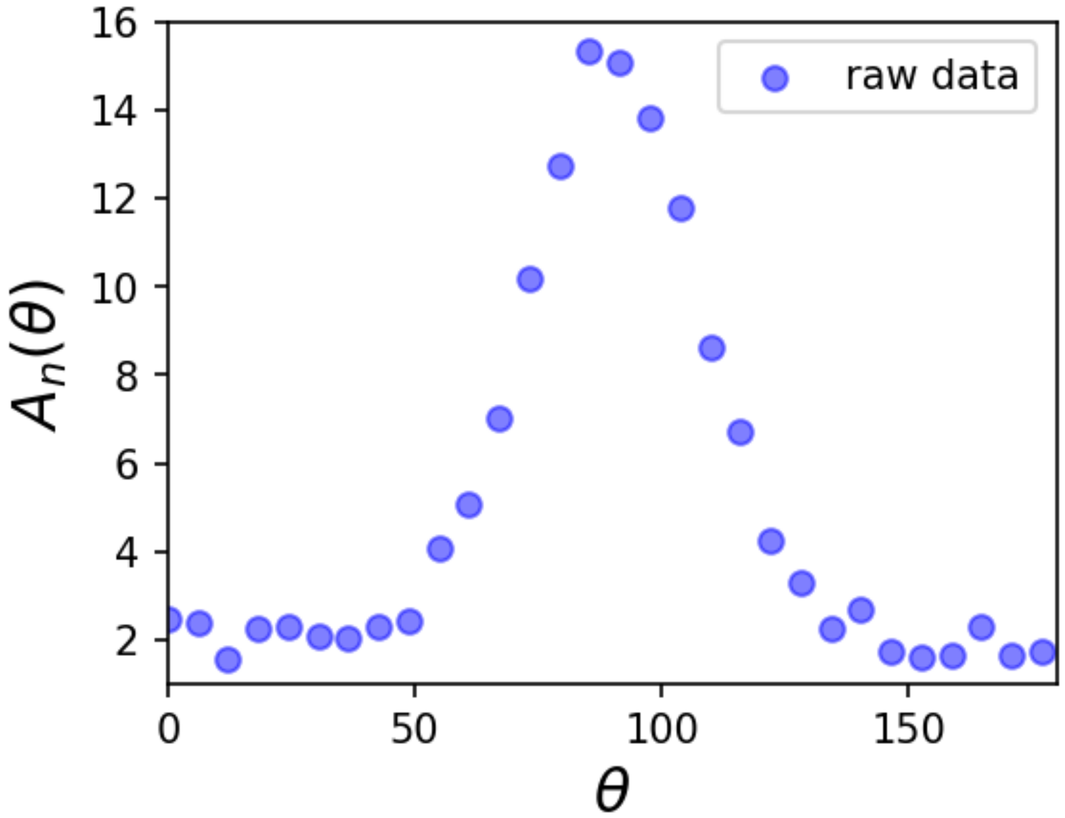


```python
class TorchModel(torch.nn.Module):
    def __init__(
            self,
            R_0,
            R_amp,
            sigma,
            theta_0
            ):
        super(TorchModel, self).__init__()

        self.R_0 = torch.nn.Parameter(torch.ones(1) * R_0)
        self.R_amp = torch.nn.Parameter(torch.ones(1) * R_amp)
        self.sigma = torch.nn.Parameter(torch.ones(1) * sigma)
        self.theta_0 = torch.nn.Parameter(torch.ones(1) * theta_0)

    def forward(self, theta):

        base_activity = torch.exp((- (theta - self.theta_0) ** 2) / (2 * self.sigma ** 2))
        modulation = (self.R_amp / (self.sigma * torch.sqrt(torch.Tensor([2 * torch.pi]))))

        return self.R_0 + modulation * base_activity
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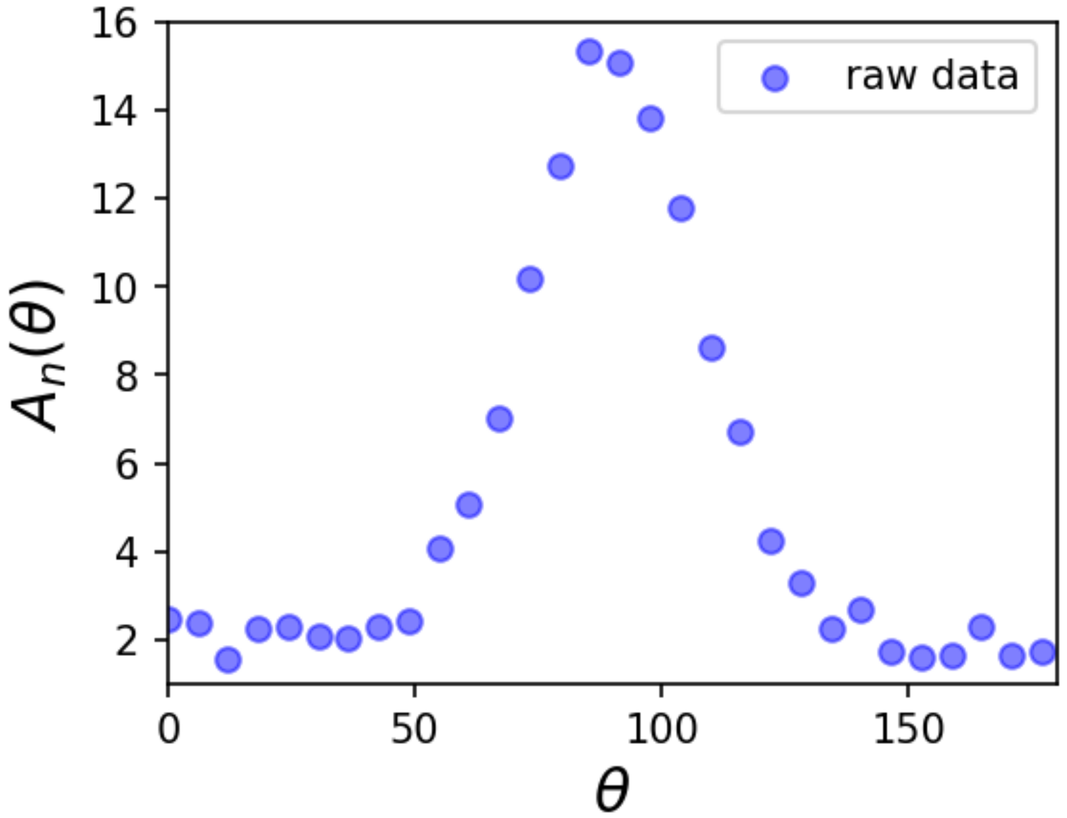


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Training loop /
Loss minimization

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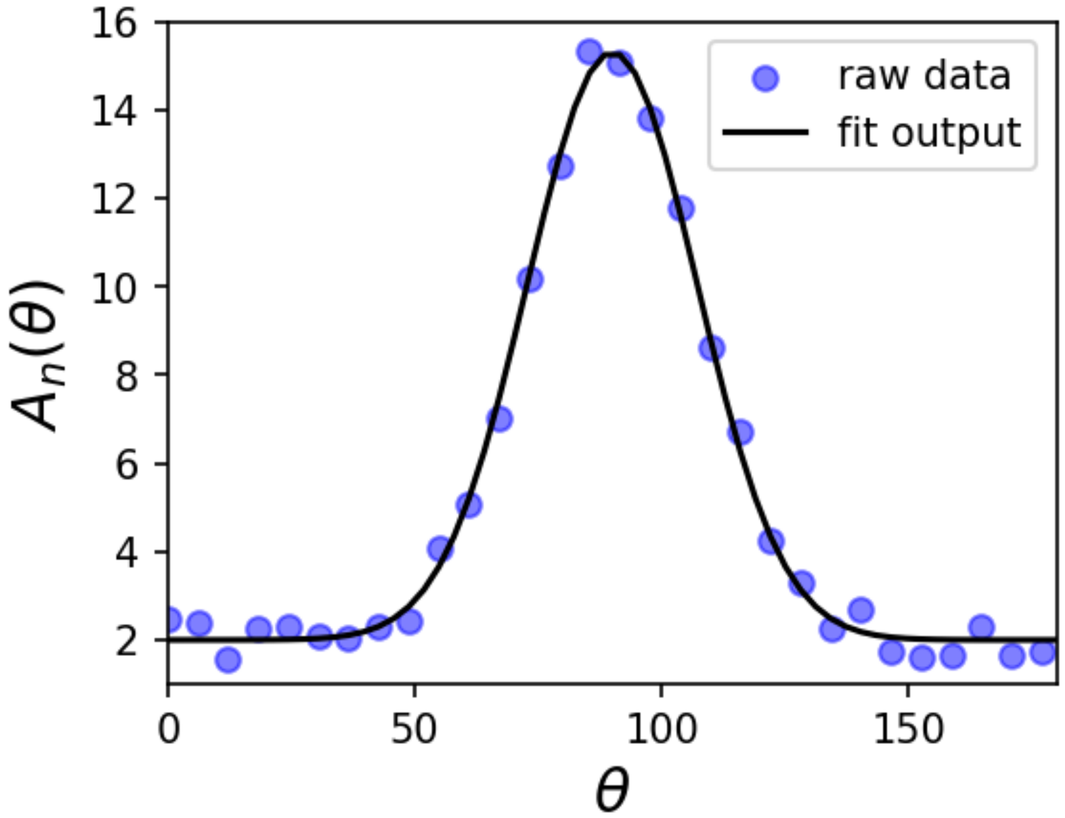


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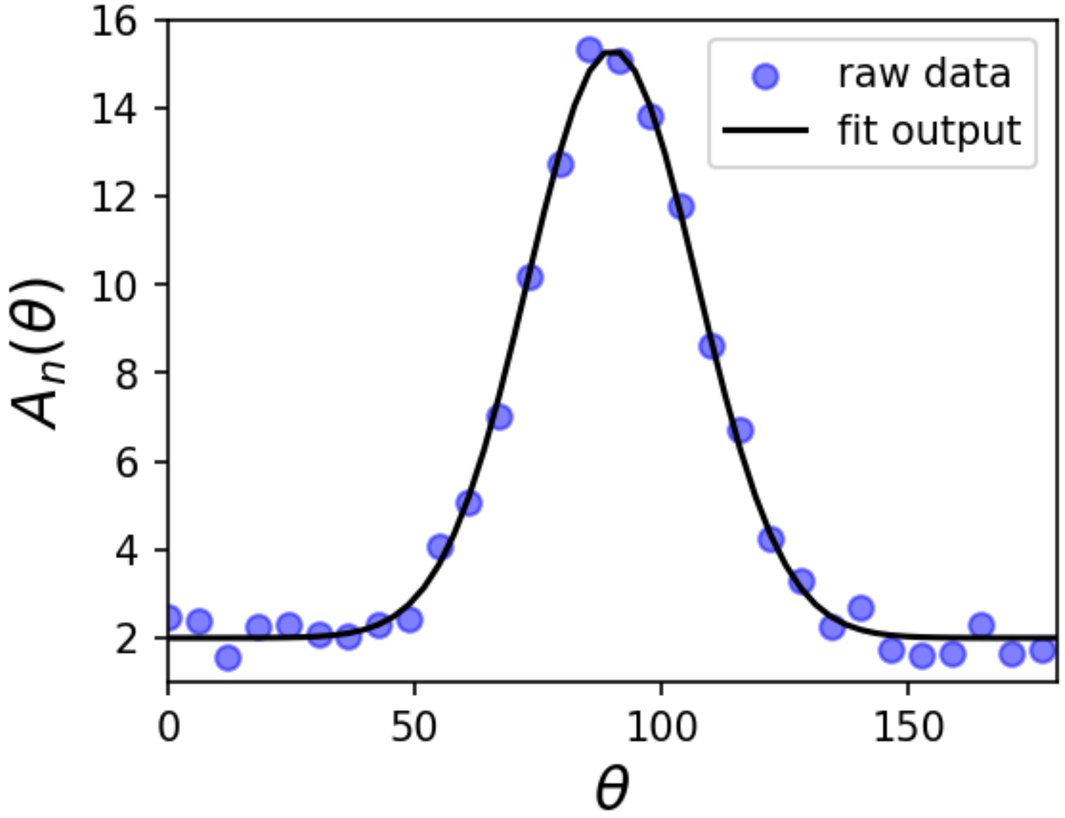

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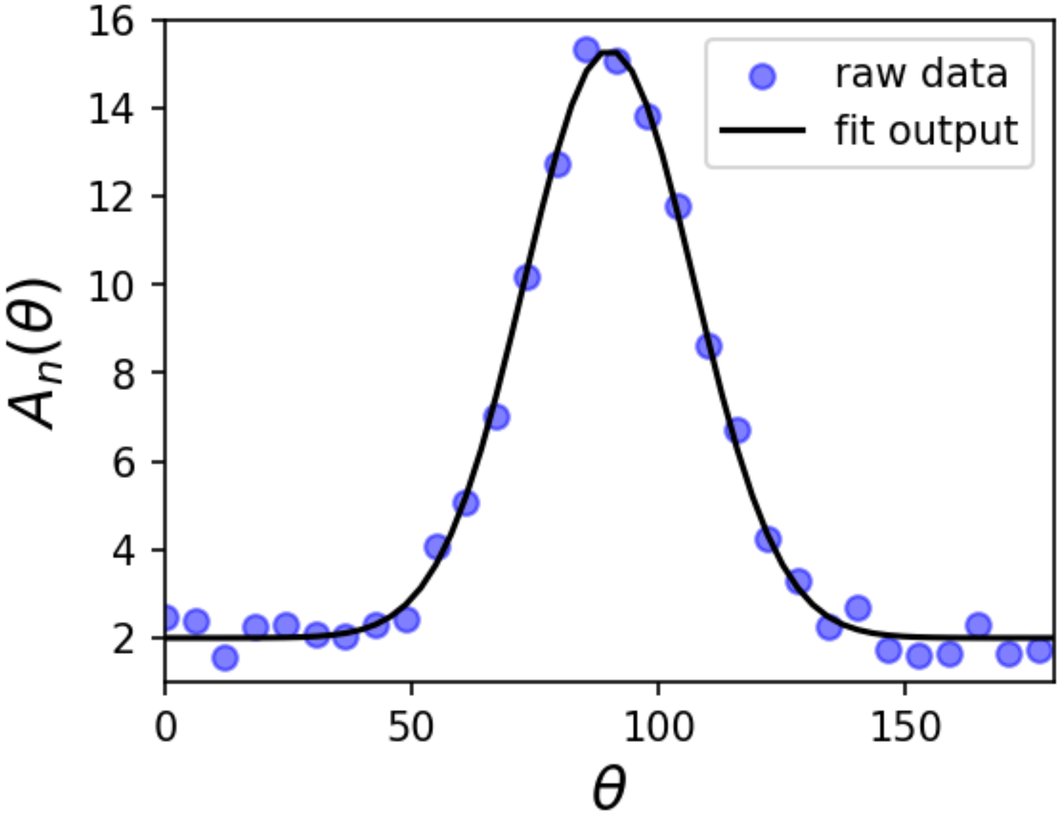
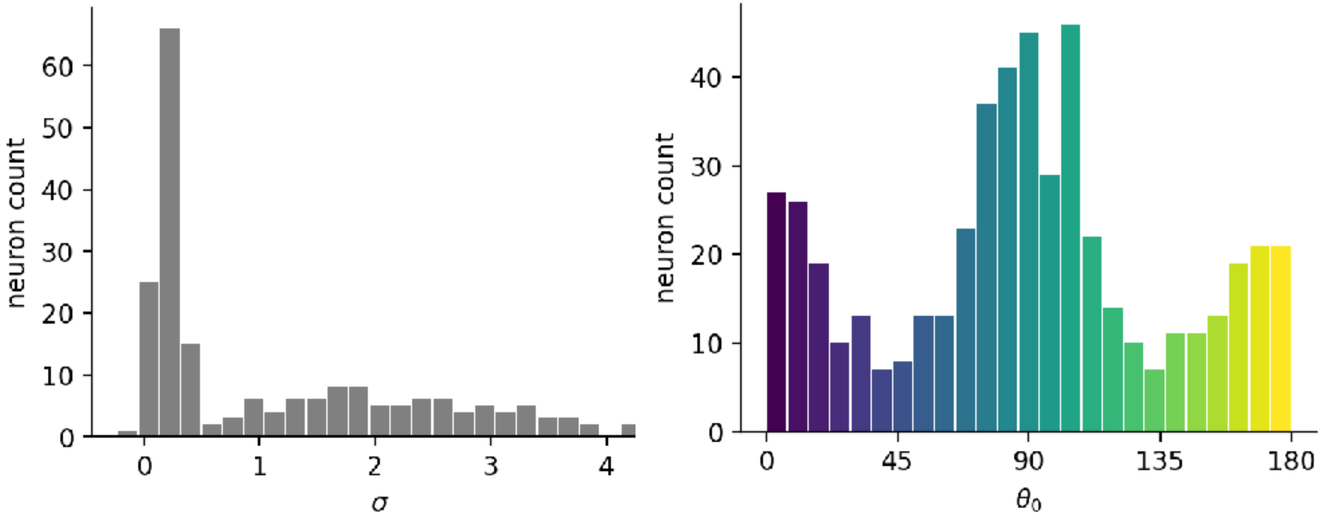


Parameter extraction



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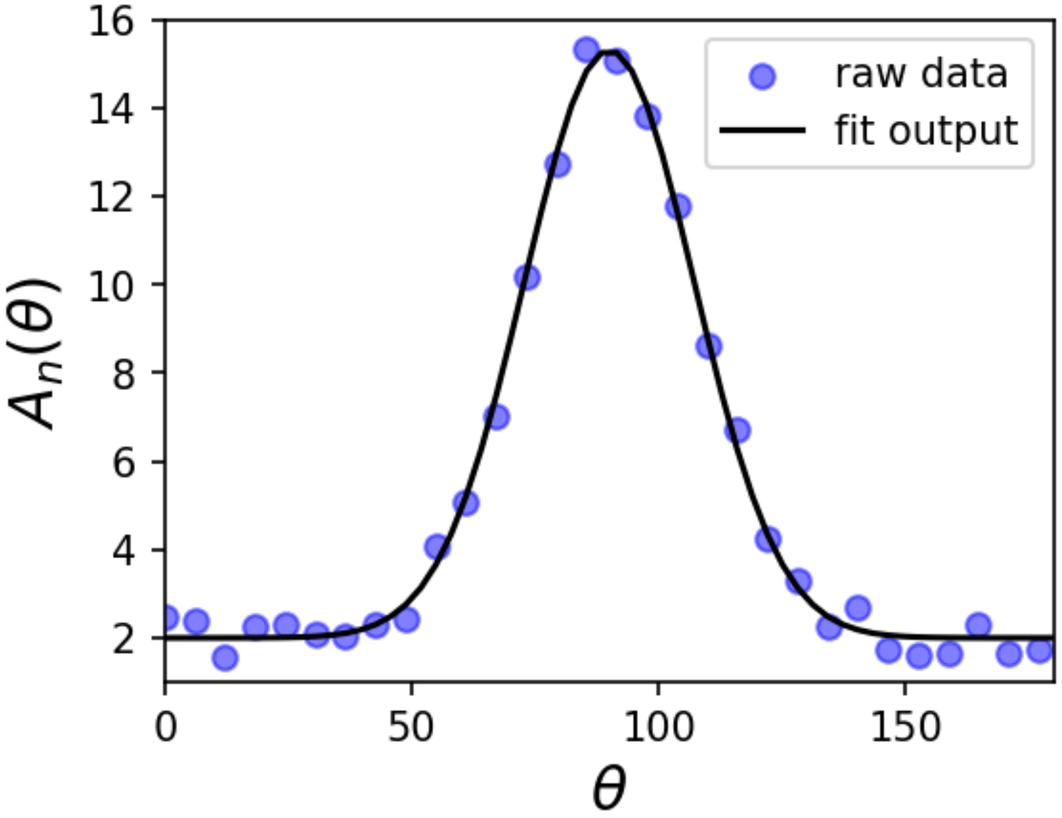

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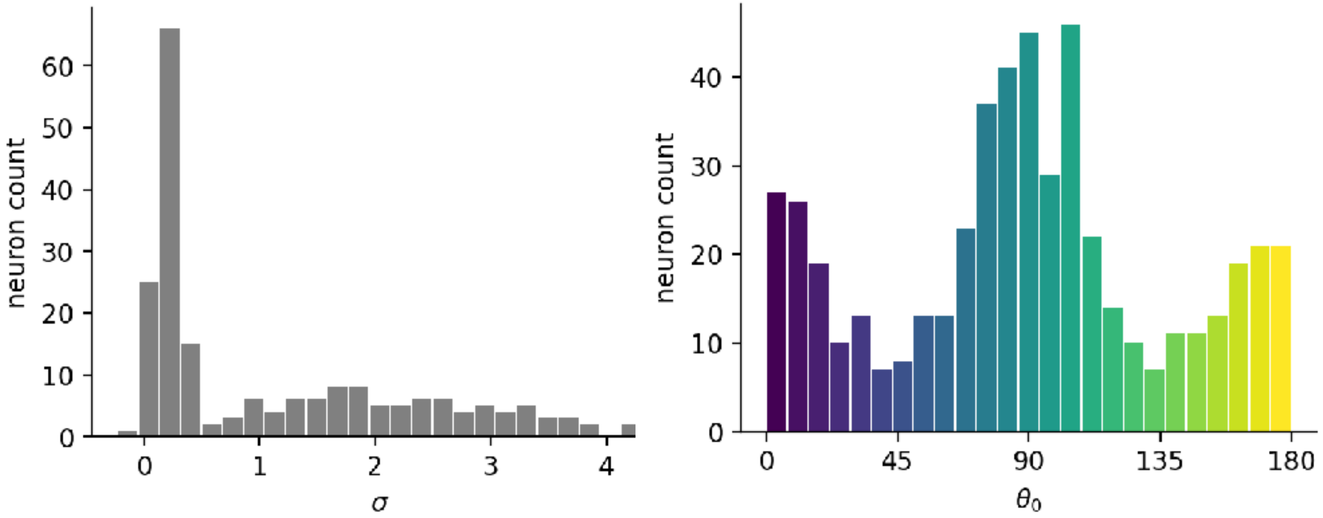

- Simplify the analysis of neuronal properties
- Compare neuronal populations (V1 vs V2)
- Identify the best tuning model (Gaussian…)

3. Few examples

Also largely used in public research :

Classification for decoding

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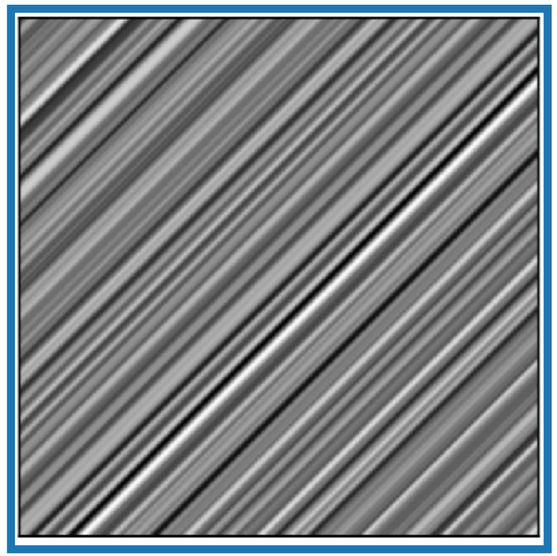

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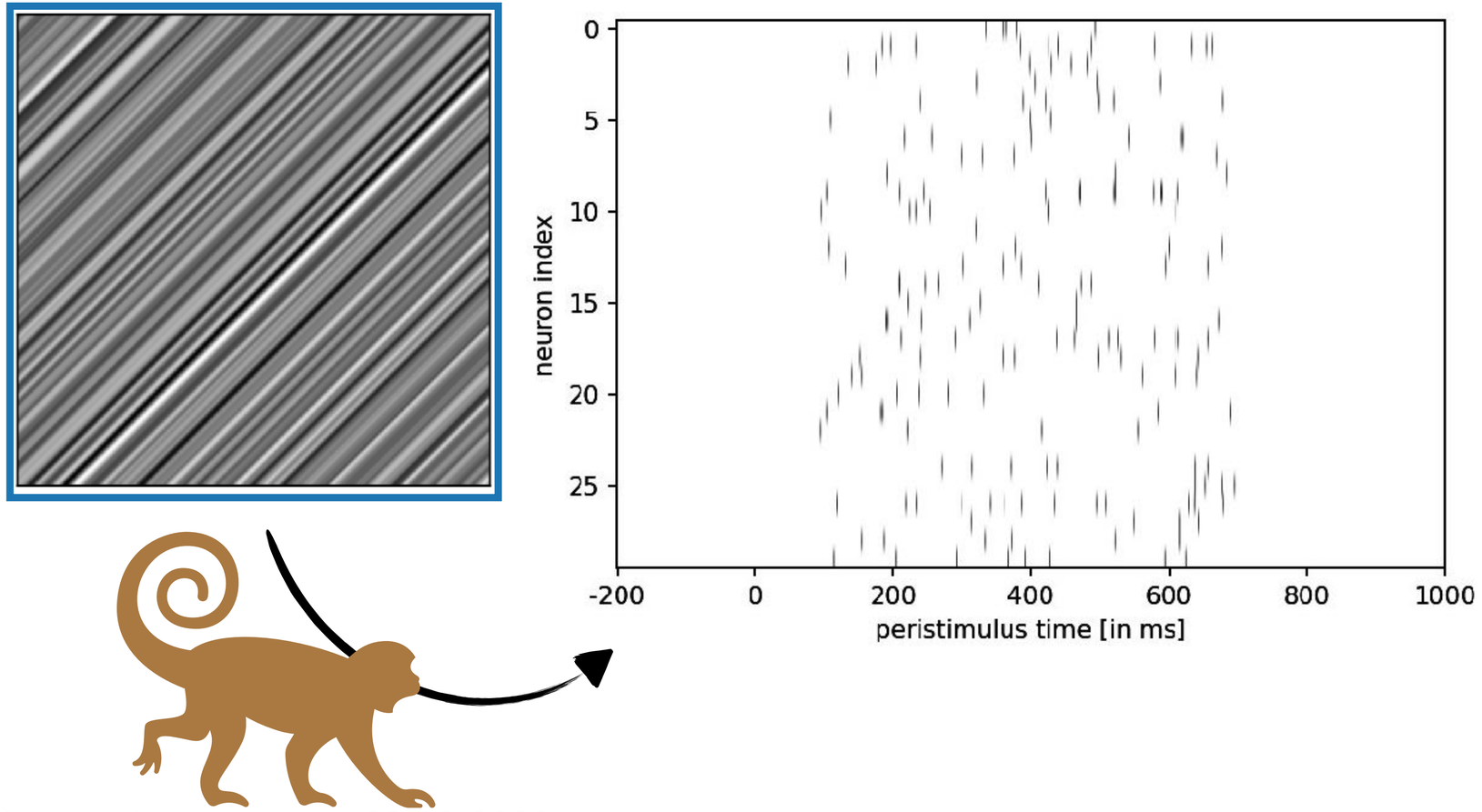

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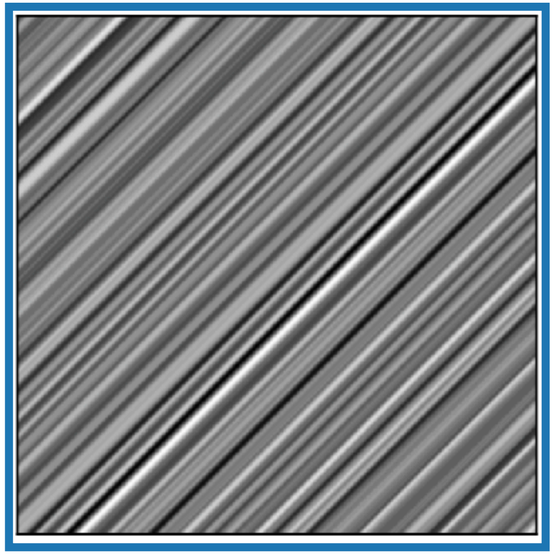

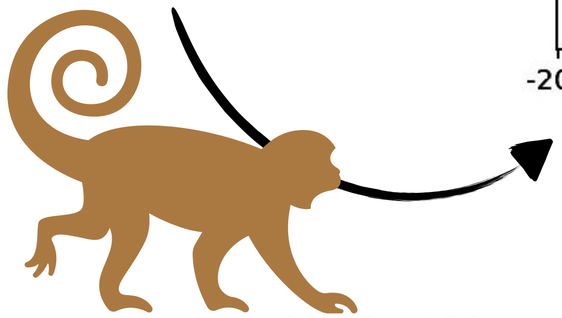

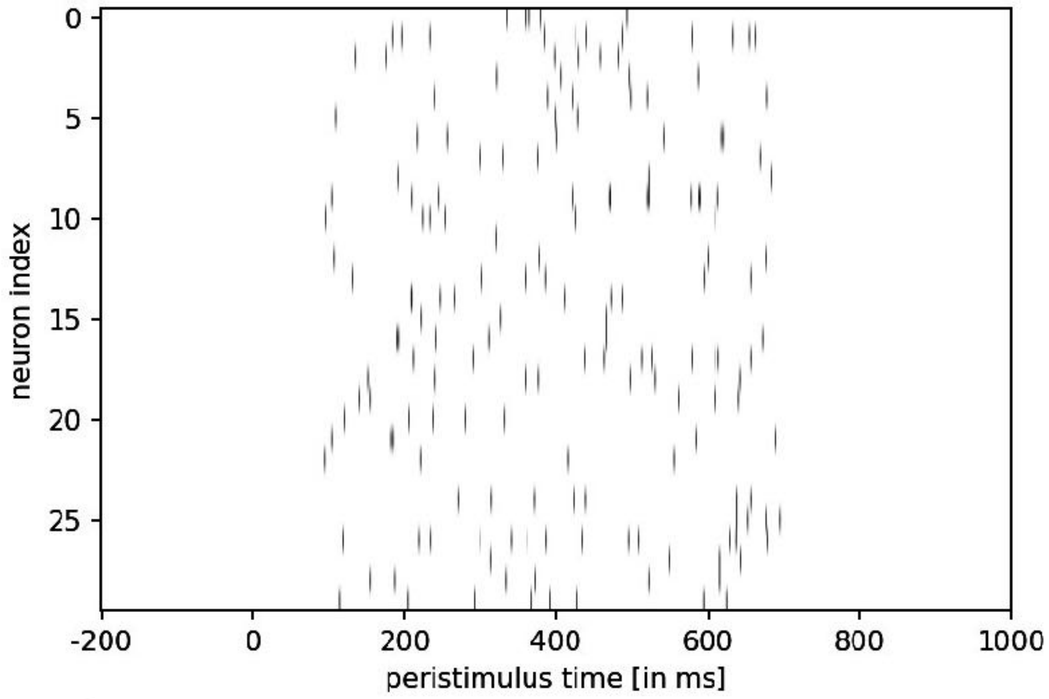

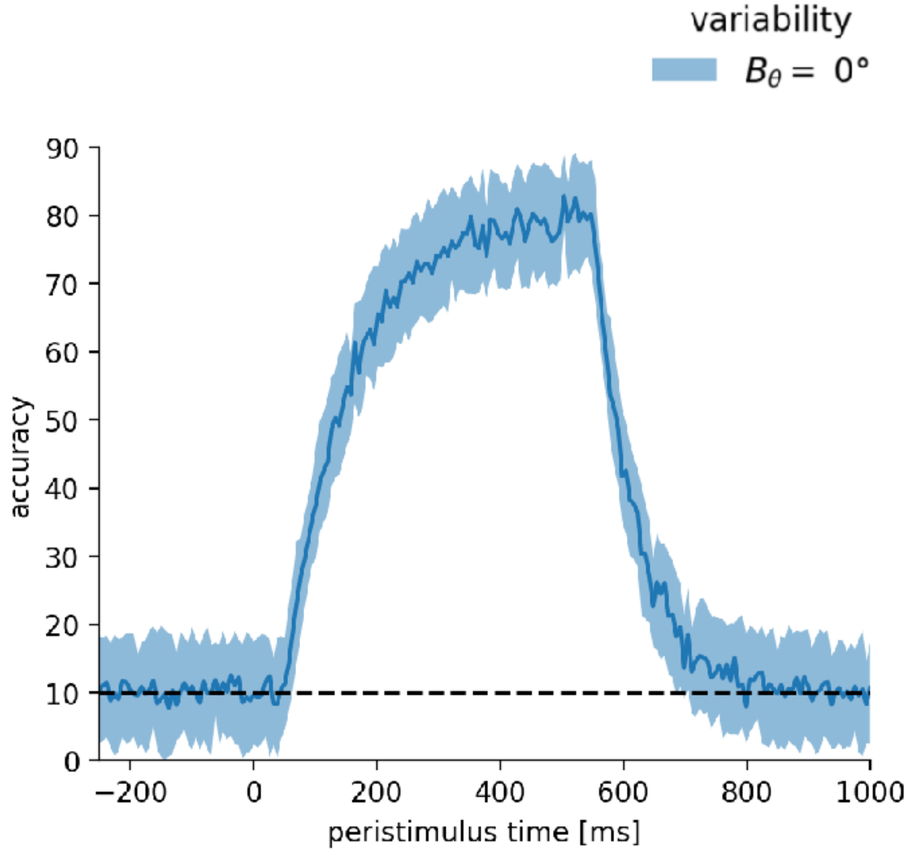

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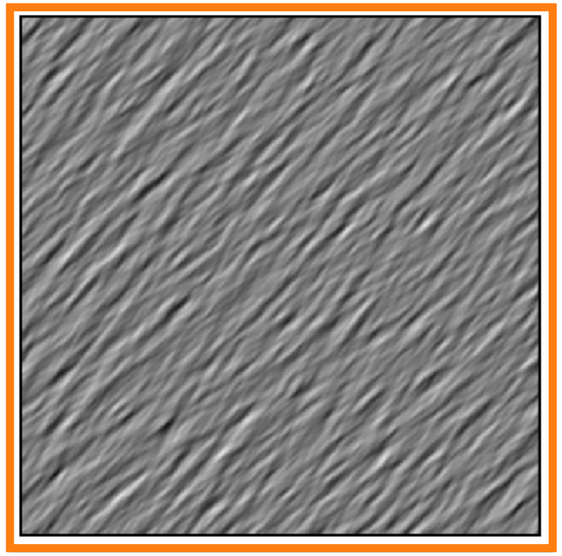

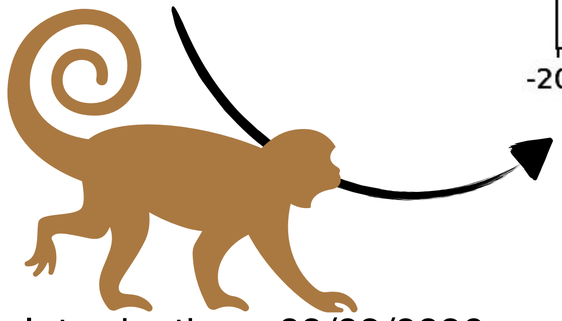

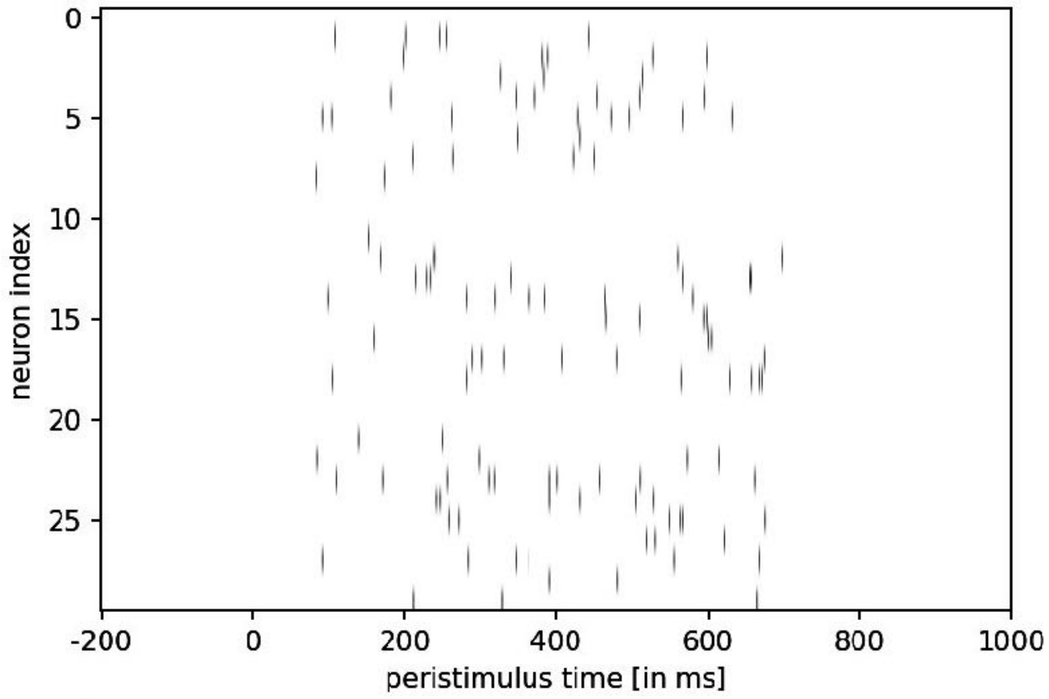

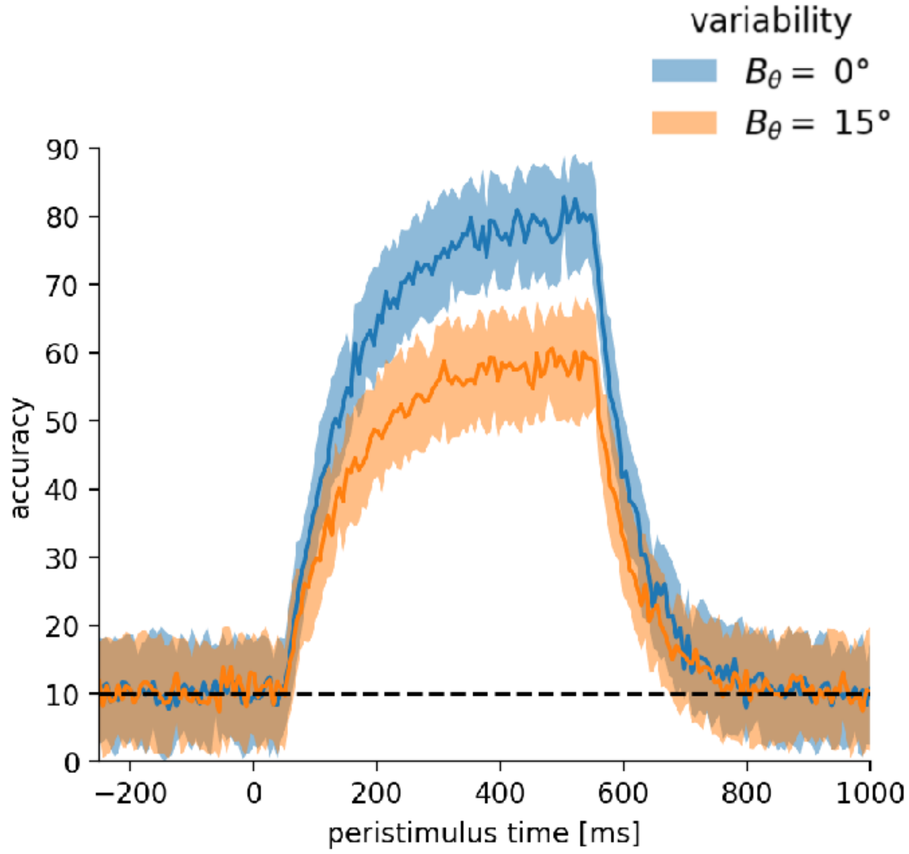

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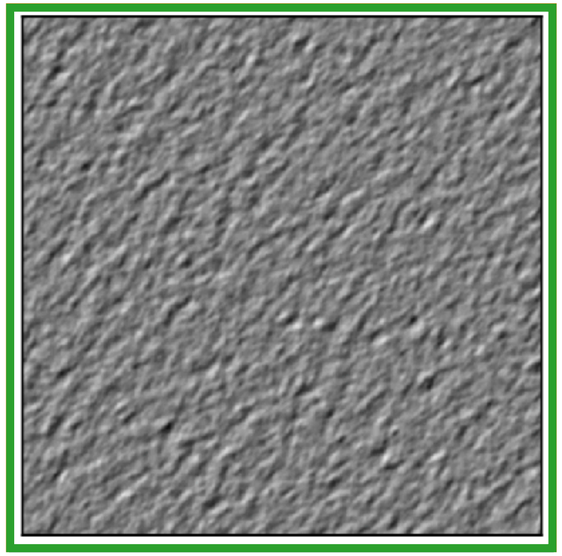

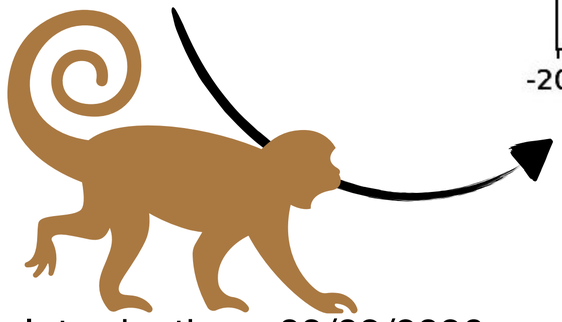

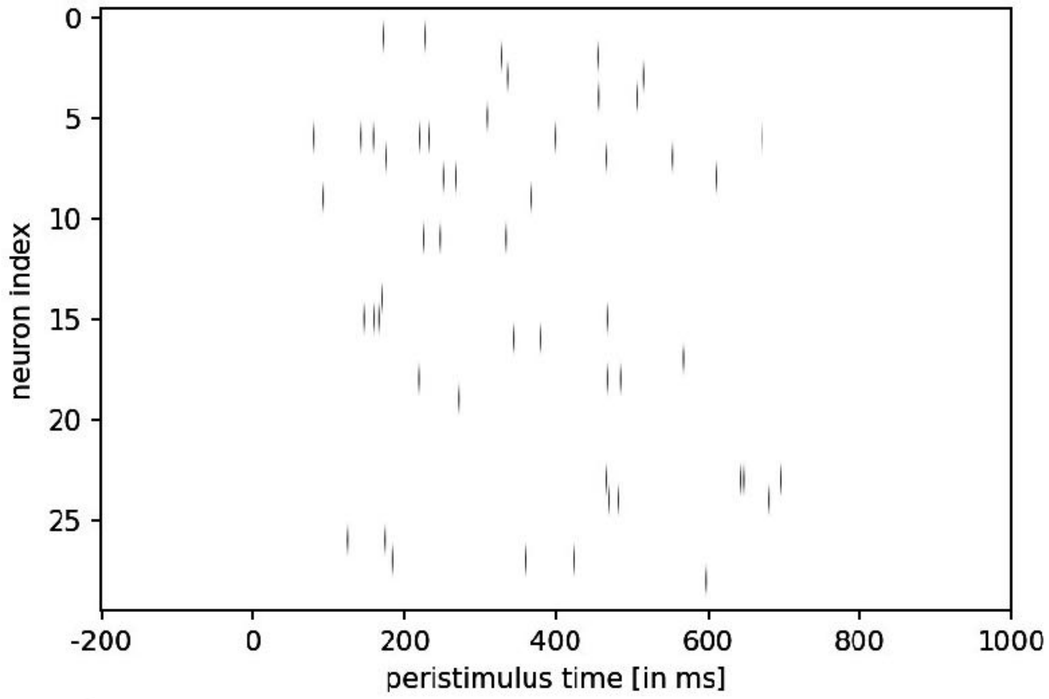

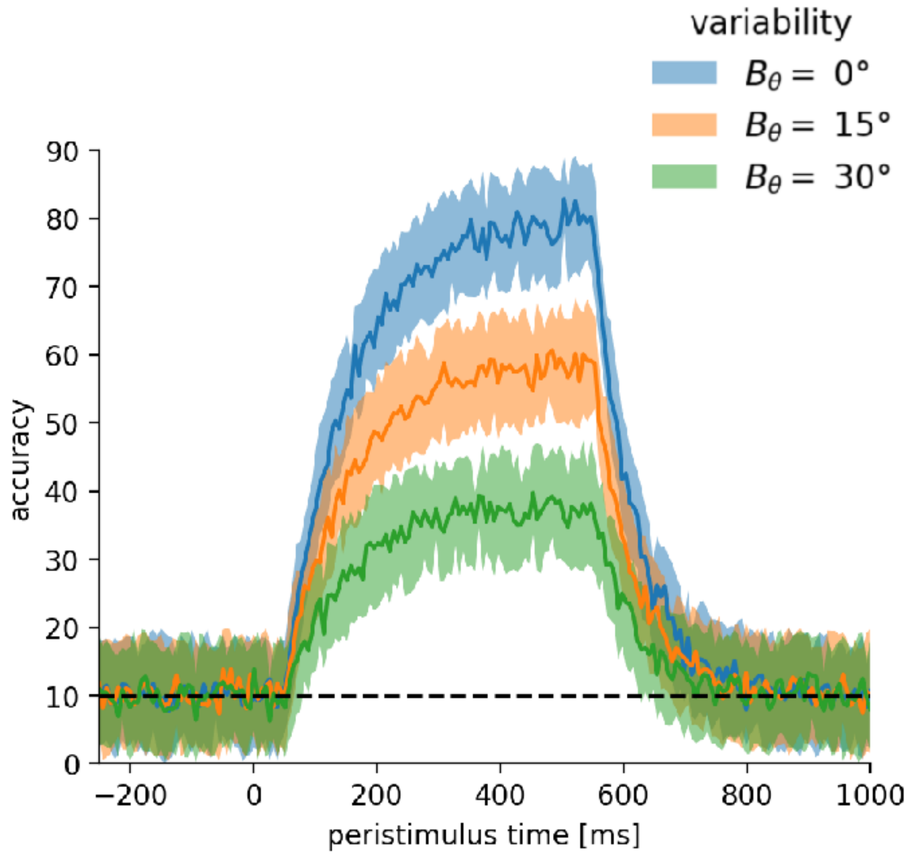

3. Few examples

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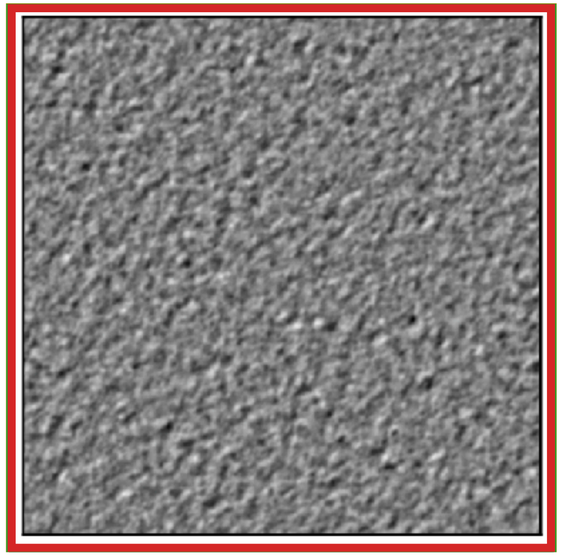
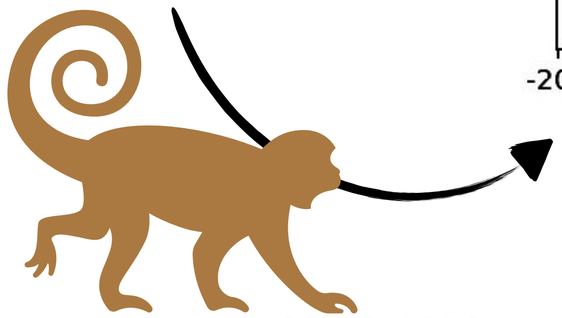
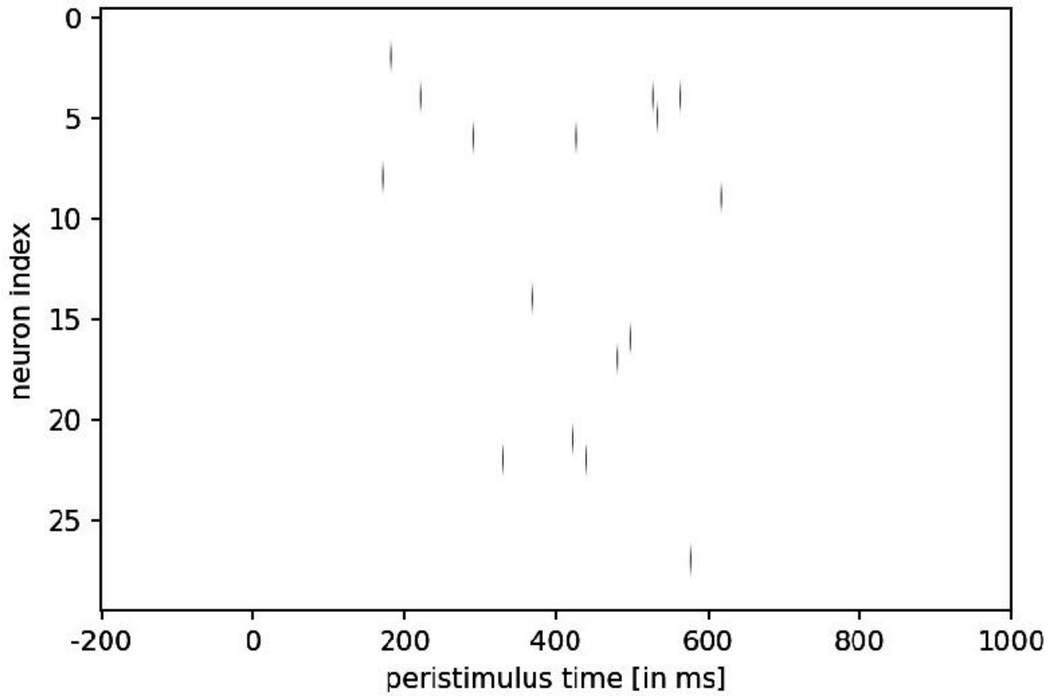
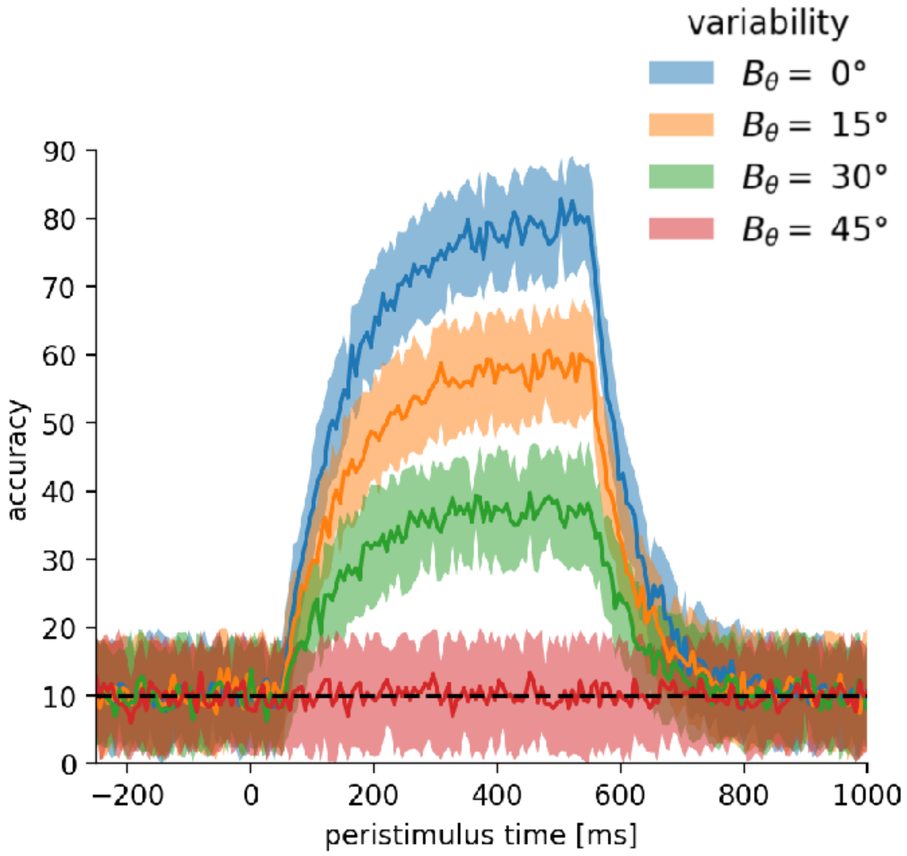
Classification for decoding







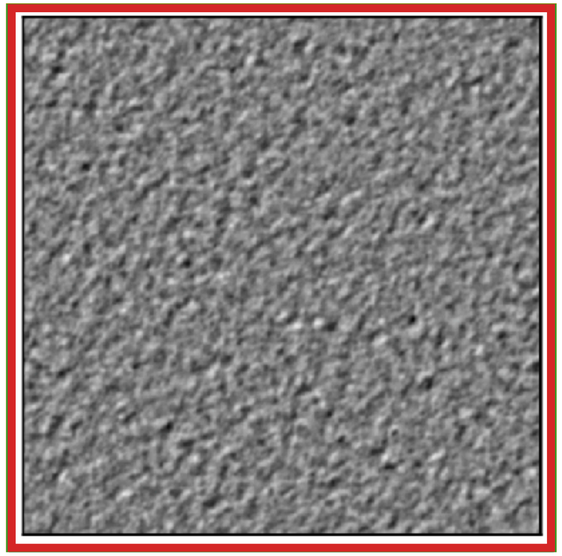


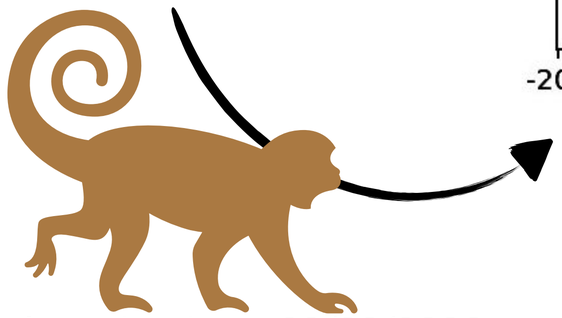
3. Few examples

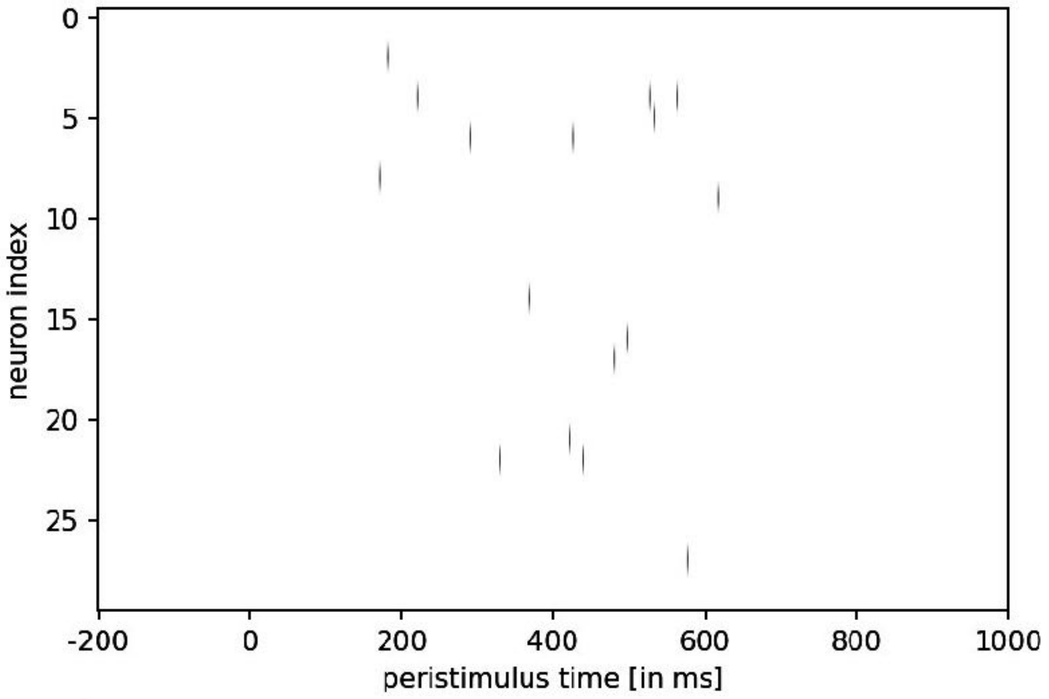
Also largely used in public research :

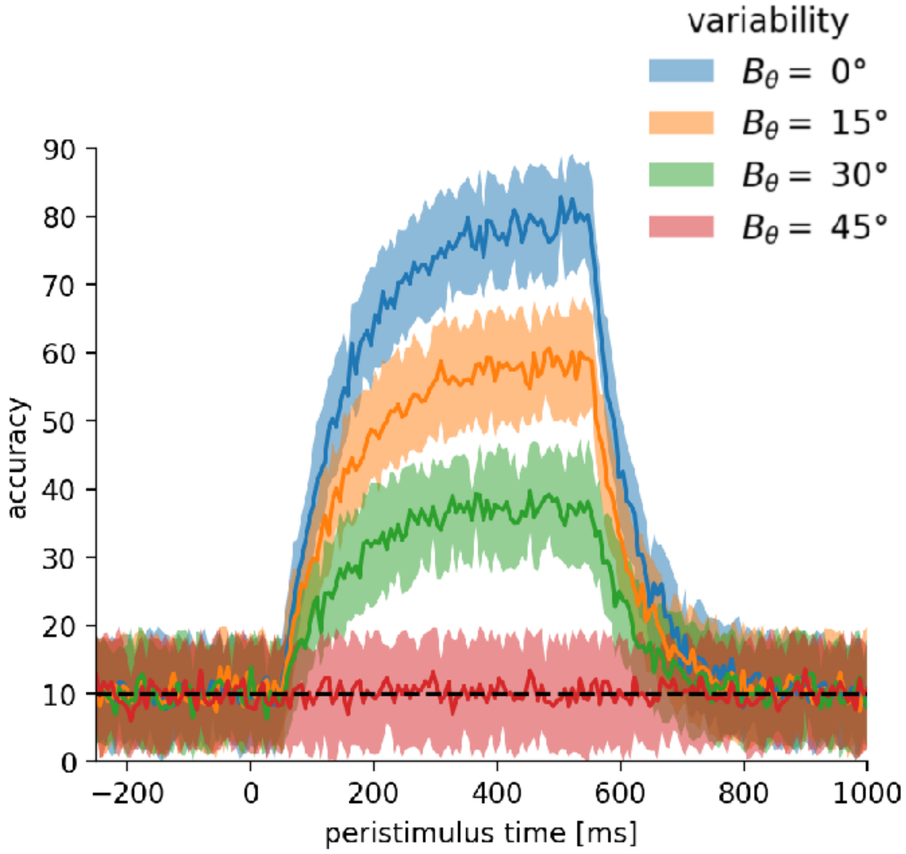
- Predict stimulus from neuronal activity
- Study how information is modulated
- Data-driven approach

Classification for decoding









3. Few examples

Also largely used in public research :

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Also largely used in public research :

Convolutional Neuronal Network

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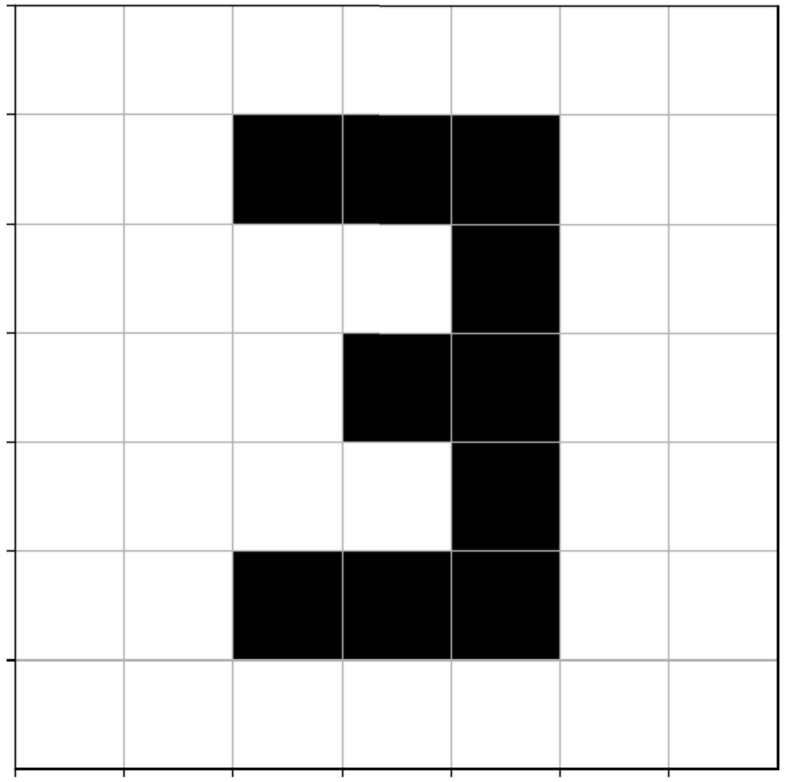
Convolutional Neuronal Network



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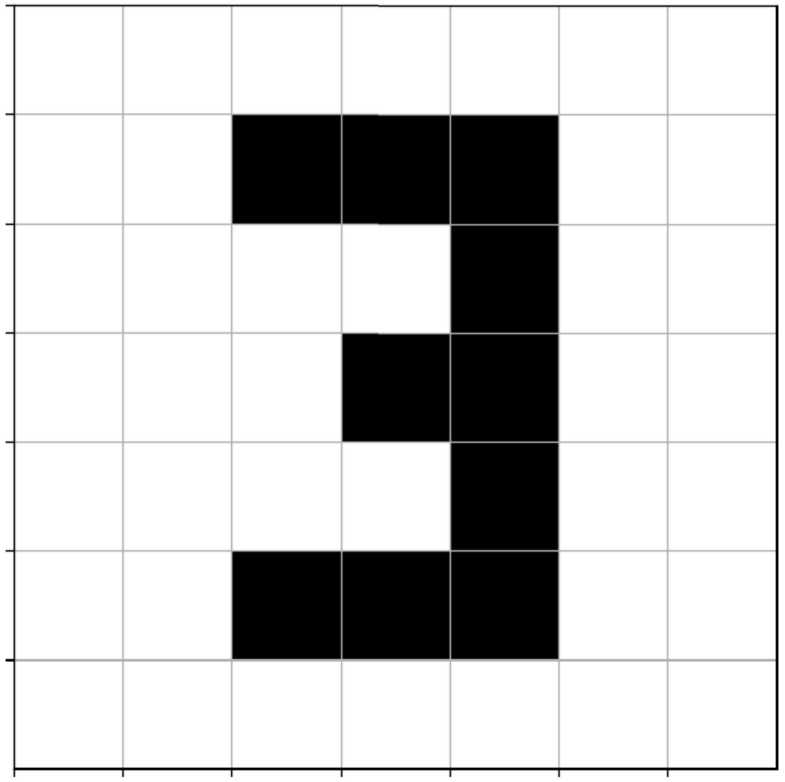

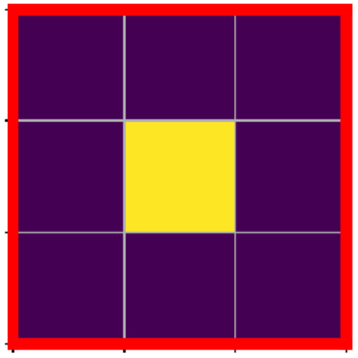

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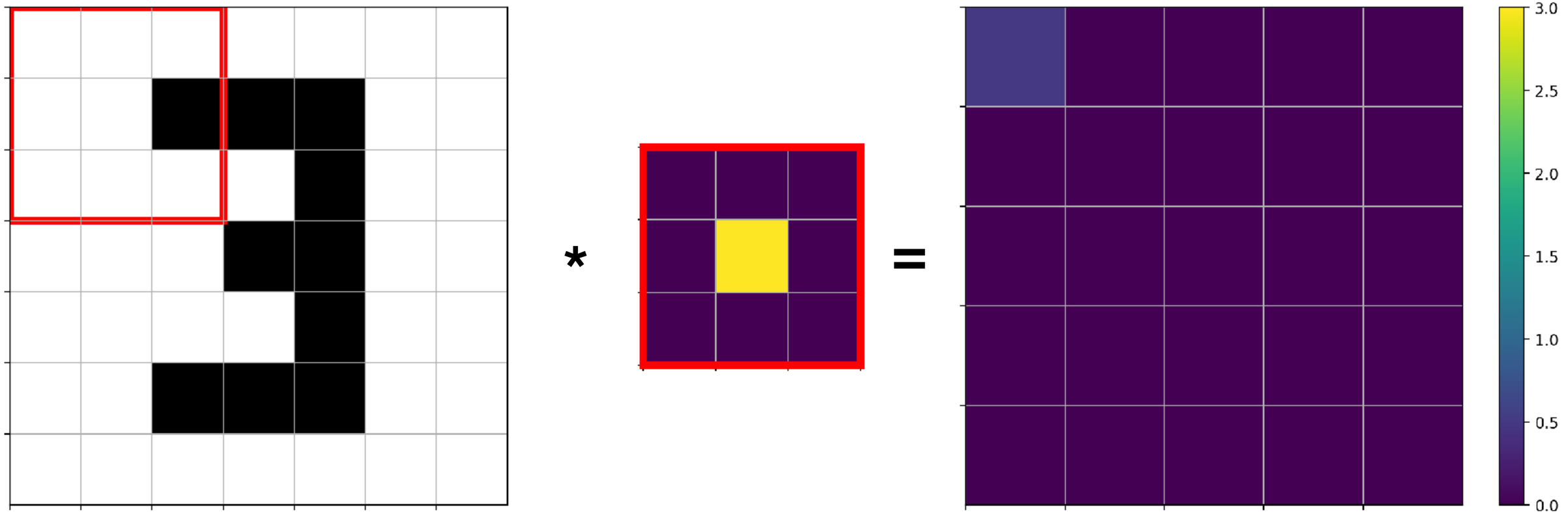

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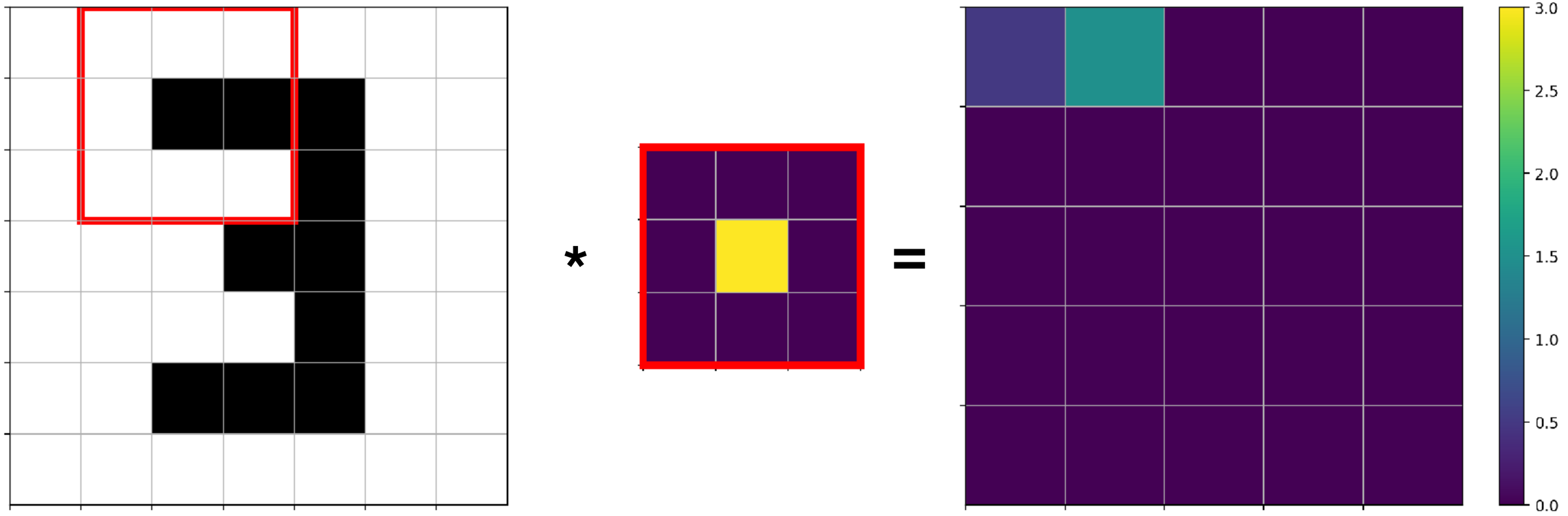

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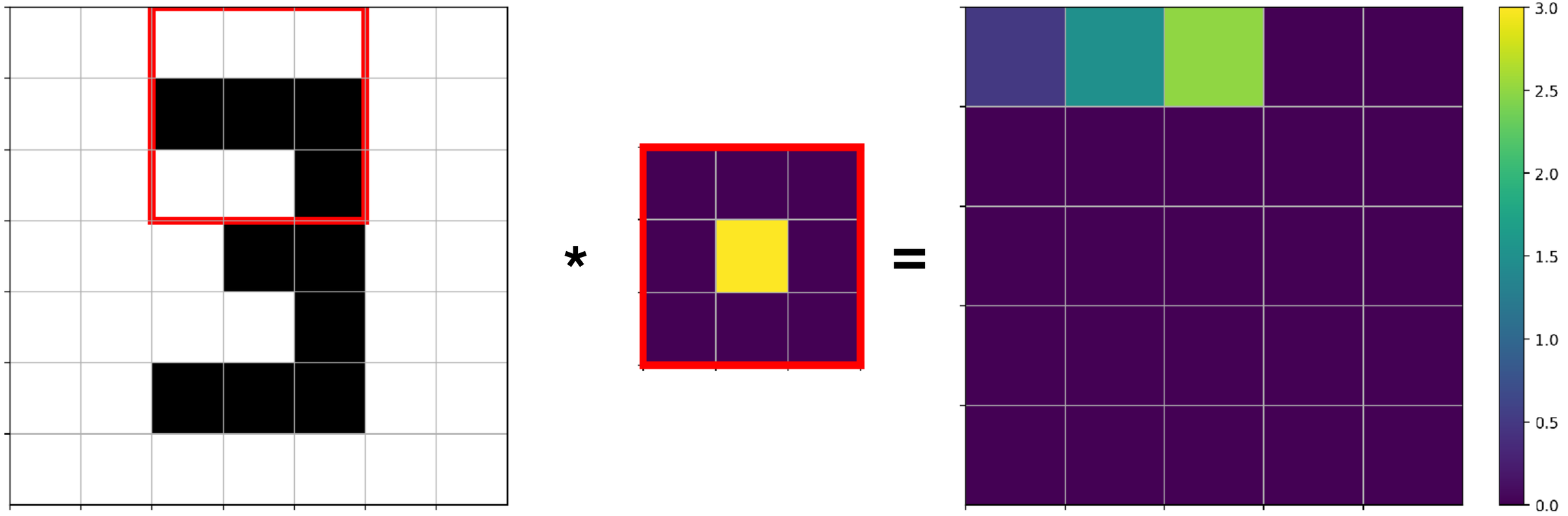

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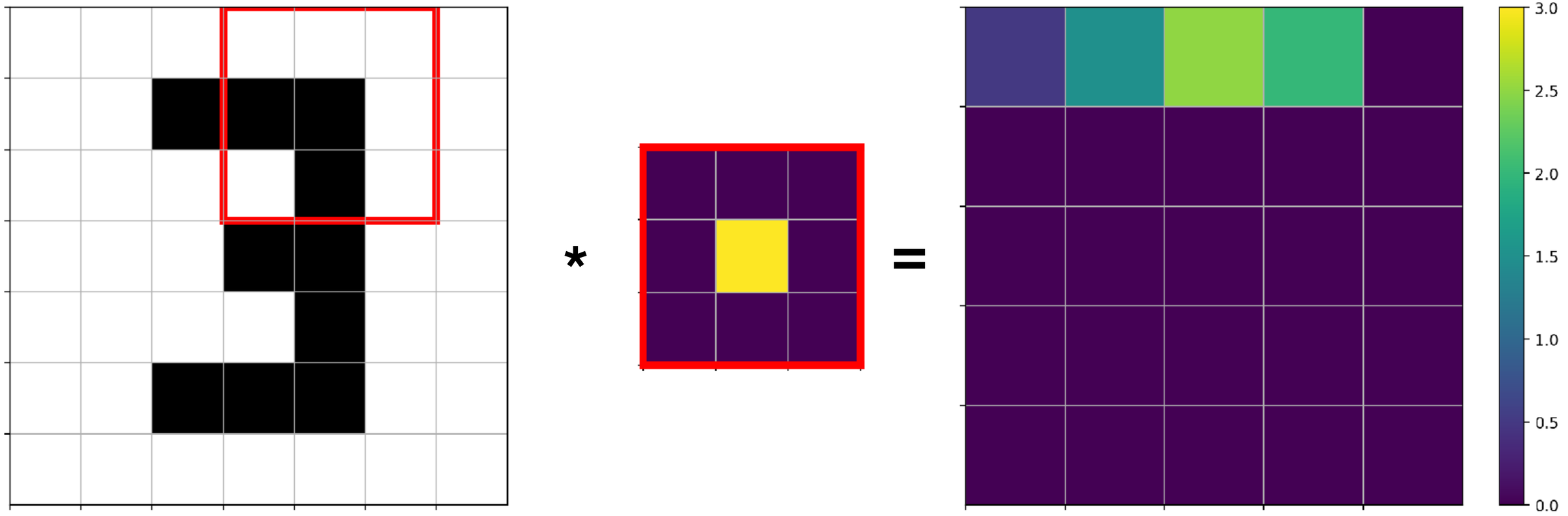

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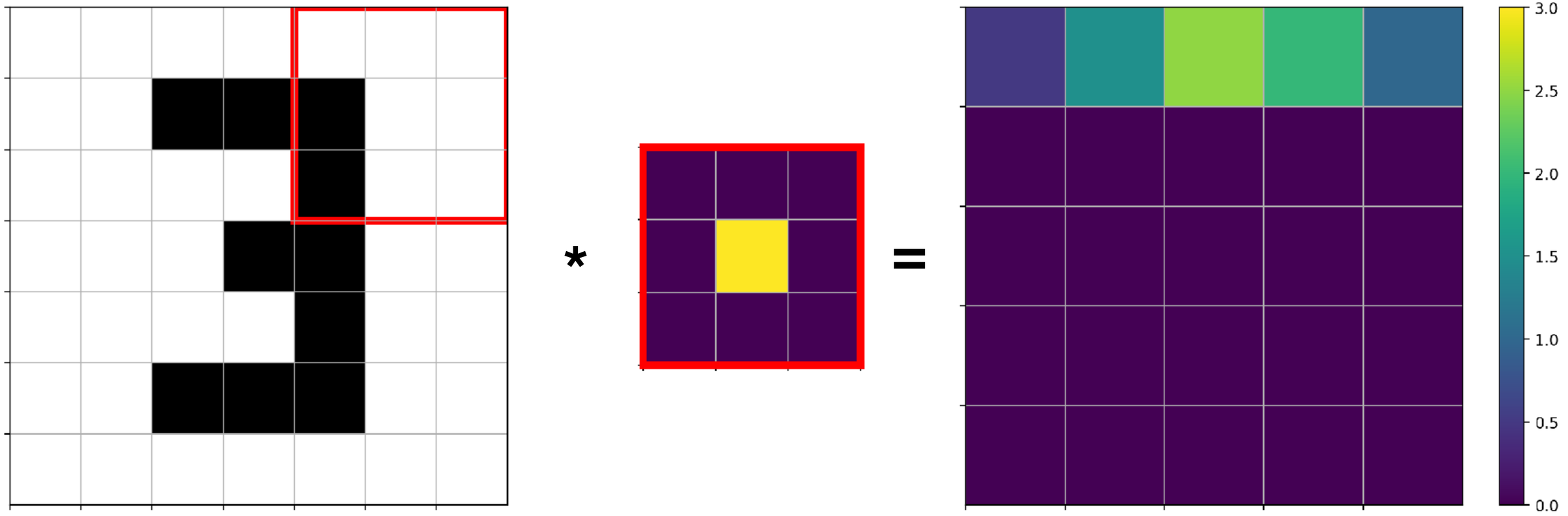

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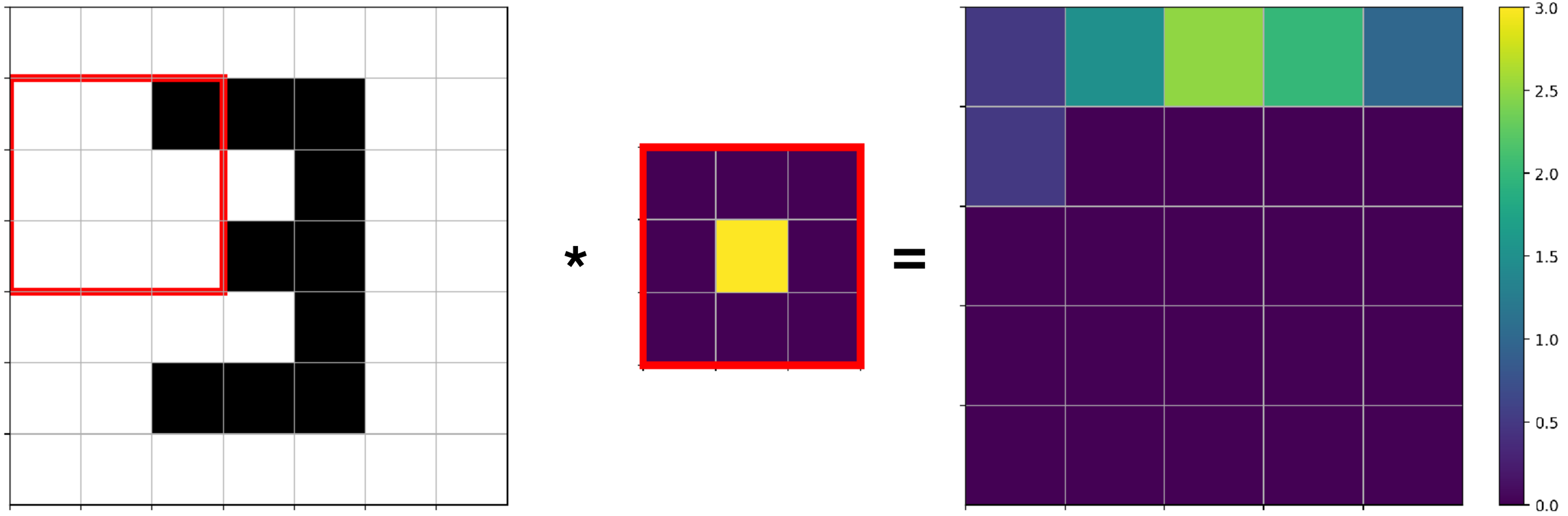

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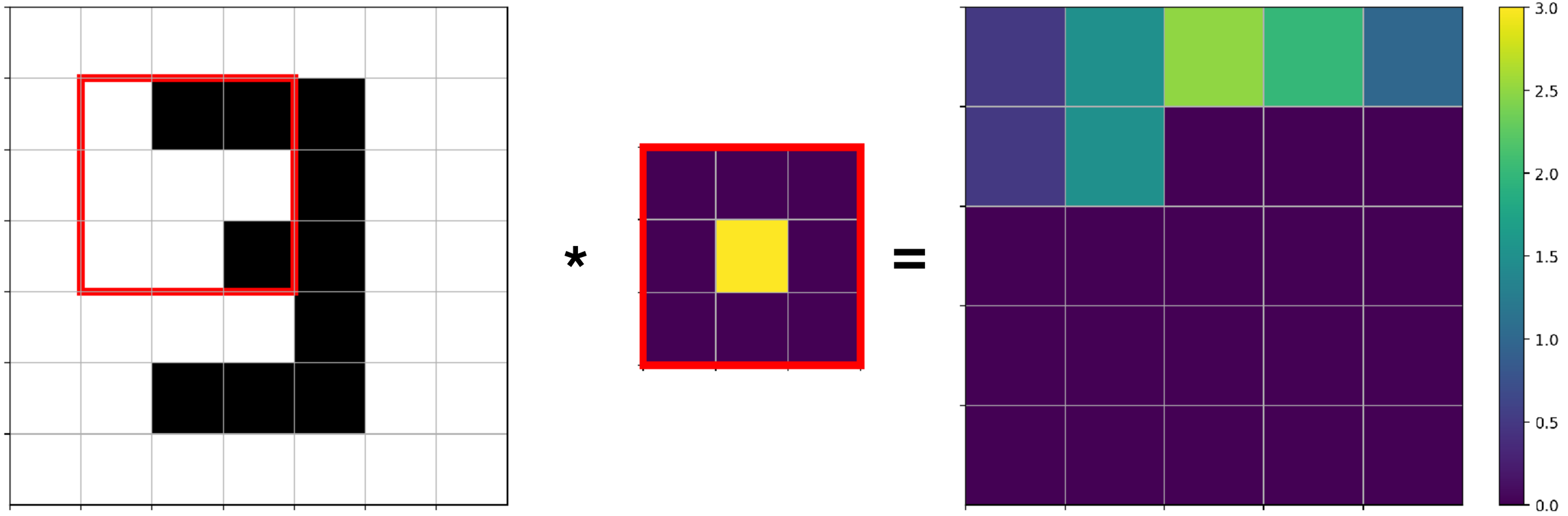

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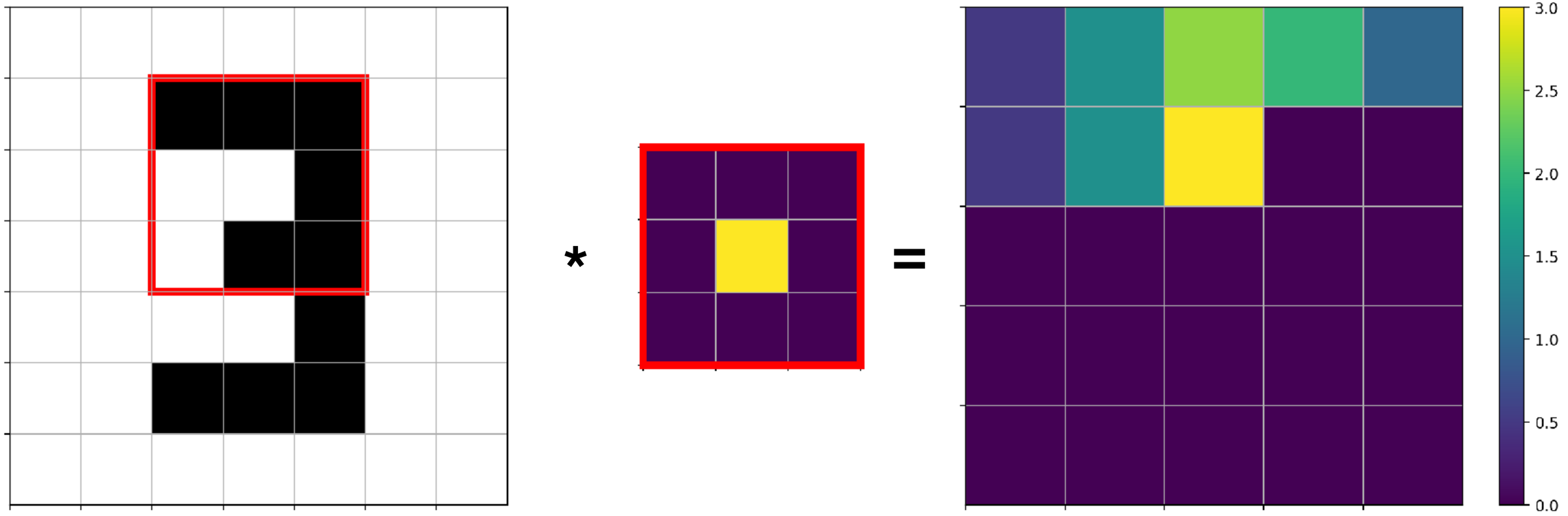

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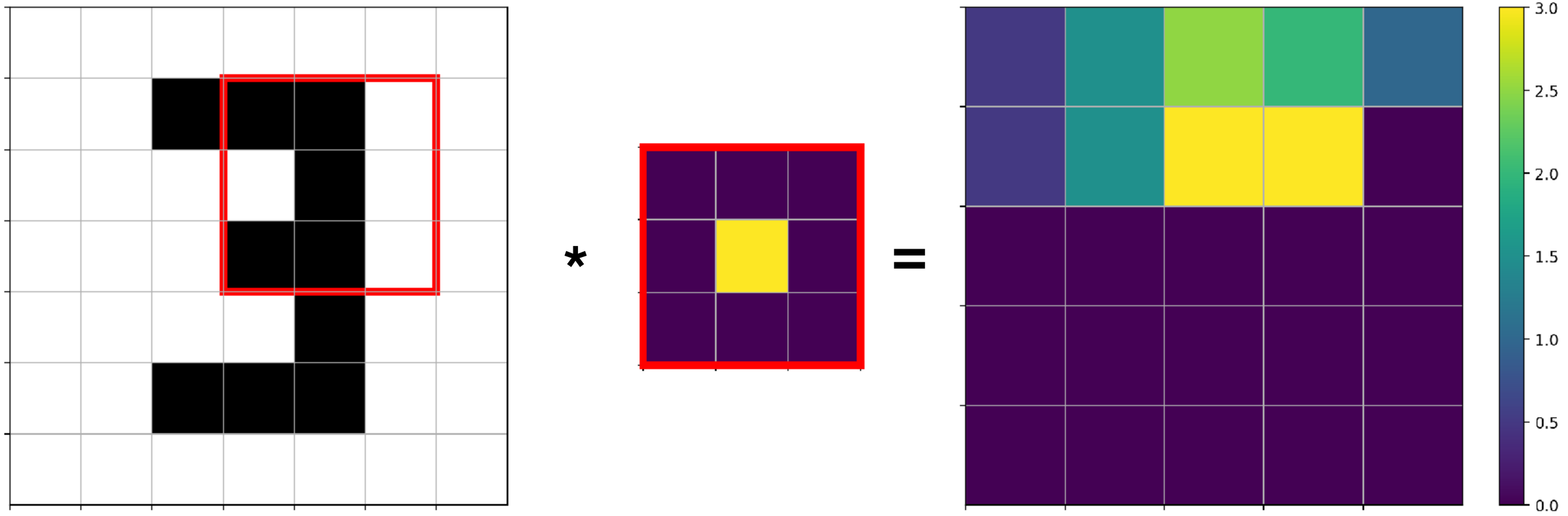

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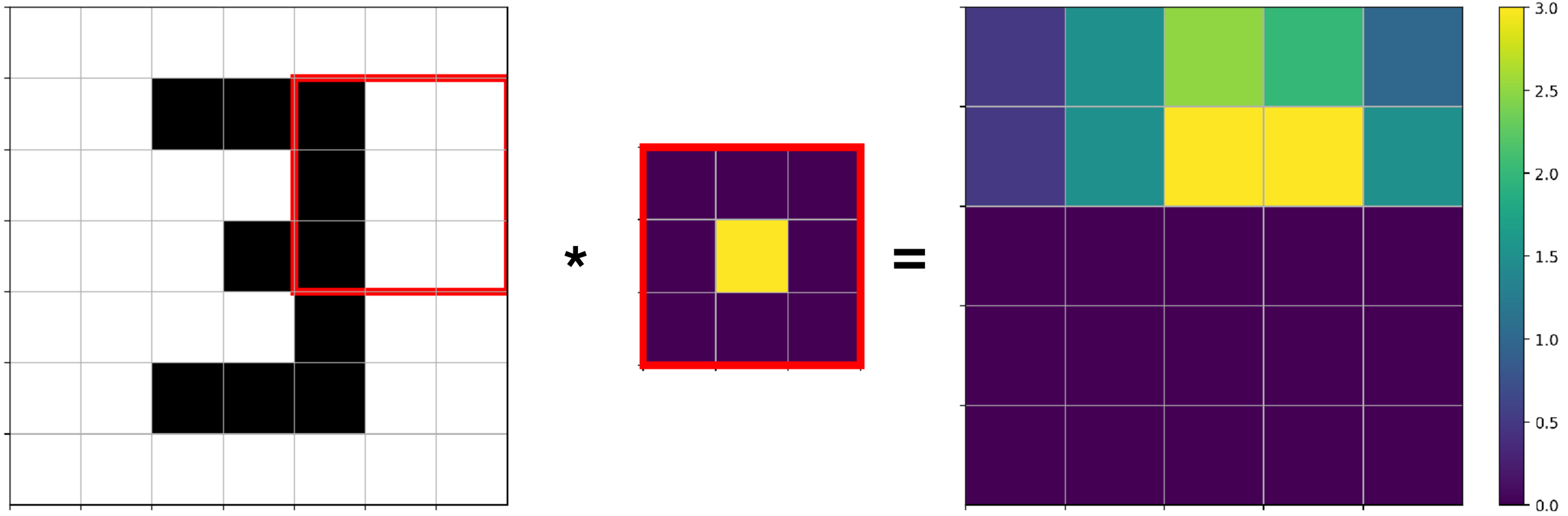

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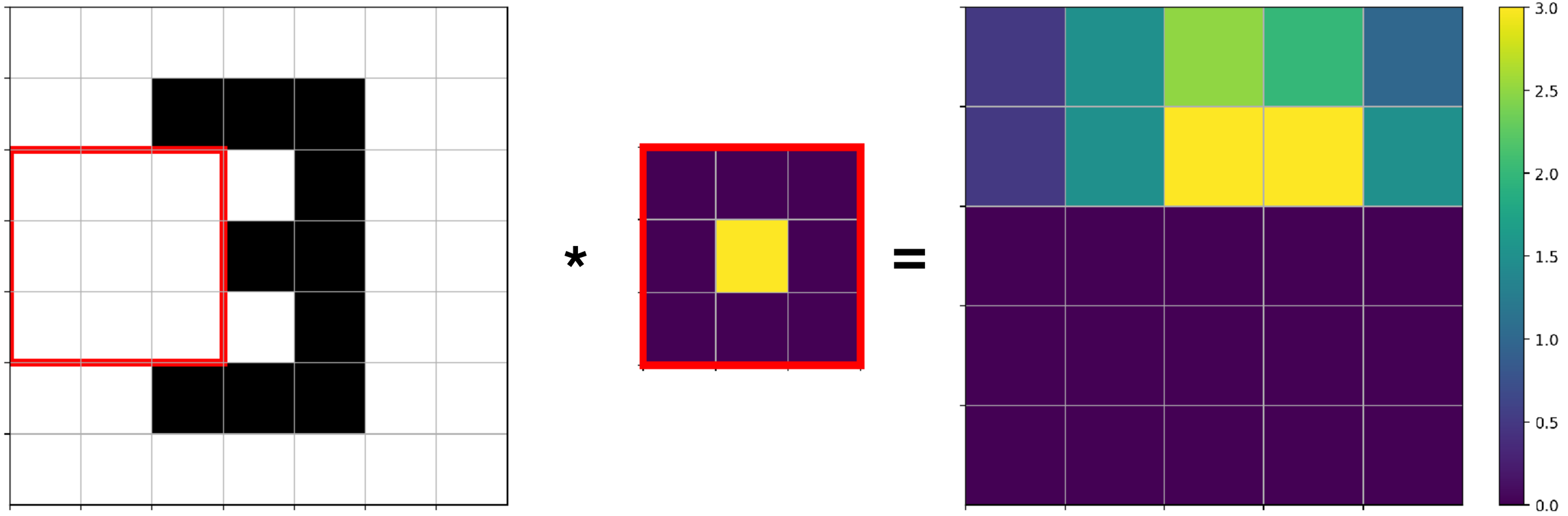

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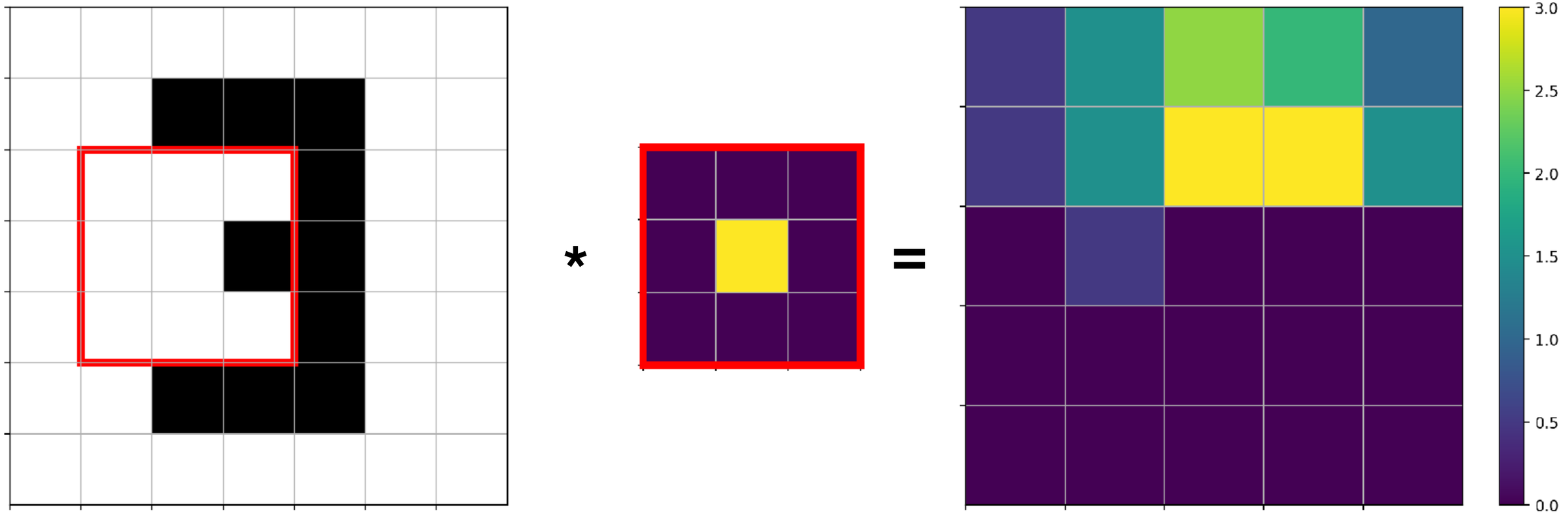

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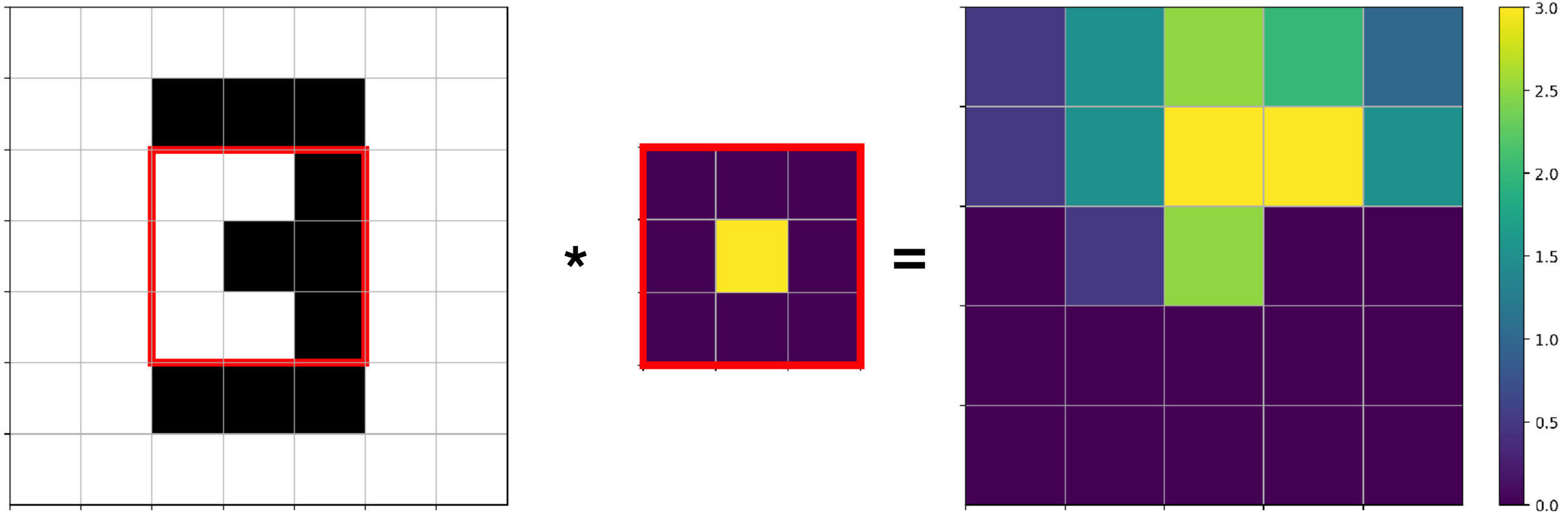

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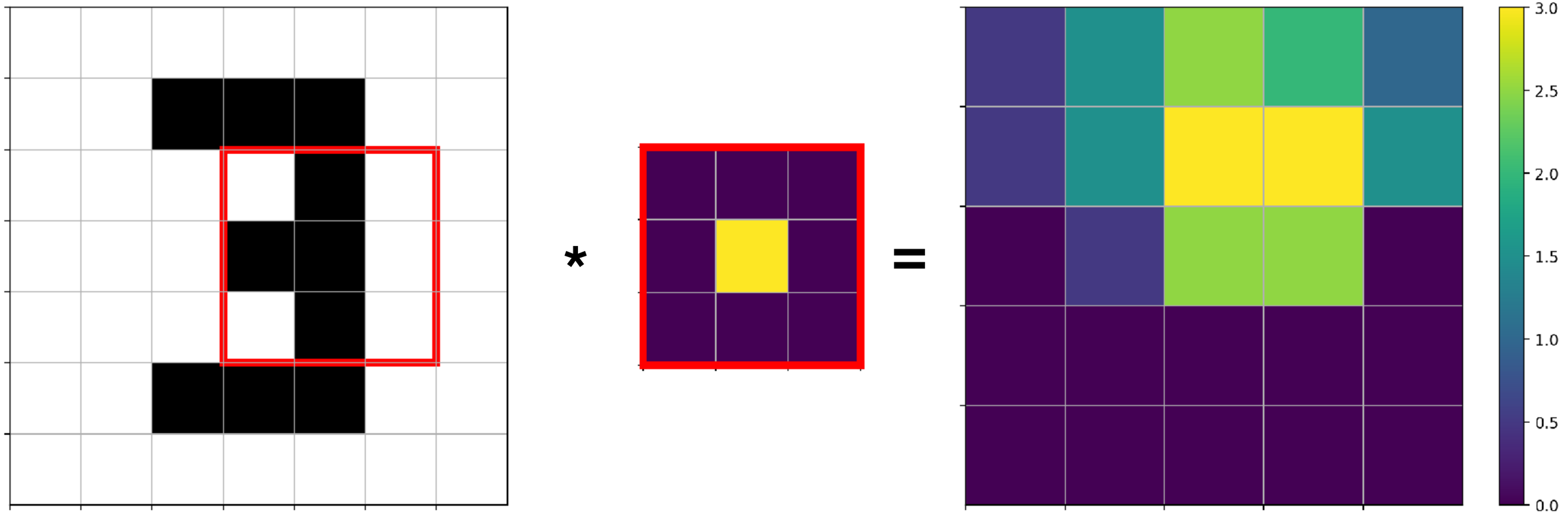

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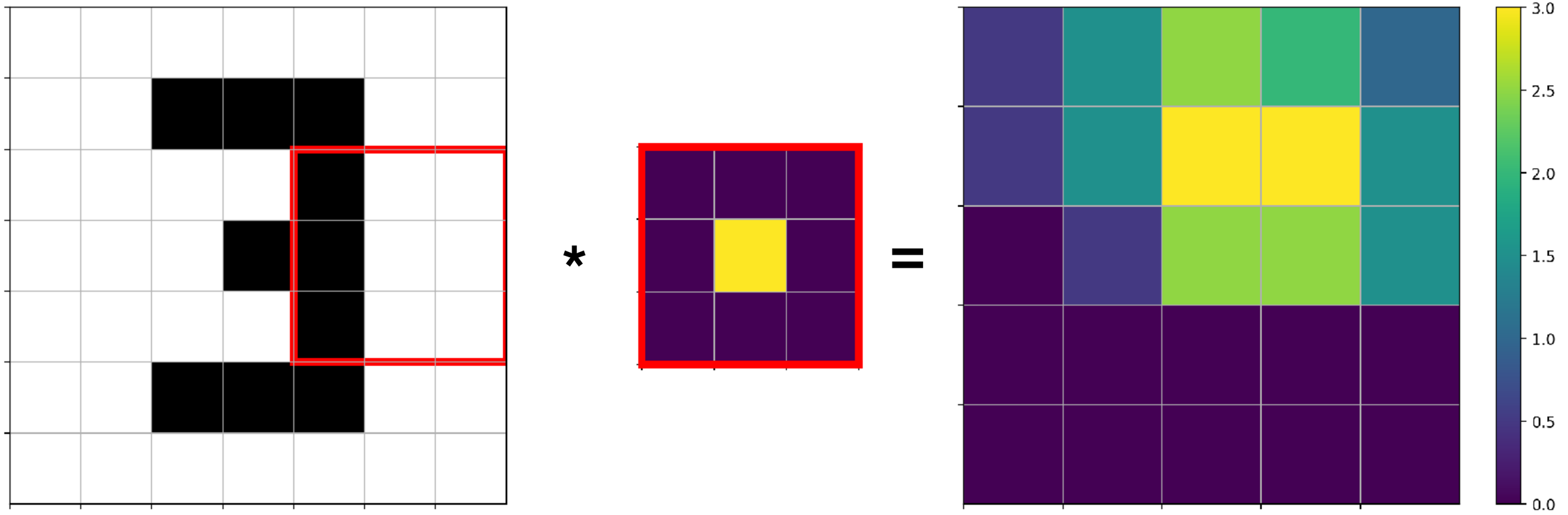

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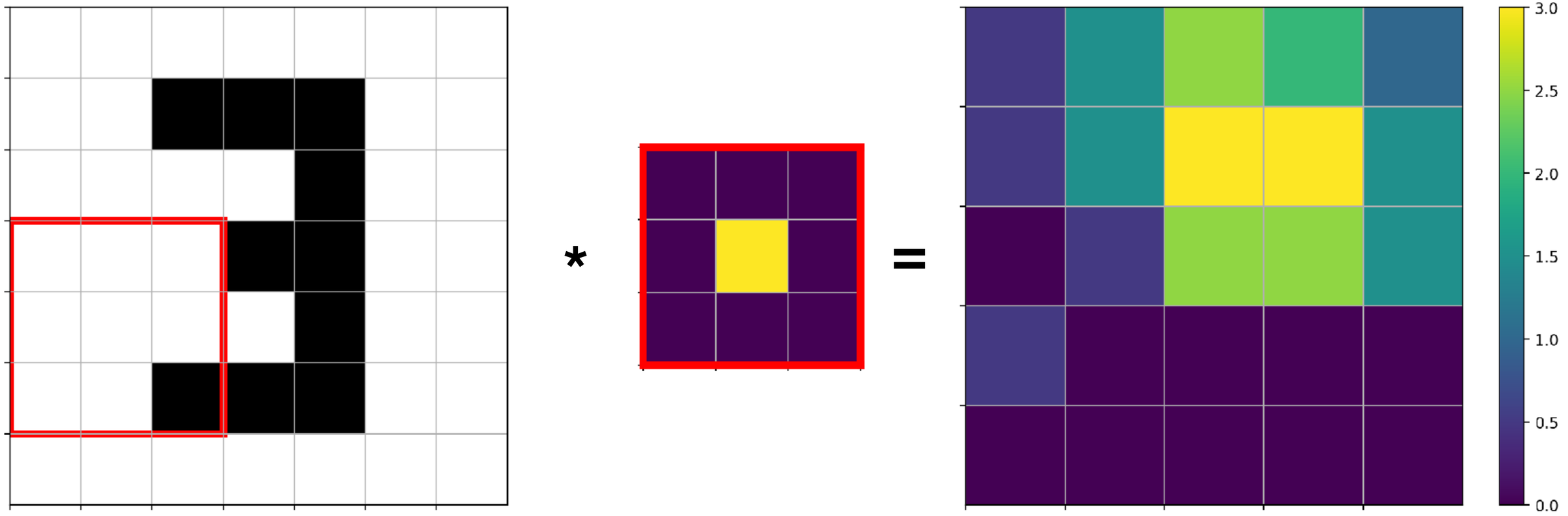

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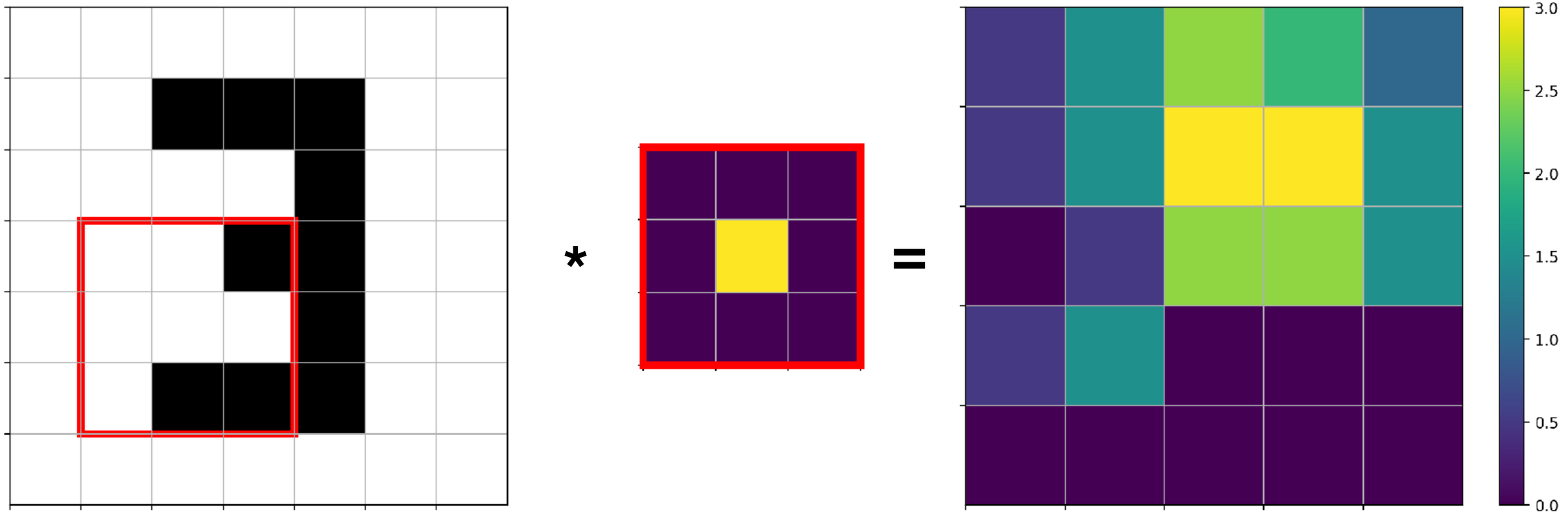

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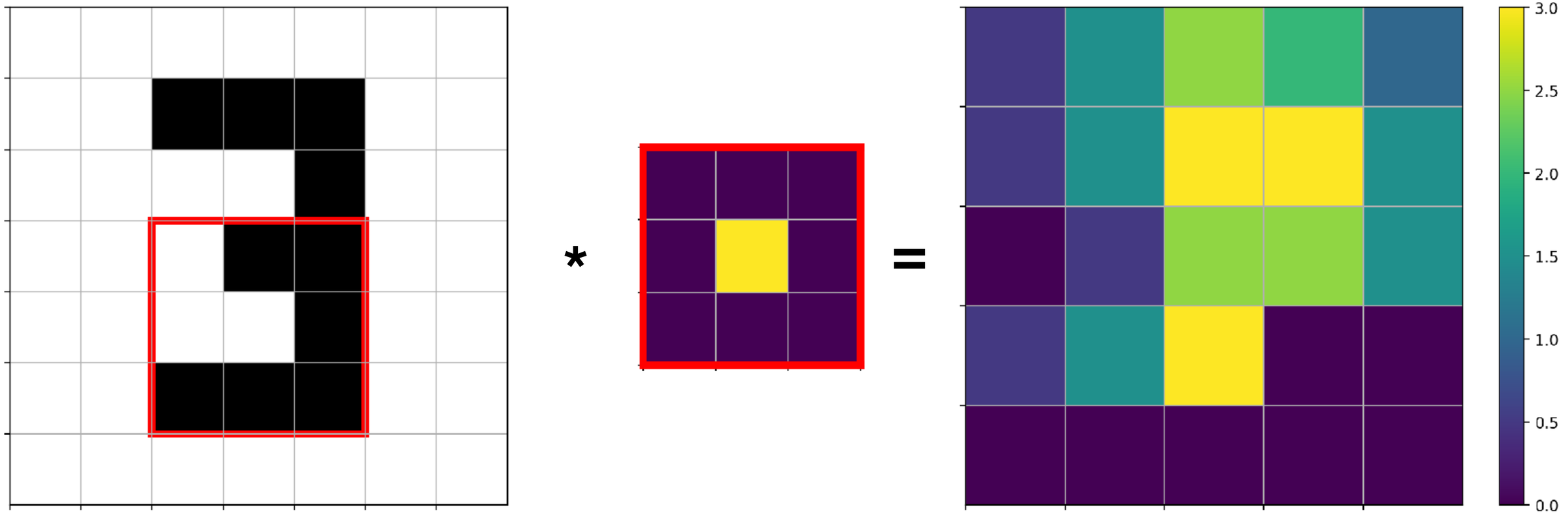

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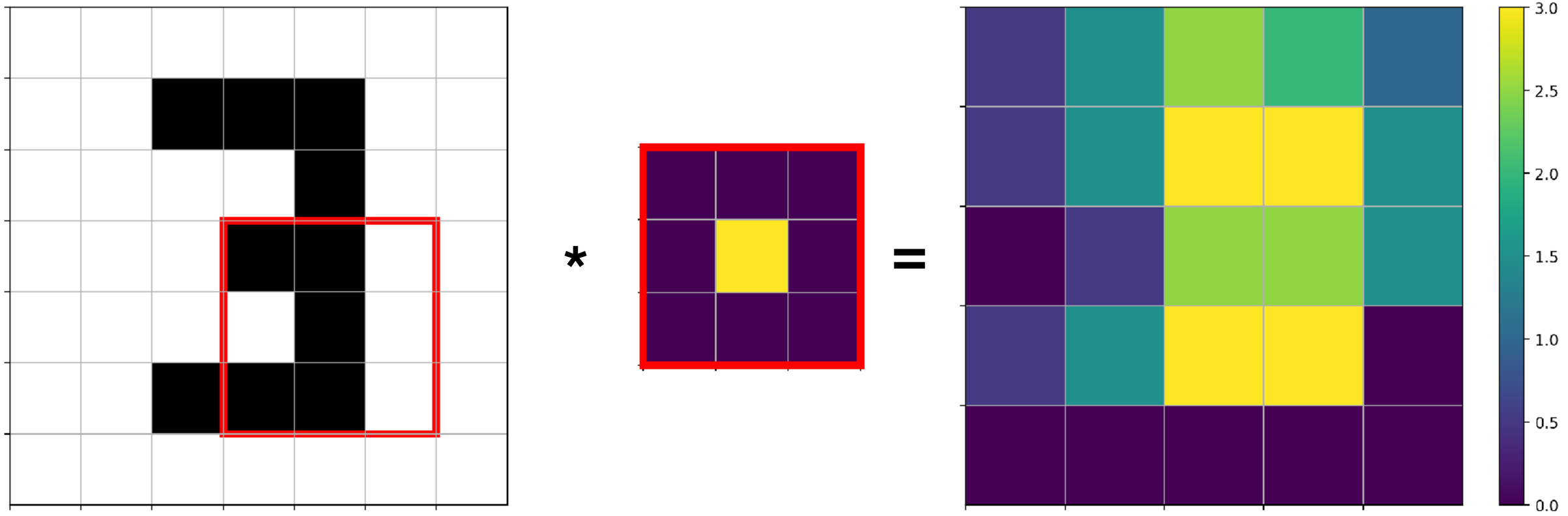

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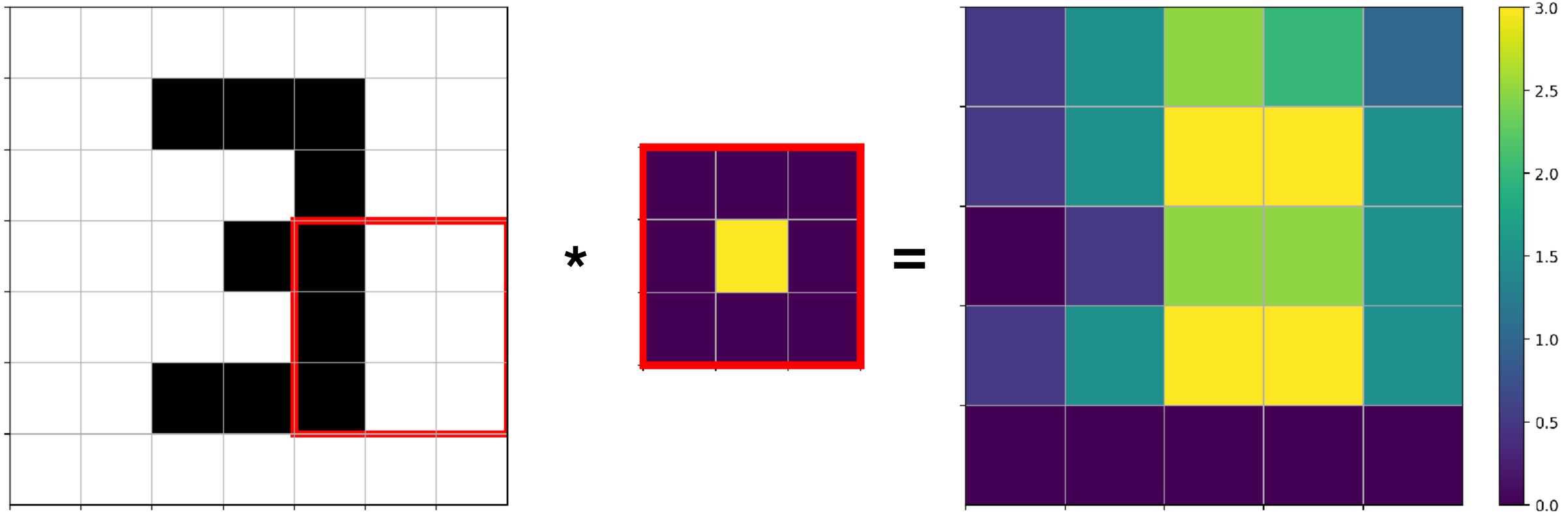

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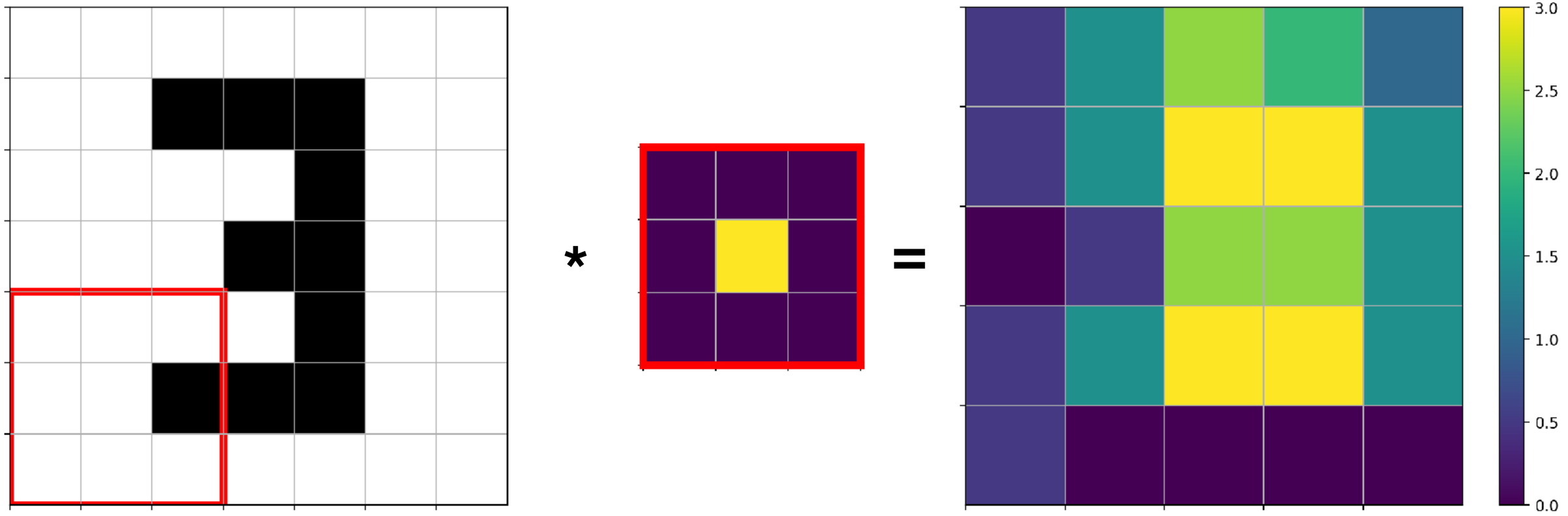

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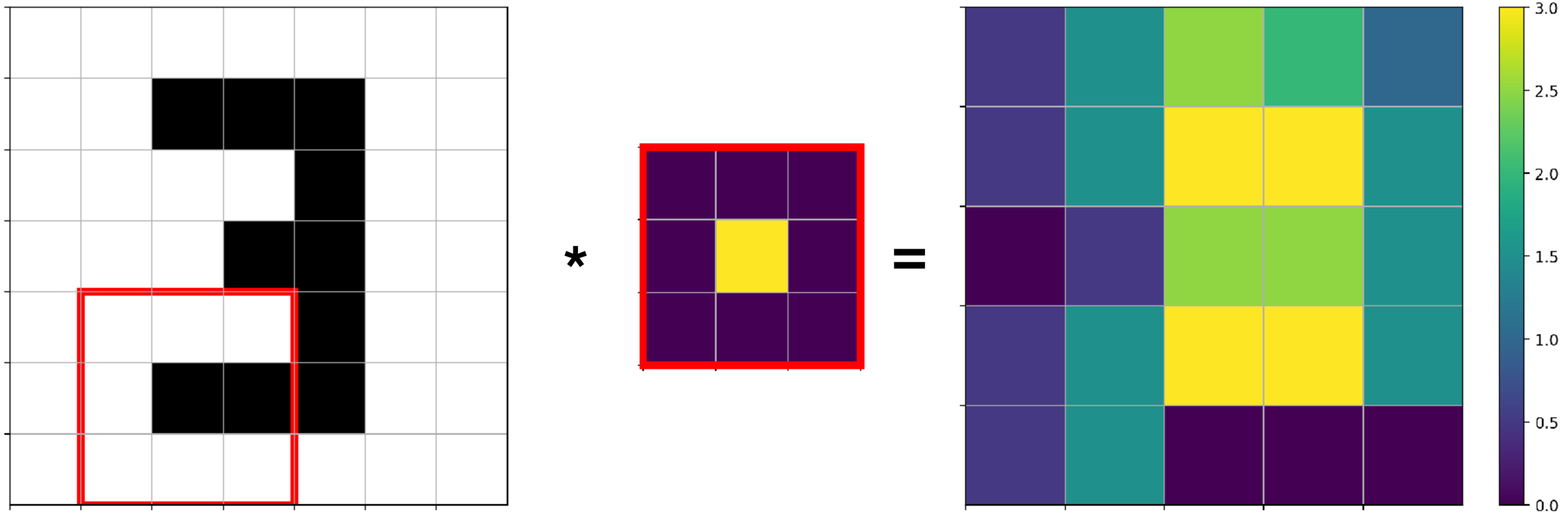

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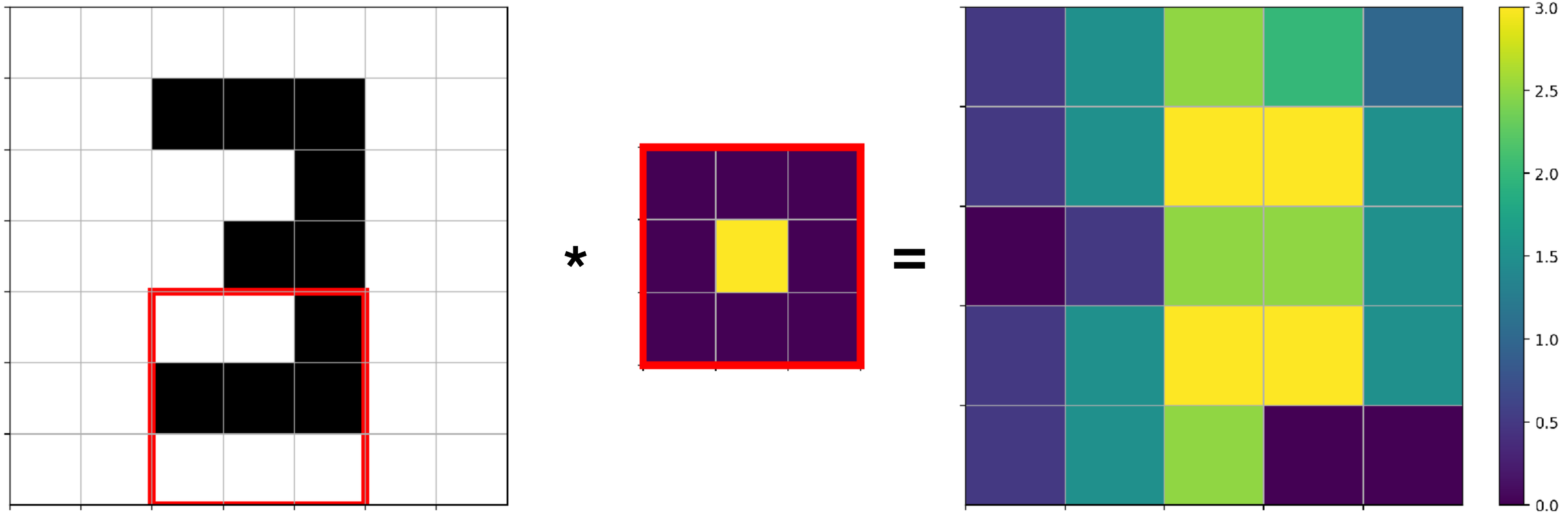

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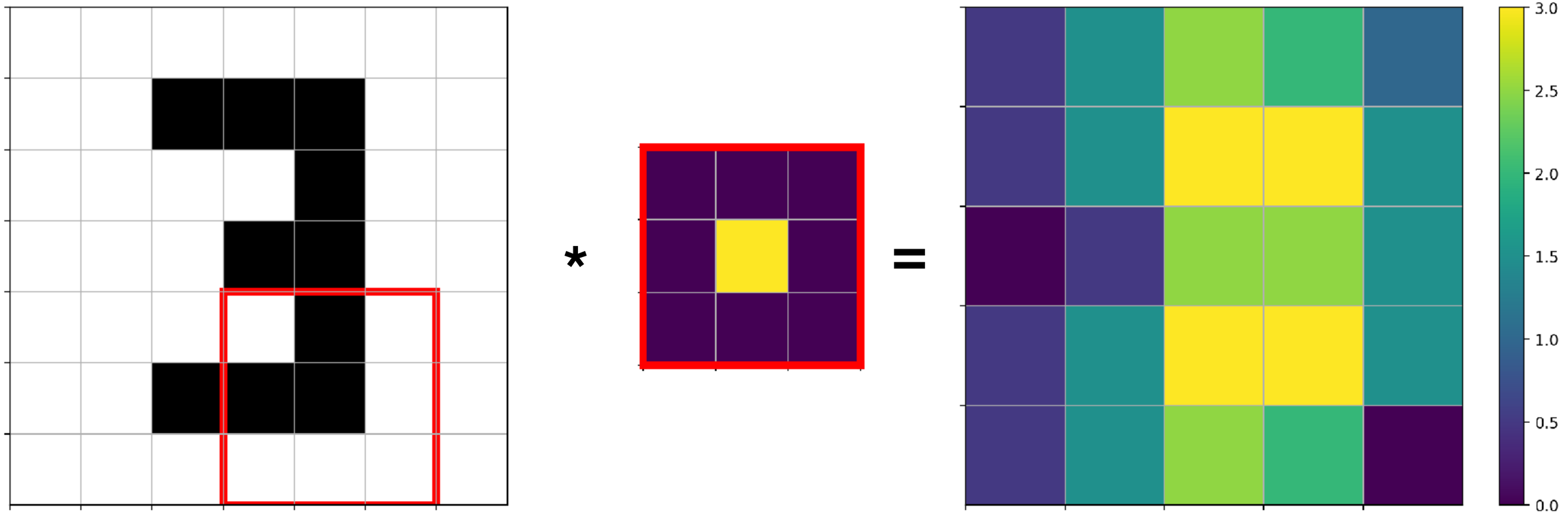

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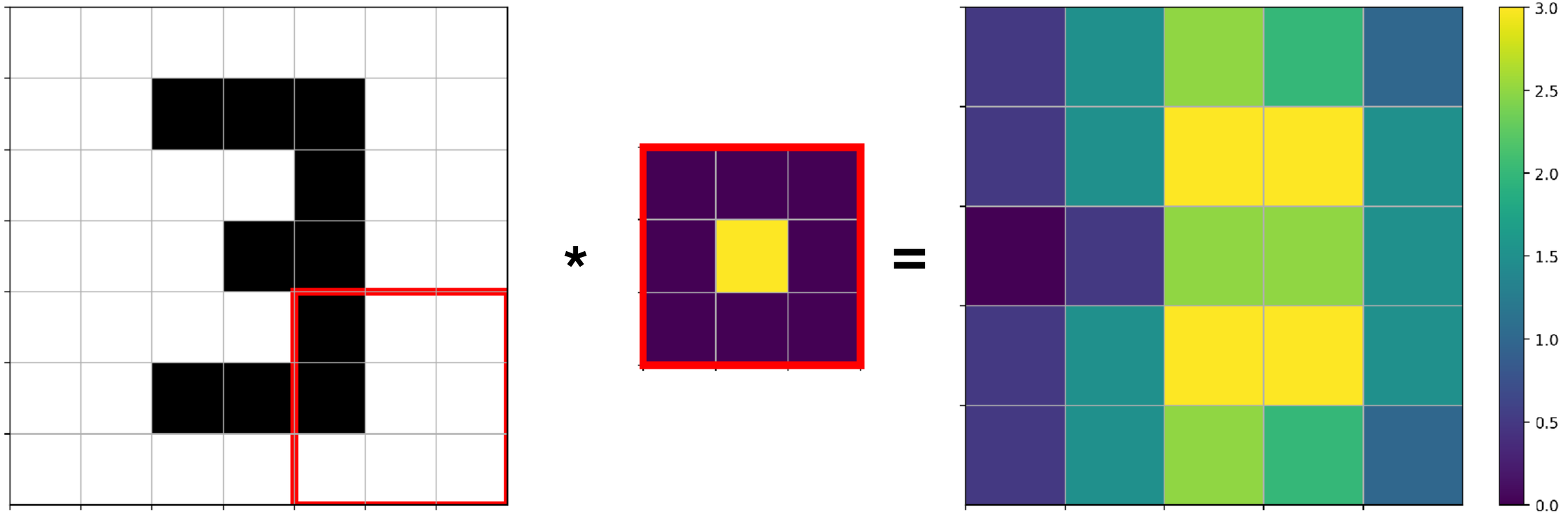

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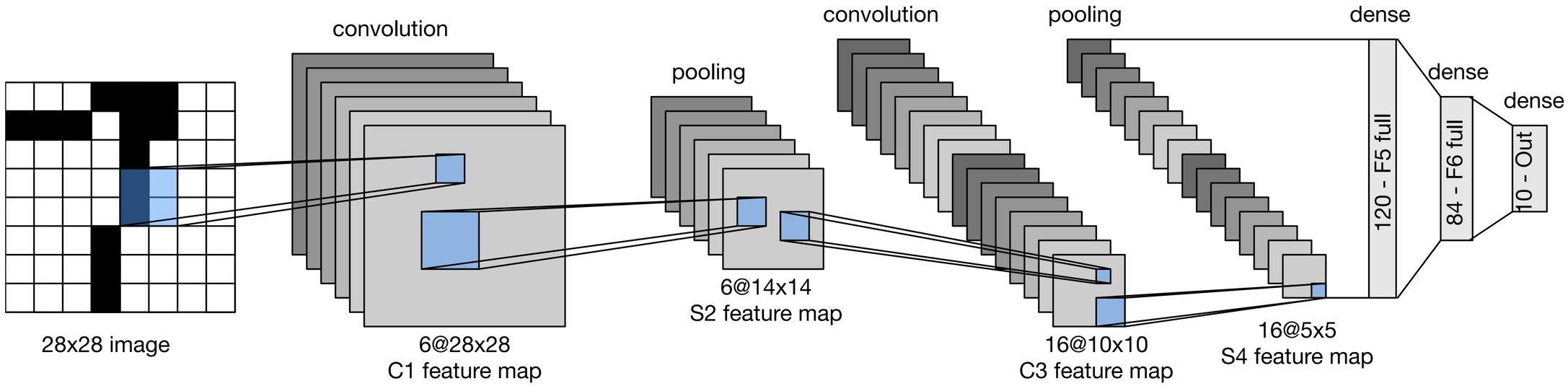

GitHub

PyTorch Introduction

Workshop on Artificial Intelligence - 03/02/2026

Matthis Dallain & Alexandre Lainé - NeOpTo team
mattis.dallain@univ-amu.fr / alexandre.laine@univ-amu.fr

Aix Marseille Université

institut de neurosciences de la timone

Additional information

PyTorch vs Keras vs TensorFlow

Software	Creator	Initial release	Software license[a]	Open source	Platform	Written in	Interface	OpenMP support	OpenCL support	CUDA support	ROCm support[1]	Automatic differentiation[2]	Has pretrained models	Recurrent nets	Convolutional nets	RBM/DBNs	Parallel execution (multi node)	Actively developed
Keras	François Chollet	2015	MIT license	Yes	Linux, macOS, Windows	Python	Python, R	Only if using Theano as backend	Can use Theano, Tensorflow or PlaidML as backends	Yes	No	Yes	Yes[20]	Yes	Yes	No[21]	Yes[22]	Yes
PyTorch	Meta AI	2016	BSD	Yes	Linux, macOS, Windows, Android[47]	Python, C, C++, CUDA	Python, C++, Julia, R[48]	Yes	Via separately maintained package[49][50][51]	Yes	Yes	Yes	Yes	Yes	Yes	Yes[52]	Yes	Yes
TensorFlow	Google Brain	2015	Apache 2.0	Yes	Linux, macOS, Windows,[55] [56] Android	C++, Python, CUDA	Python (Keras), C/C++, Java, Go, JavaScript, R,[57] Julia, Swift	No	On roadmap[58] but already with SYCL[59] support	Yes	Yes	Yes[60]	Yes[61]	Yes	Yes	Yes	Yes	Yes

DBN = Deep Belief Network / RBM = Restricted Boltzmann Machine / ROCm = CUDA for AMD GPU
OpenMP = CPU (GPU) parallelization / OpenCL portability between