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Introduction of DeepLearning

4 November 2020

Presented by Red Hsu

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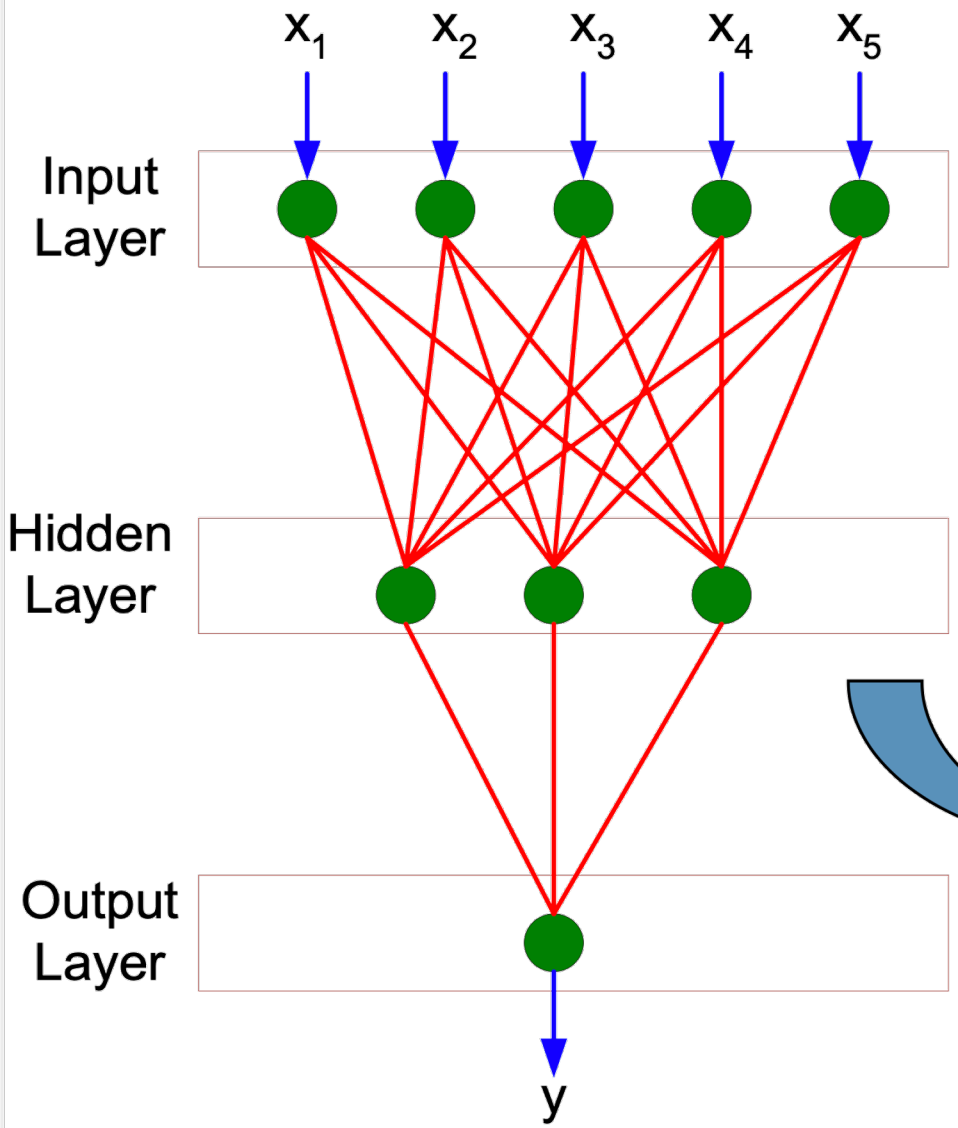
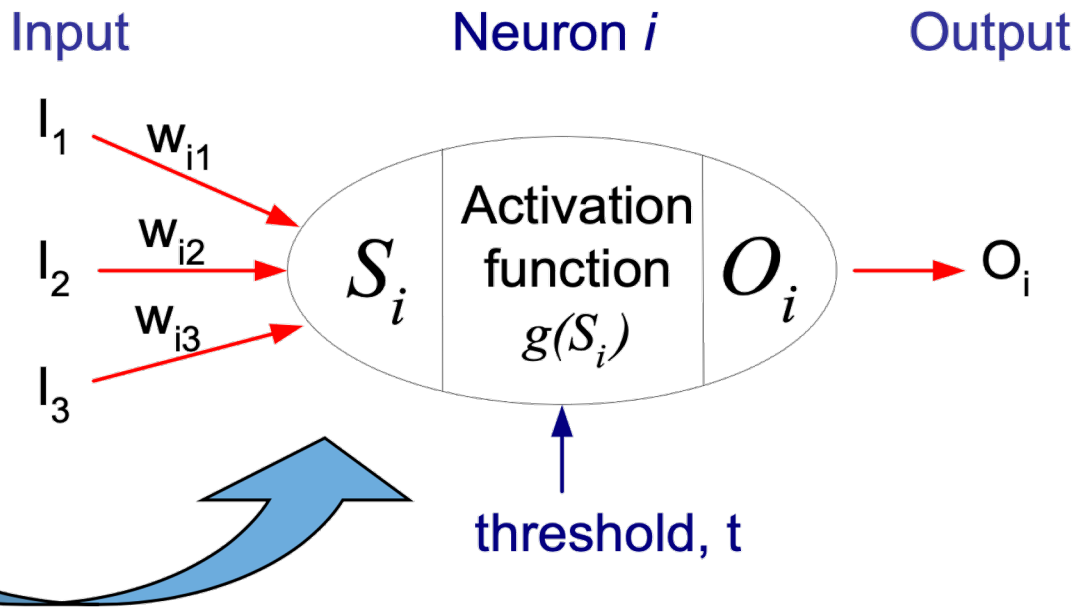
Contents

- 介紹人工神經網路的數學基礎、超參數等介紹
- 機器學習基礎，介紹操作流程
- 建立多分類問題的模型
- 進行模型能力評估
- 使用預訓練的人工神經模型
- 使用LSTM來進行循環神經網路
- 使用生成式深度學習來操作文字生成、風格轉換
- 人工智慧的未來發展

Artificial Neural Network





Training ANN means learning the weights of the neurons

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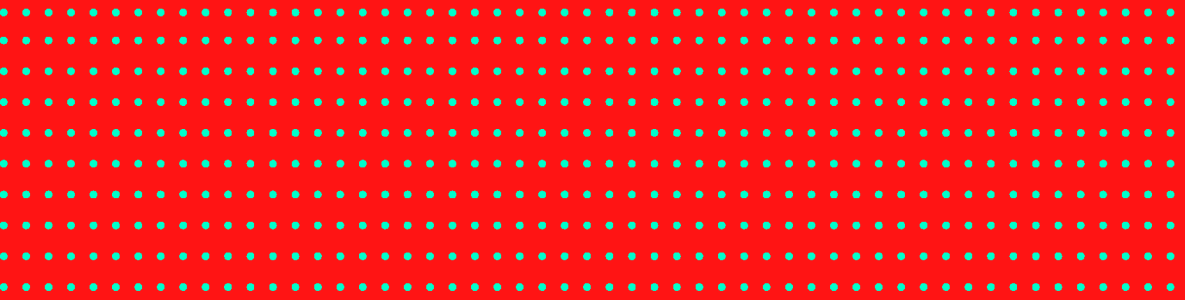
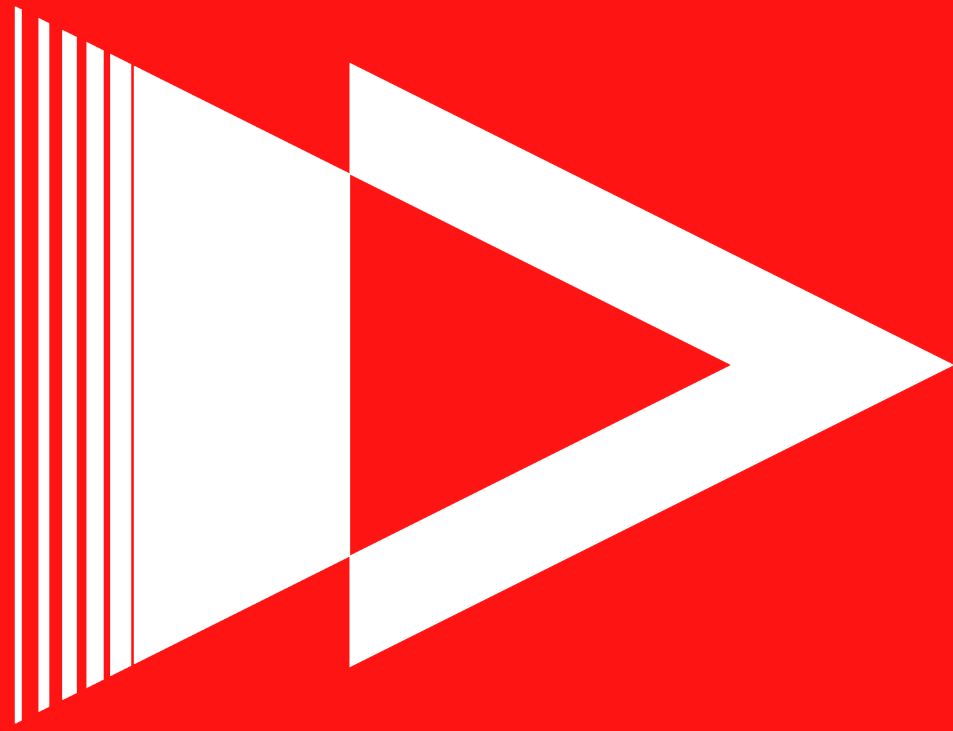
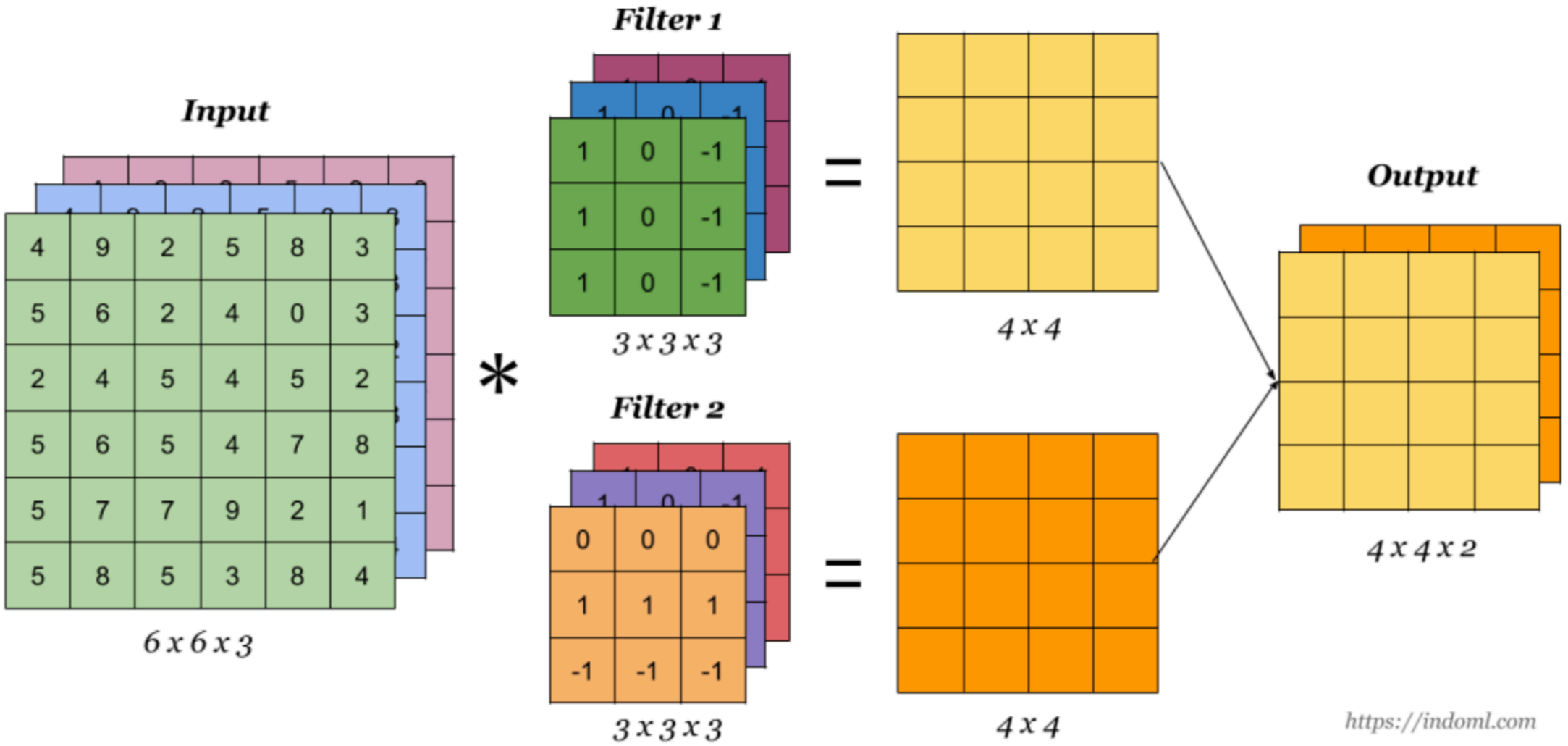
Lab

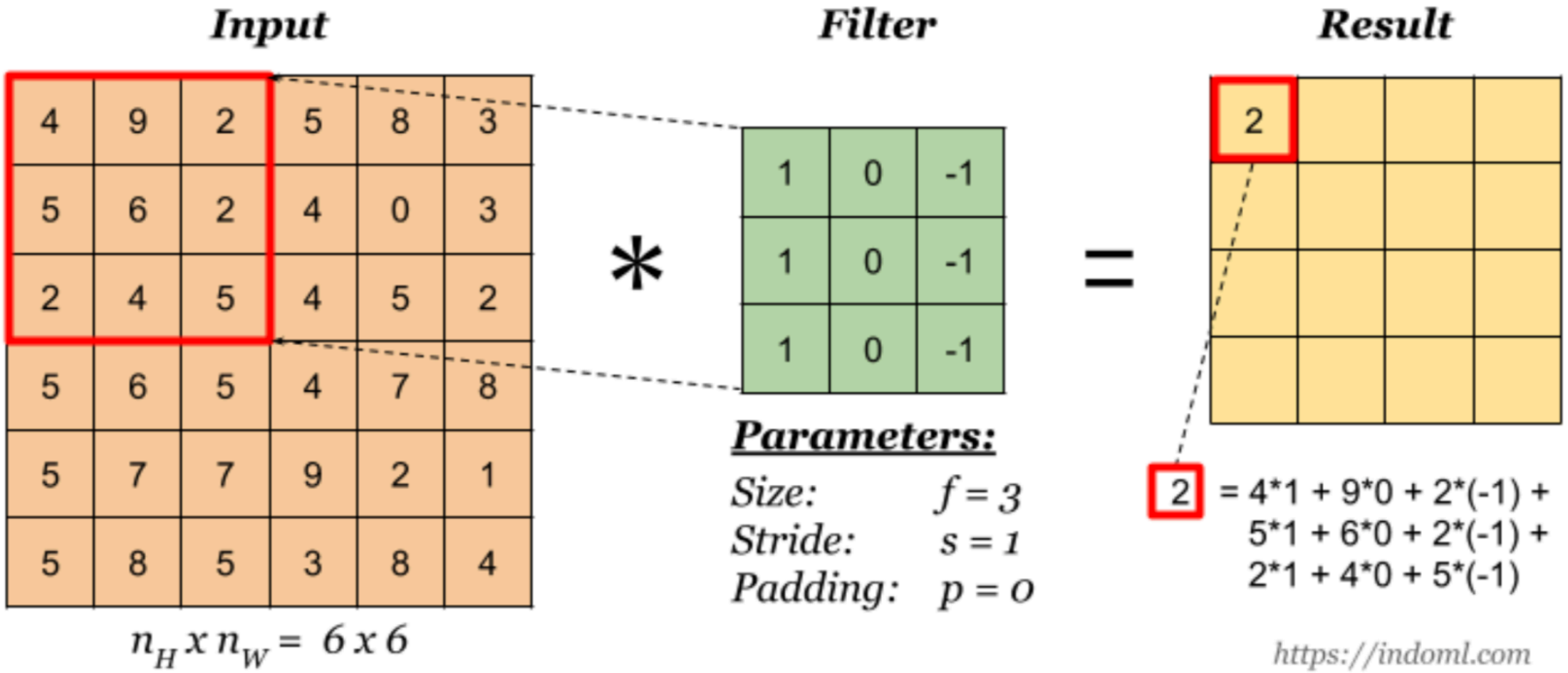




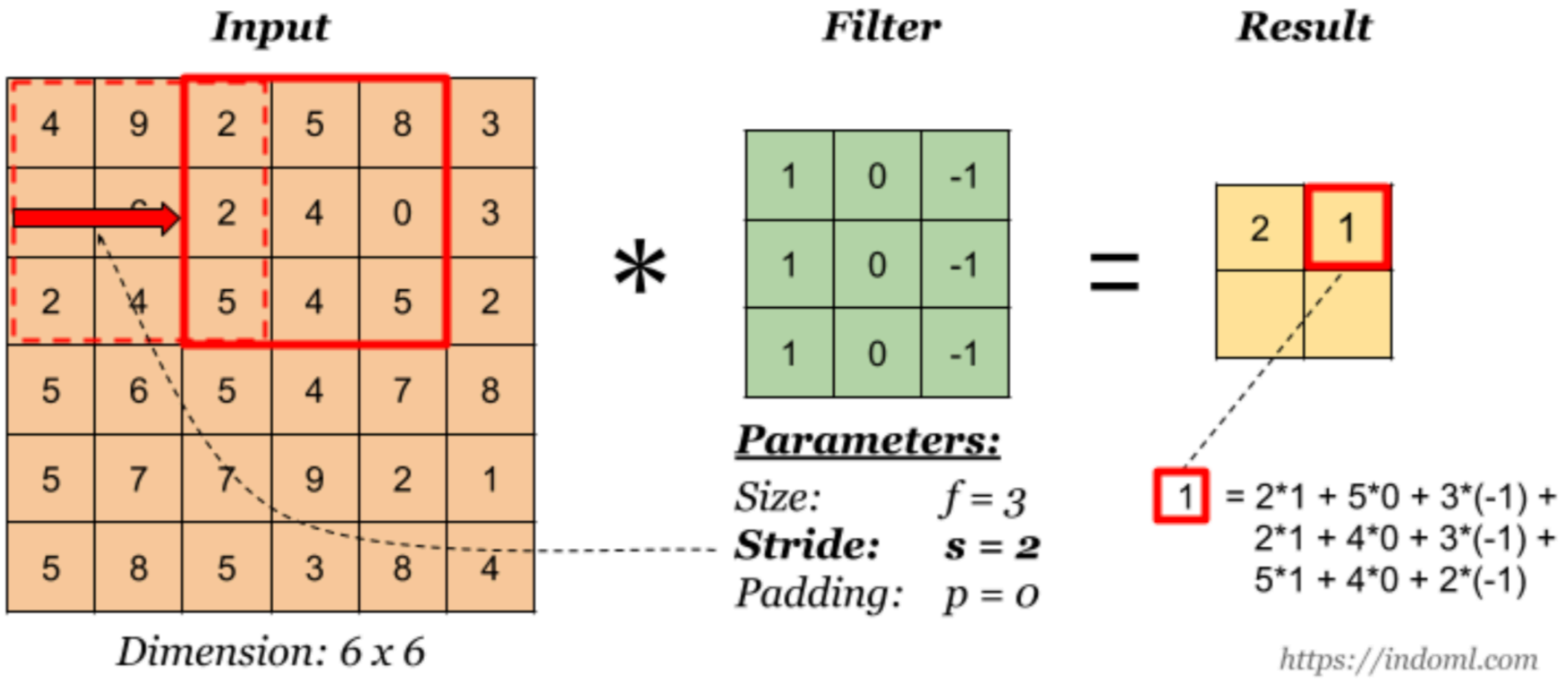
Convolotions



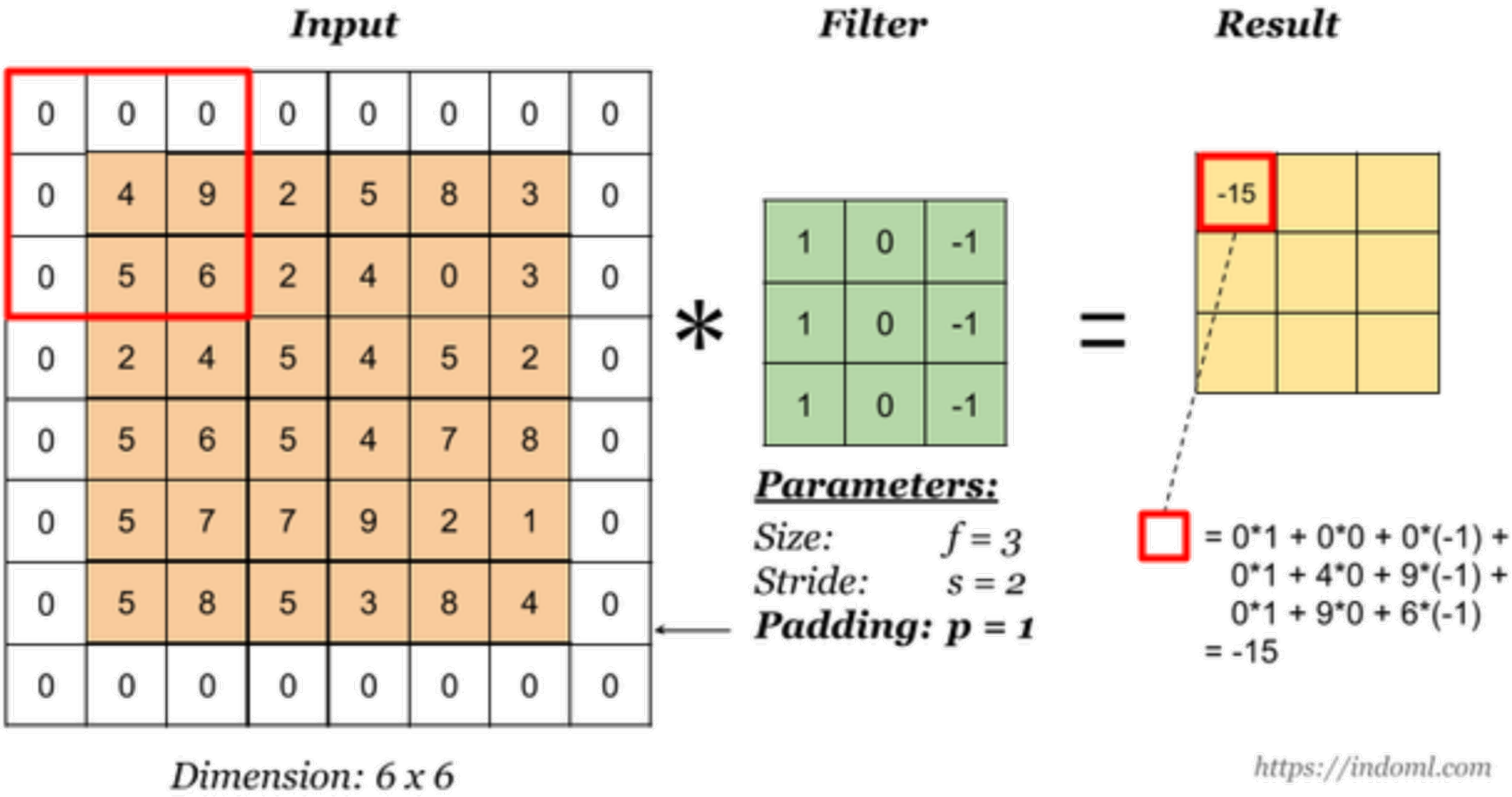
Filter


Input
Filter
Result
4 9 2 5 8 3
5 6 2 4 0 3
2 4 5 4 5 2
5 6 5 4 7 8
5 7 7 9 2 1
5 8 5 3 8 4
*
1 0 -1
1 0 -1
1 0 -1
=
2
Parameters:
Size: f = 3
Stride: s = 1
Padding: p = 0
2 = 4*1 + 9*0 + 2*(-1) +
5*1 + 6*0 + 2*(-1) +
2*1 + 4*0 + 5*(-1)
$n_H \times n_W = 6 \times 6$
https://indoml.com

Stride


Input
Filter
Result
4 9 2 5 8 3
2 4 0 3
2 4 5 4 5 2
5 6 5 4 7 8
5 7 7 9 2 1
5 8 5 3 8 4
*
1 0 -1
1 0 -1
1 0 -1
=
2 1
Parameters:
Size: f = 3
Stride: s = 2
Padding: p = 0
1 = 2*1 + 5*0 + 3*(-1) +
2*1 + 4*0 + 3*(-1) +
5*1 + 4*0 + 2*(-1)
Dimension: 6 x 6
https://indoml.com

Padding


Input
Filter
Result
0 0 0 0 0 0 0 0
0 4 9 2 5 8 3 0
0 5 6 2 4 0 3 0
0 2 4 5 4 5 2 0
0 5 6 5 4 7 8 0
0 5 7 7 9 2 1 0
0 5 8 5 3 8 4 0
0 0 0 0 0 0 0 0
*
1 0 -1
1 0 -1
1 0 -1
=
-15
Parameters:
Size: f = 3
Stride: s = 2
Padding: p = 1
= 0*1 + 0*0 + 0*(-1) +
0*1 + 4*0 + 9*(-1) +
0*1 + 9*0 + 6*(-1)
= -15
Dimension: 6 x 6
https://indoml.com

Optimizer

Define a set of functions

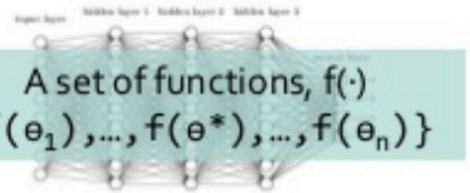
↓

Evaluate and Search

↓

Pick the best function

特定的網絡架構



A set of functions, f(·)

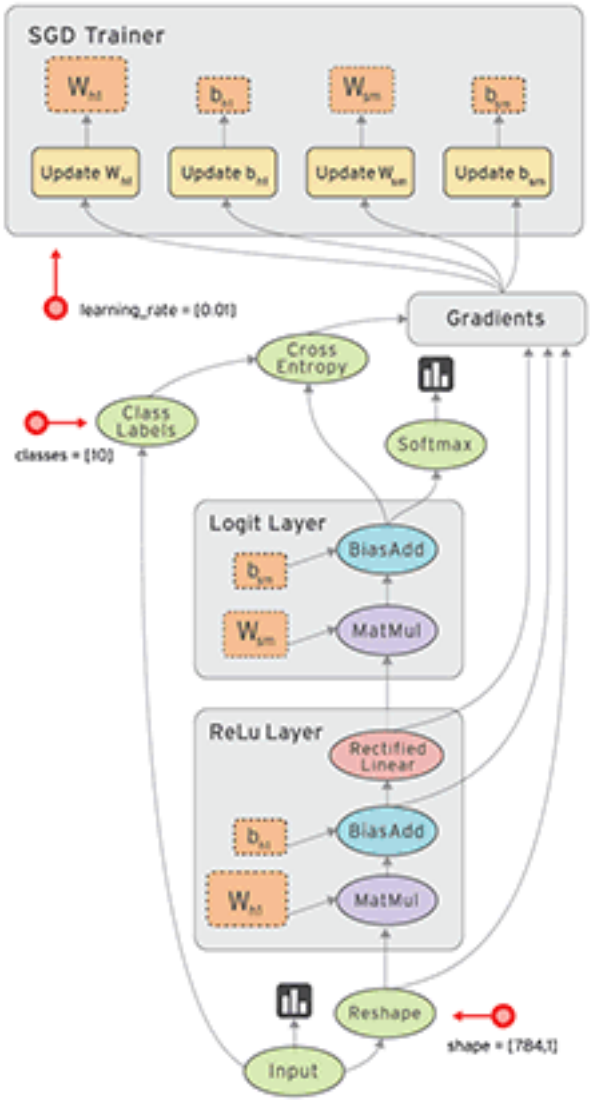
$\{f(\theta_1),\ldots,f(\theta^*),\ldots,f(\theta_n)\}$

不斷修正 f 的參數

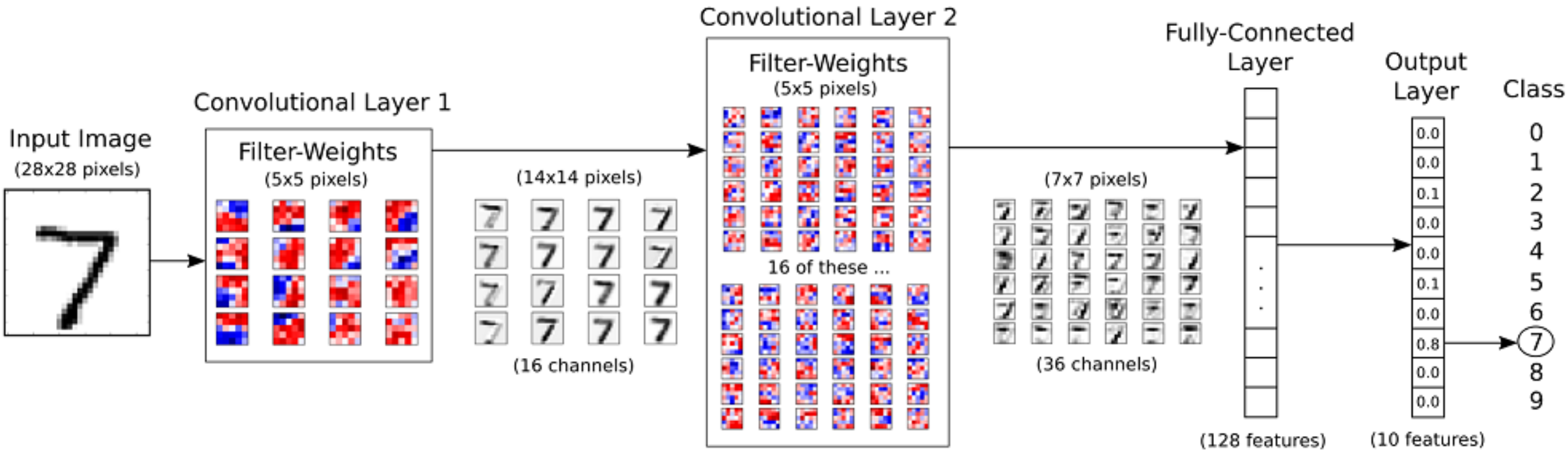
$f(\theta_{94})$ ➔
$f(\theta_{87})$ ➔
$f(\theta_{945})$...

找到最適合的參數

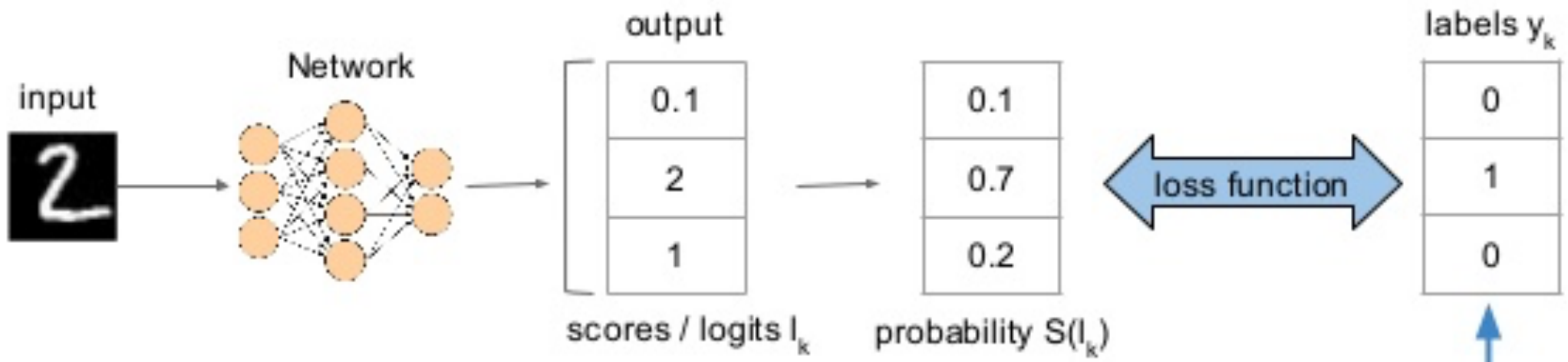
$f(\theta^*)$



Convolution



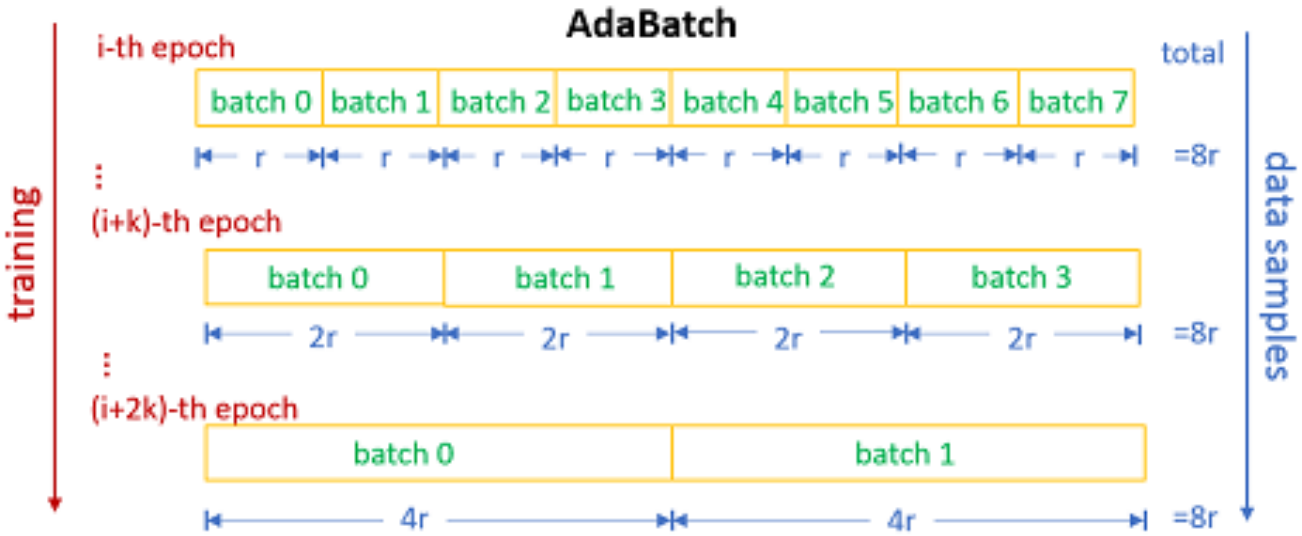
Crossentropy

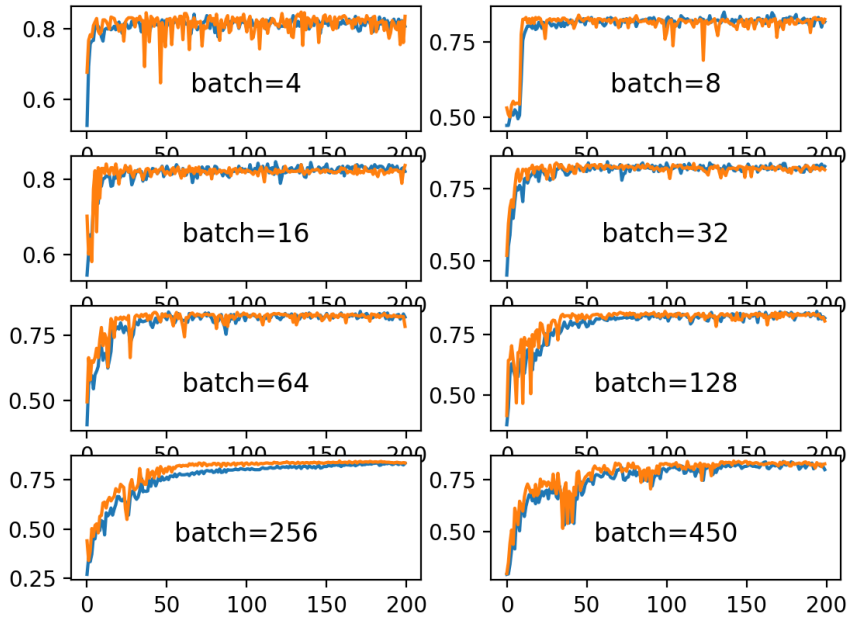


$$\mathcal{L}_i = -\sum_k y_k \log(S(l_k)) = -\log(S(l))$$

Only the confidence for the GT class is considered.

Batch


AdaBatch
i-th epoch
total
batch 0
batch 1
batch 2
batch 3
batch 4
batch 5
batch 6
batch 7
r
=8r
(i+k)-th epoch
batch 0
batch 1
batch 2
batch 3
2r
=8r
(i+2k)-th epoch
batch 0
batch 1
4r
=8r
training
data samples


batch=4
batch=8
batch=16
batch=32
batch=64
batch=128
batch=256
batch=450

Dataset

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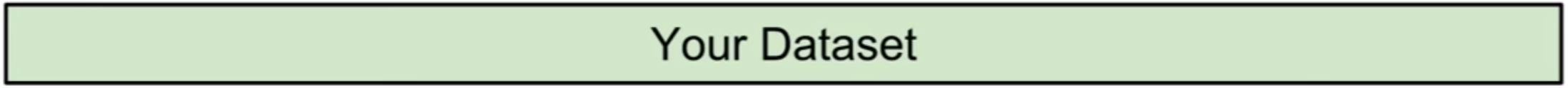
Idea #1: Choose hyperparameters that work best on the data

BAD: K = 1 always works perfectly on training data



Idea #2: Split data into **train** and **test**, choose hyperparameters that work best on test data

BAD: No idea how algorith will perform on new data

Idea #3: Split data into **train**, **val**, and **test**; choose hyperparameters on val and evaluate on test

Better!

SGD Stochastic Gradient Descent

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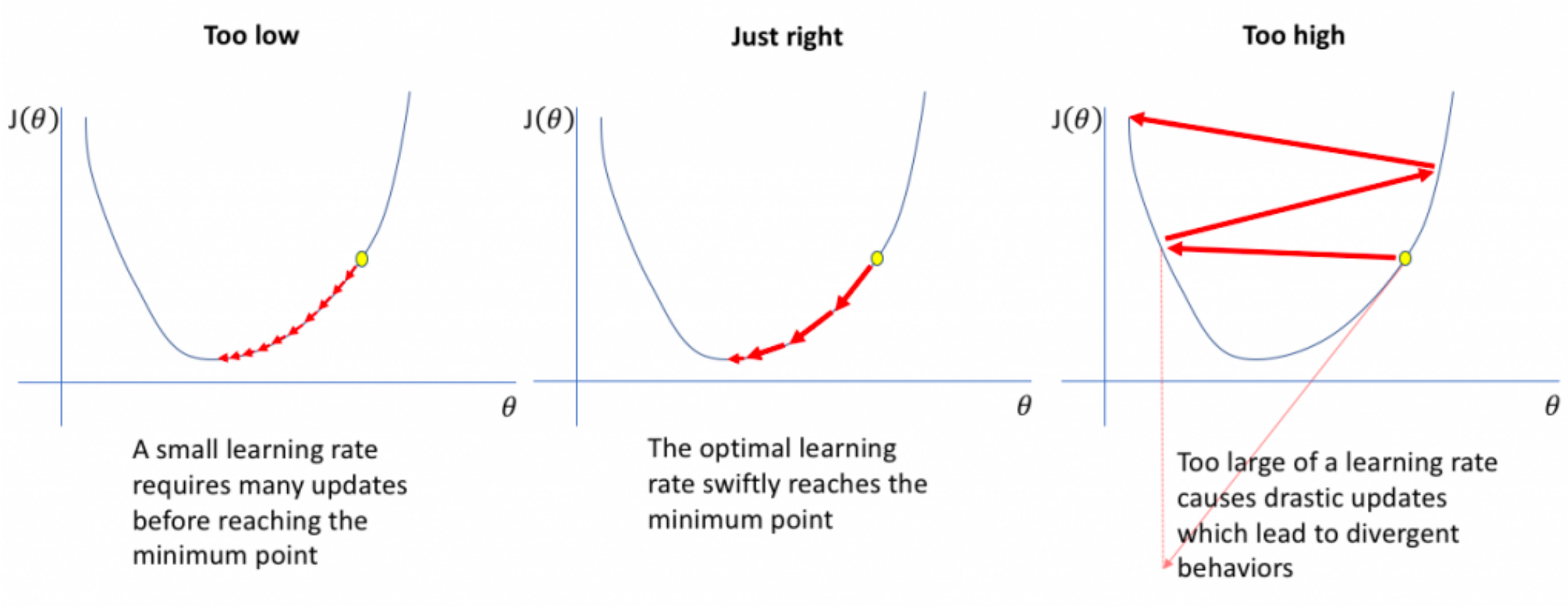

Deep

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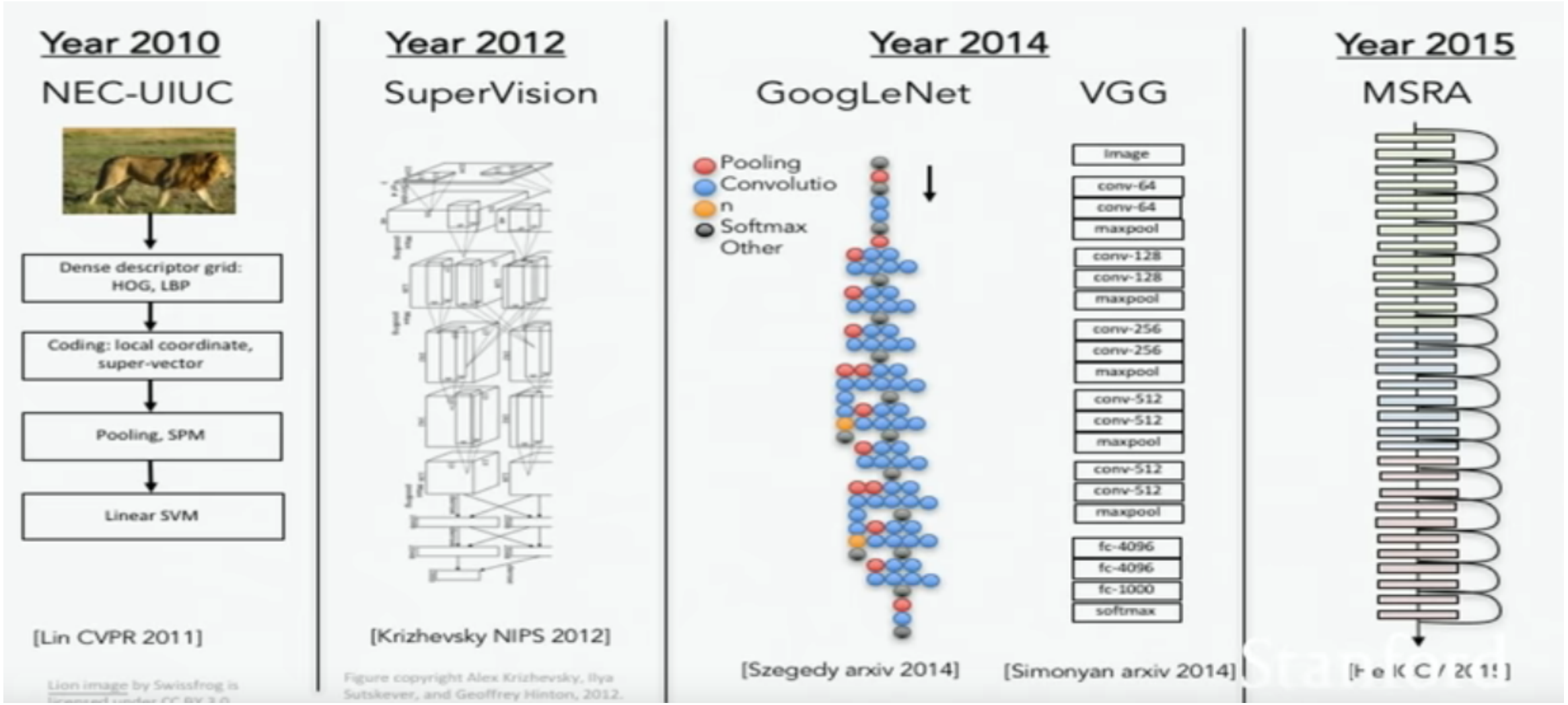

Programming Languages for A.I.

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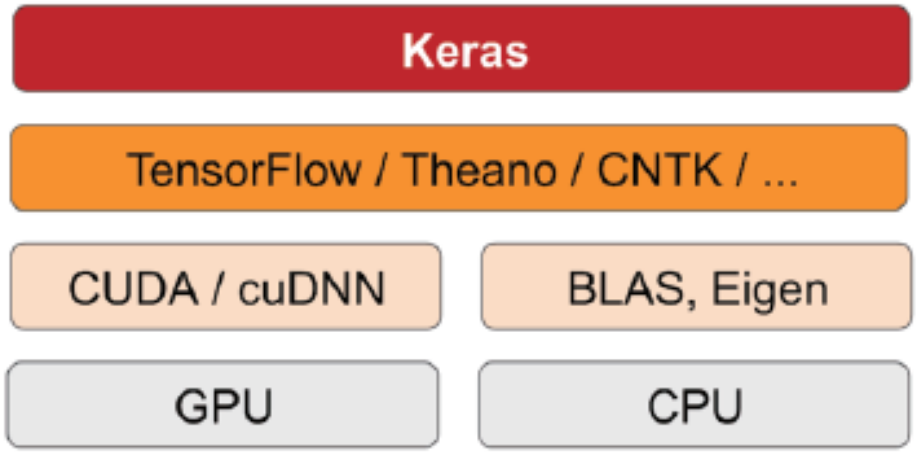
- Keras is a high-level API to build and train deep learning models.
  - User friendly
  - Modular and composable
  - Easy to extend



https://www.tensorflow.org/guide/keras

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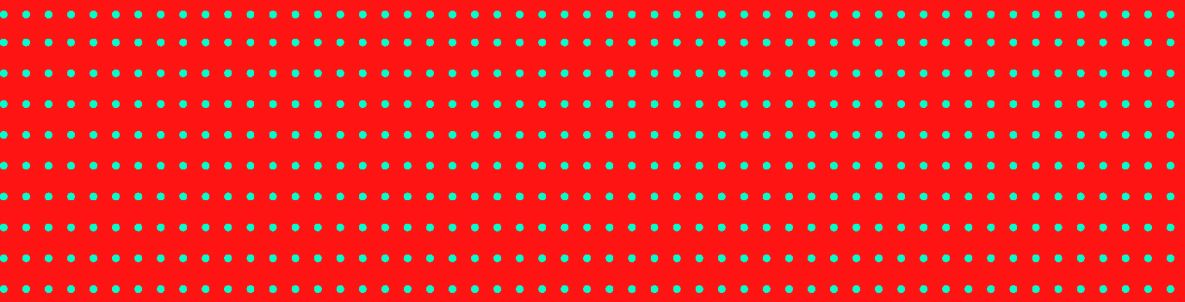
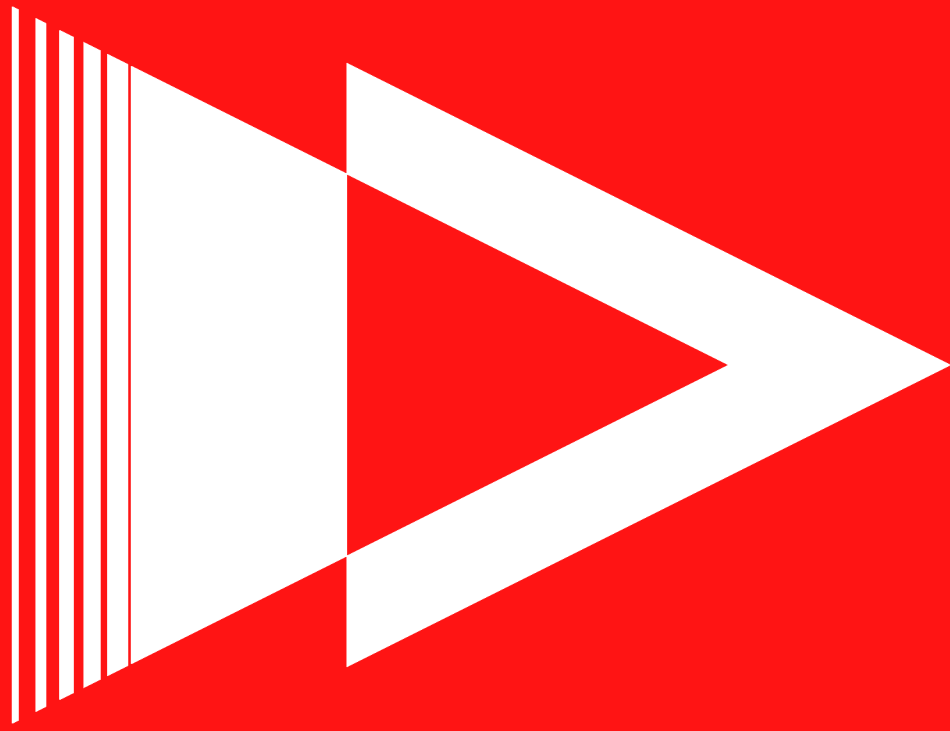
Lab





Machine Learning v Deep Learning

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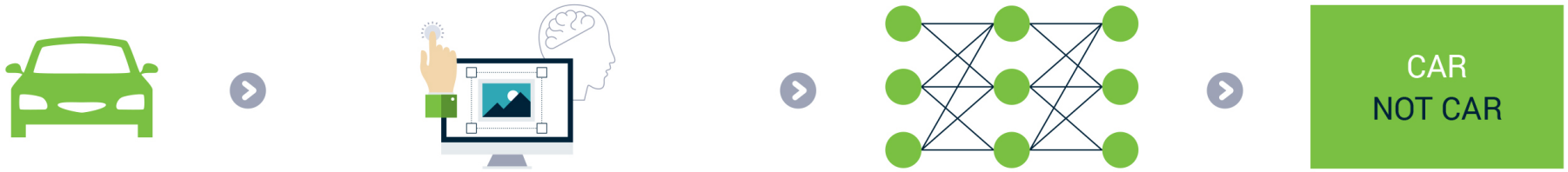
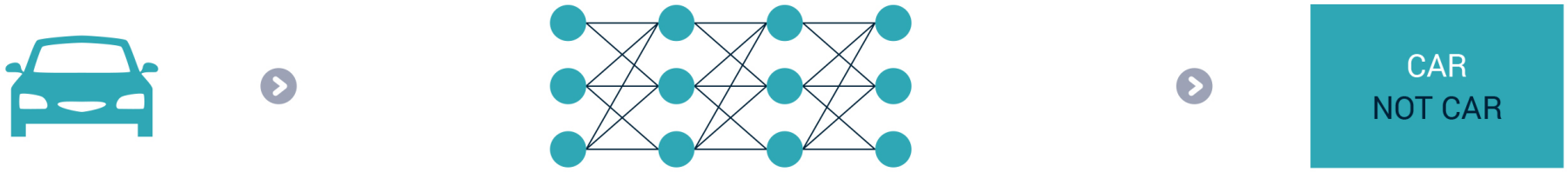
Machine Learning



Input → Feature extraction → Classification → Output

Deep Learning



Input → Feature extraction + Classification → Output

Overfitting &Underfitting

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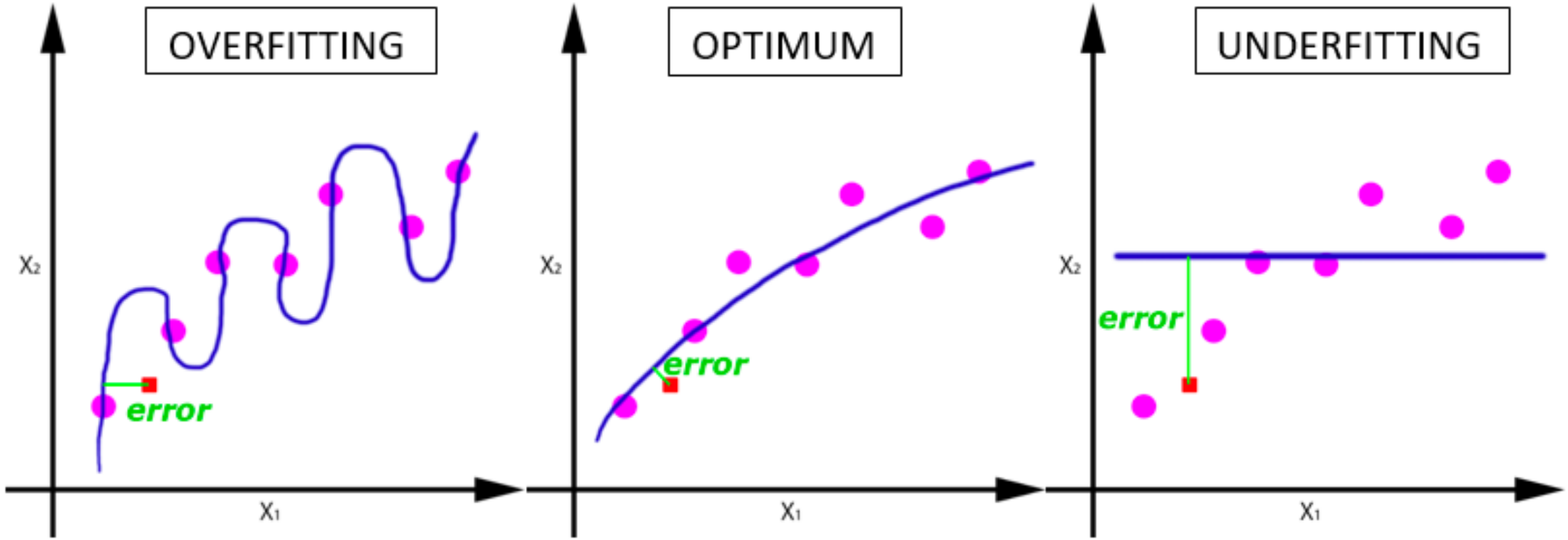

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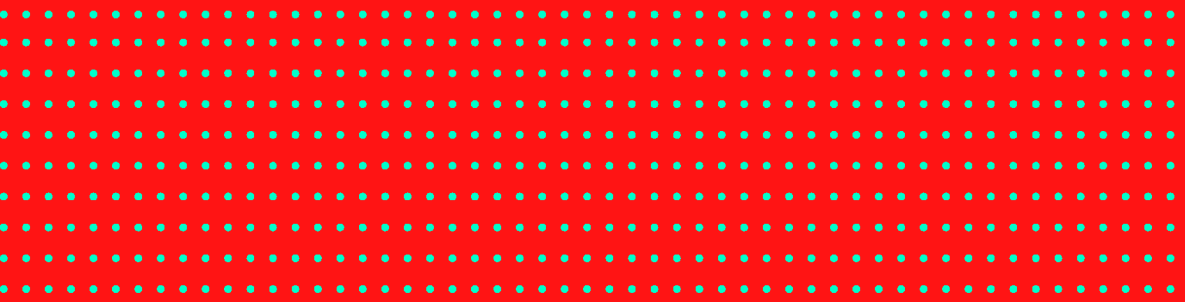
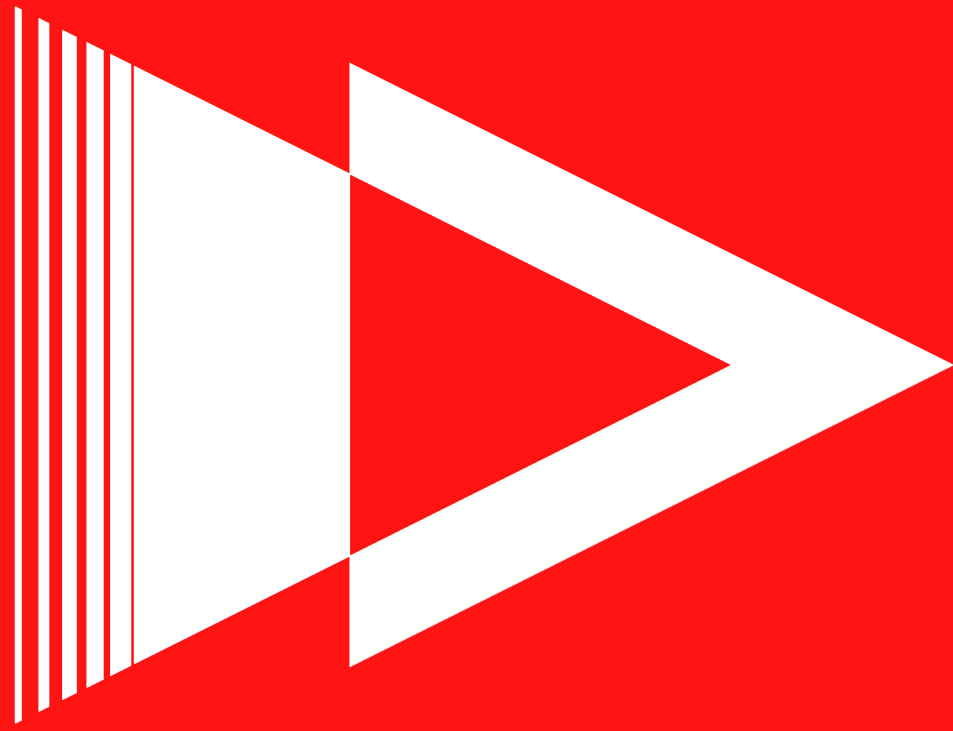
Lab





Google Duplex

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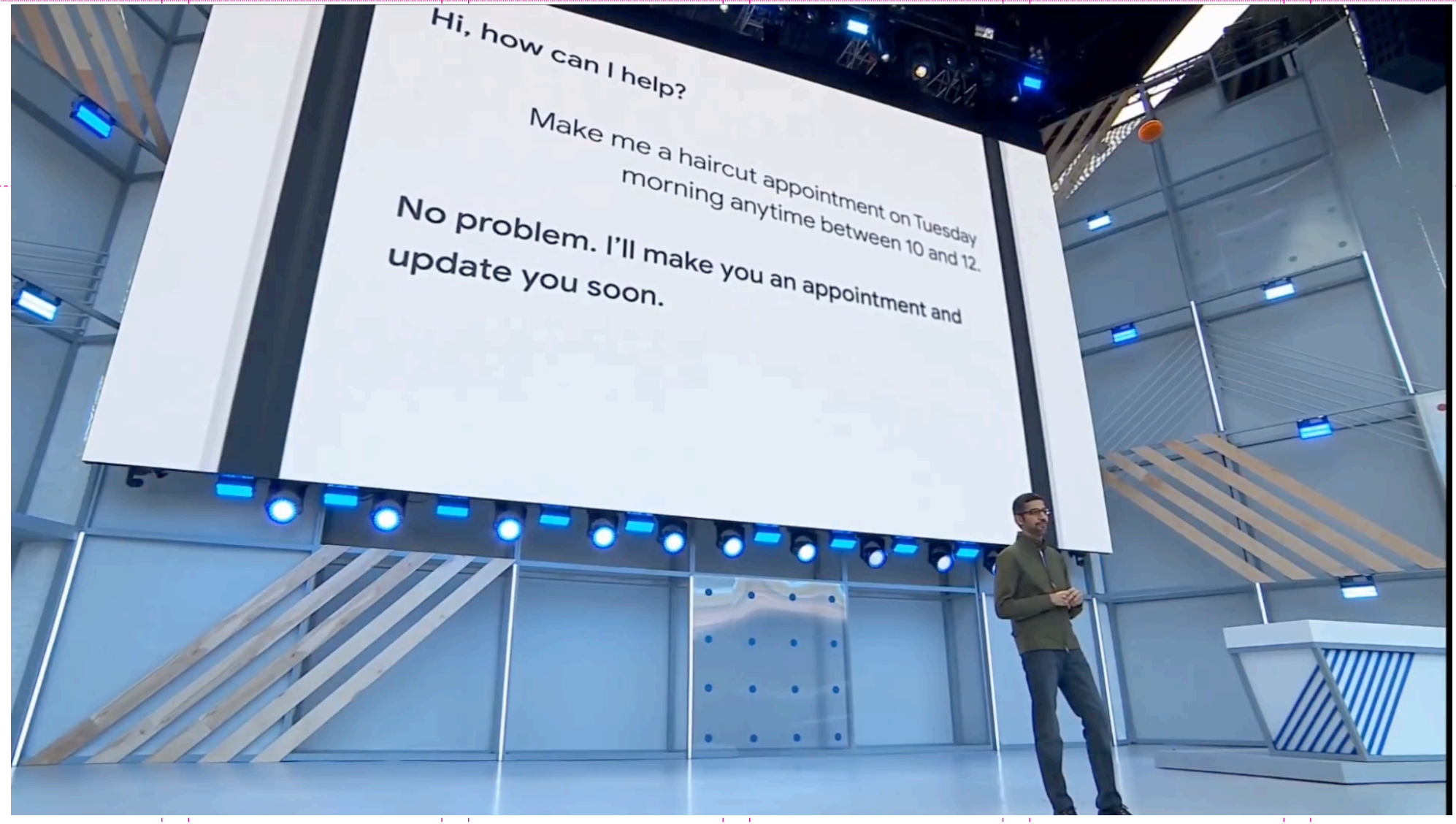

Computer Vision - ICNet

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ICNet for Real-Time Semantic Segmentation on High-Resolution Images

Hengshuang Zhao[1] Xiaojuan Qi[1] Xiaoyong Shen[1] Jianping Shi[2] Jiaya Jia[1]
[1]The Chinese University of Hong Kong [2]SenseTime Group Limited

*Each frame in the video is processed independently at the rate of **30** fps on a **1024*2048** resolution image.*

Computer Vision - RoadDNA

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AIVA

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A. I. Scifi Movies

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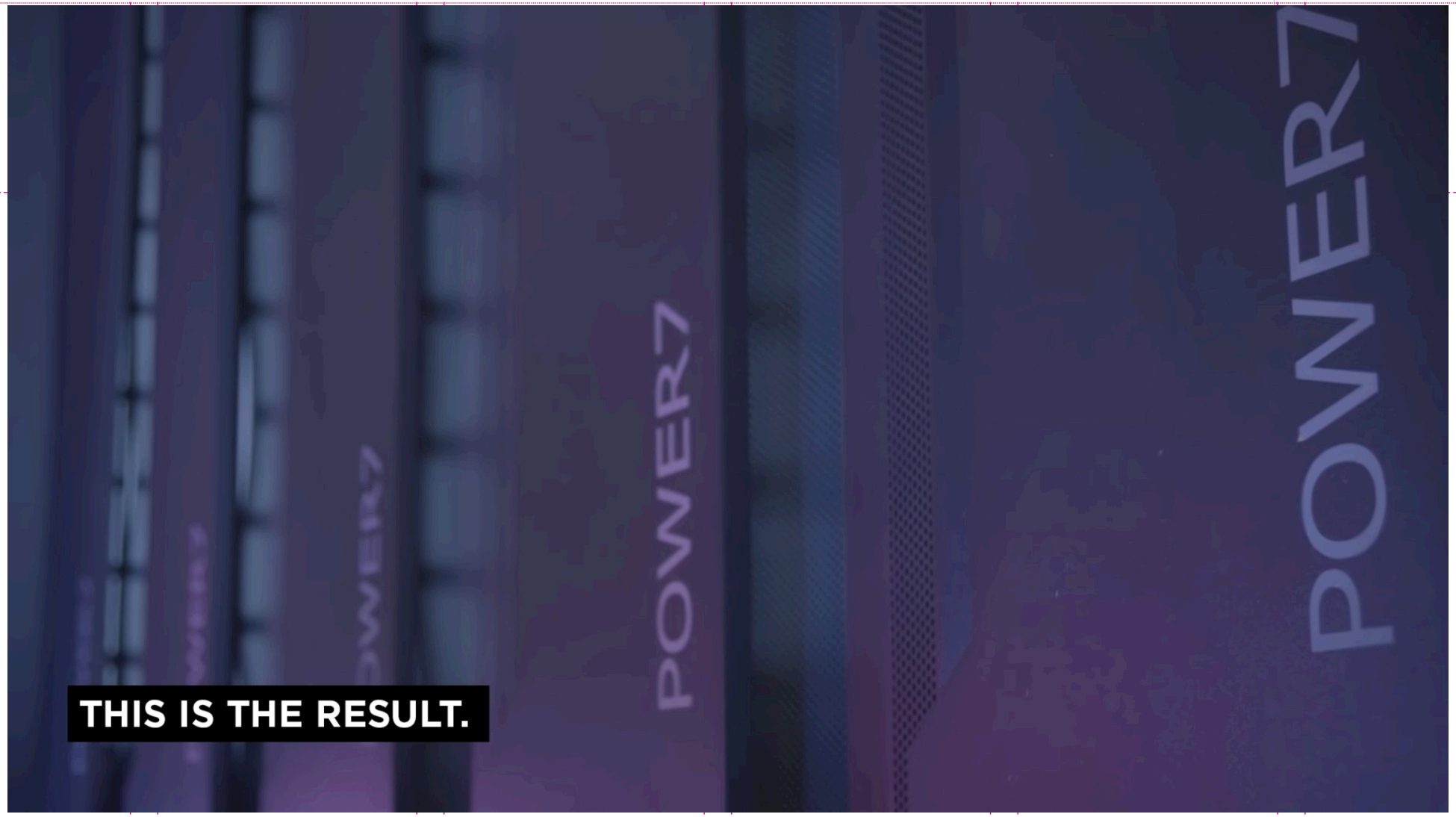

GAN

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It might
look goofy ...

Transfer Learning

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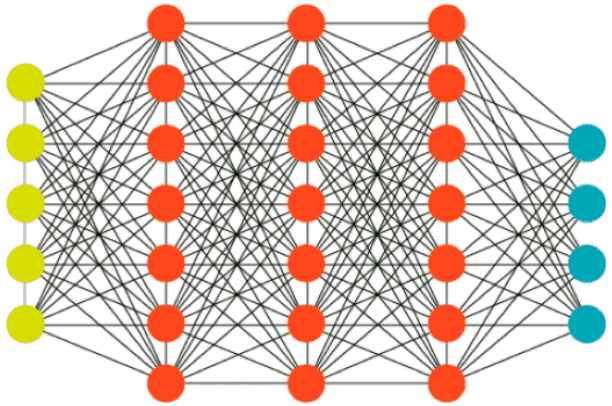
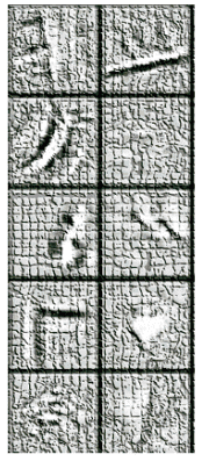


SoftMax

GIANT PANDA 0.9
RED PANDA 0.05
RACCOON 0.01
...

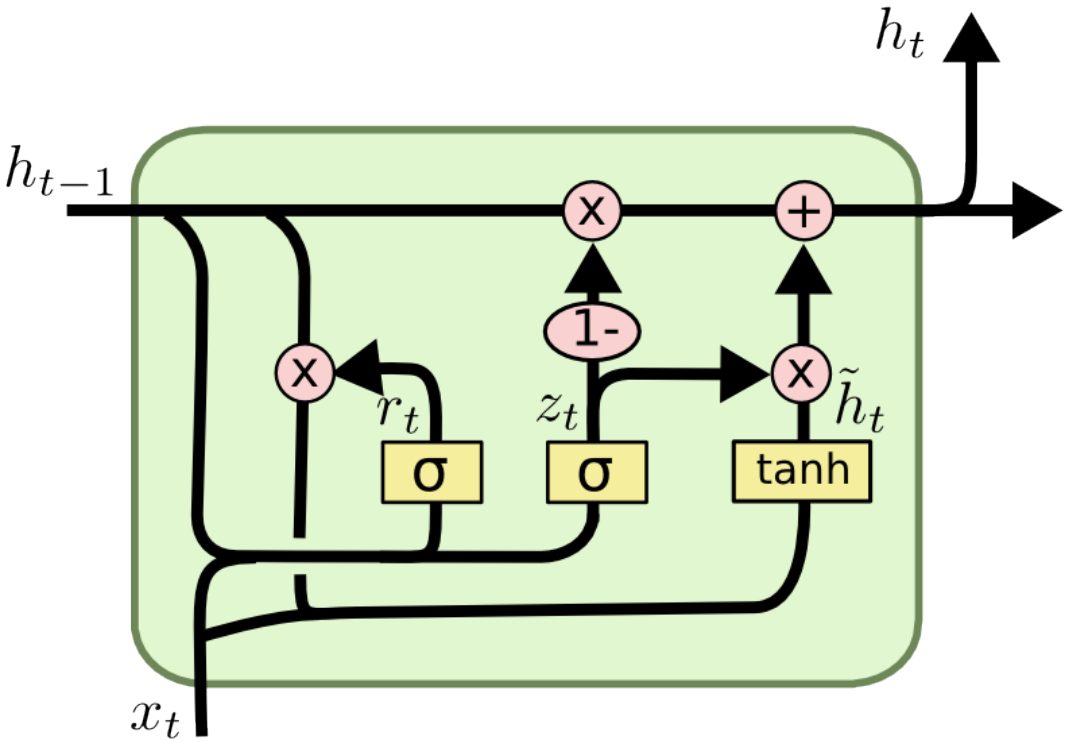
DeepImageFeaturizer



Classifier

Chihuahua

LSTM



$$z_t = \sigma\left(W_z \cdot [h_{t-1}, x_t]\right)$$

$$r_t = \sigma\left(W_r \cdot [h_{t-1}, x_t]\right)$$

$$\tilde{h}_t = \tanh\left(W \cdot [r_t * h_{t-1}, x_t]\right)$$

$$h_t = (1 - z_t) * h_{t-1} + z_t * \tilde{h}_t$$

GAN

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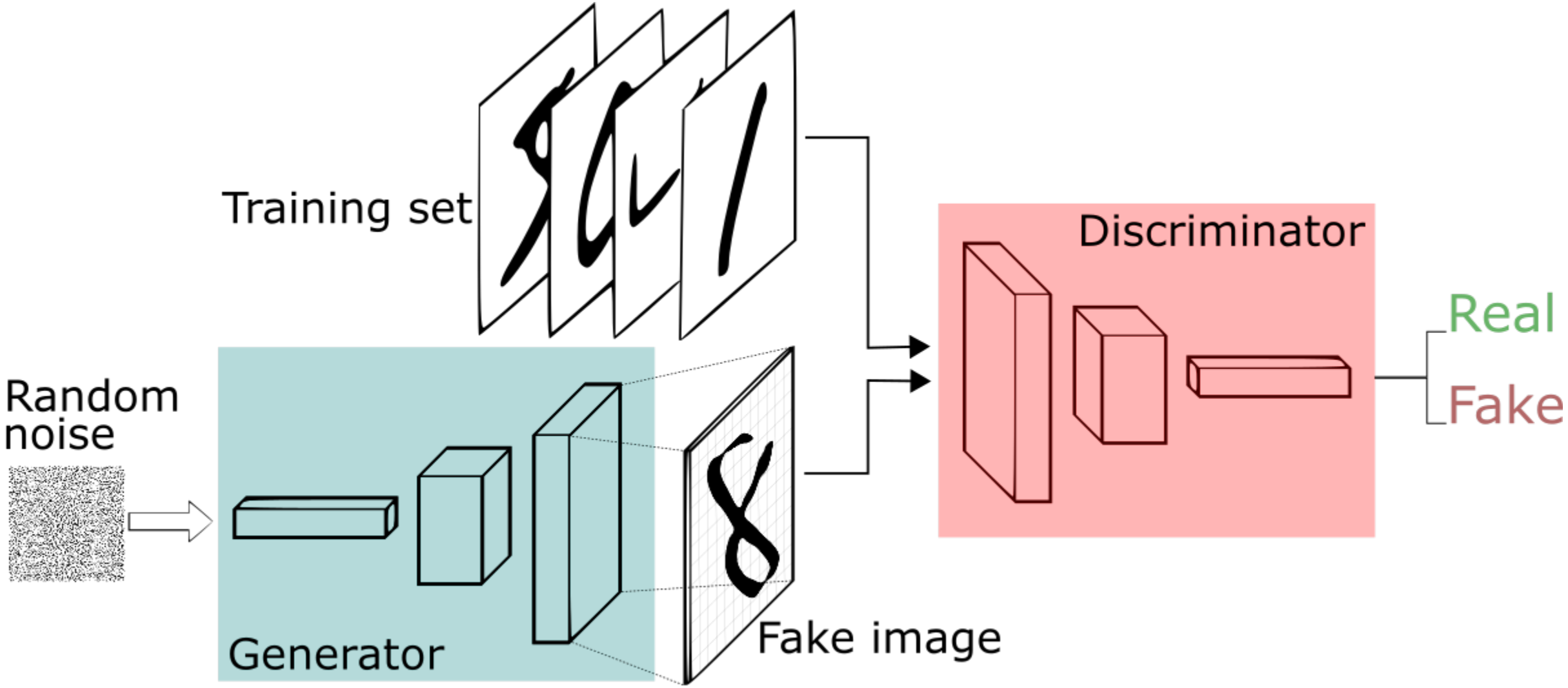
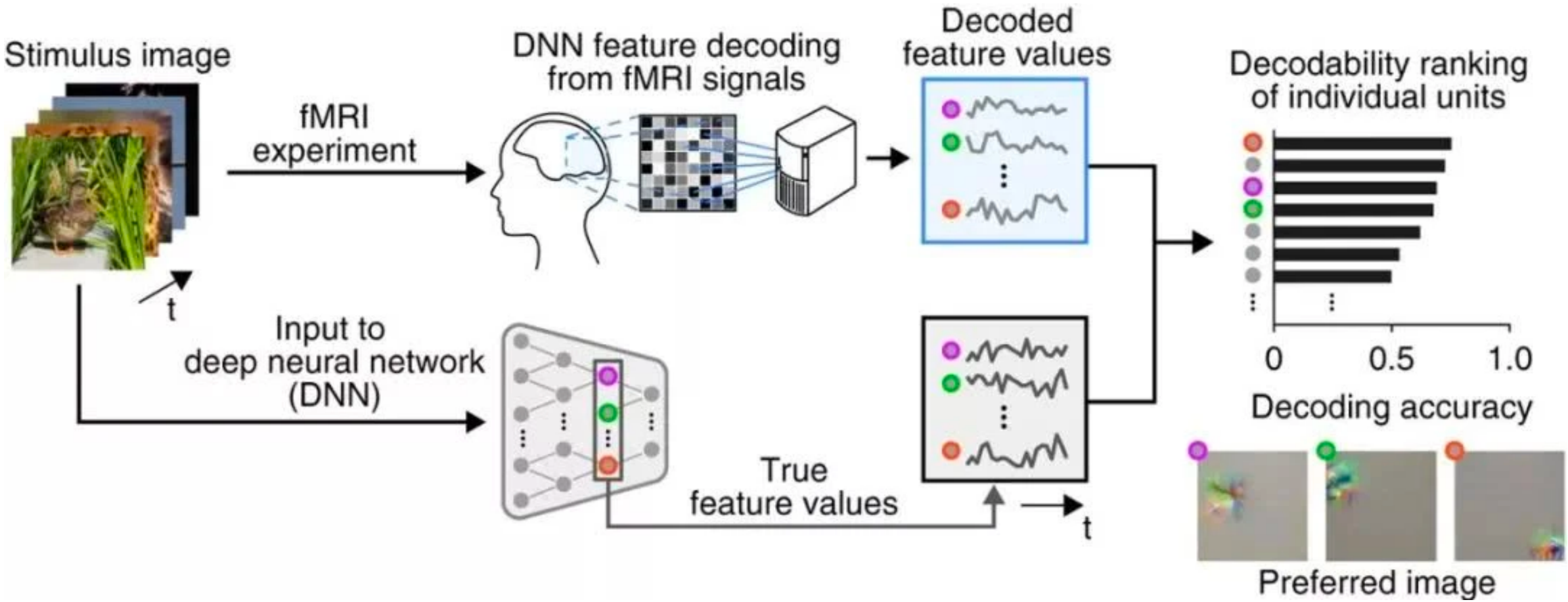


Integrated Gradients



Resources – Tensorflow

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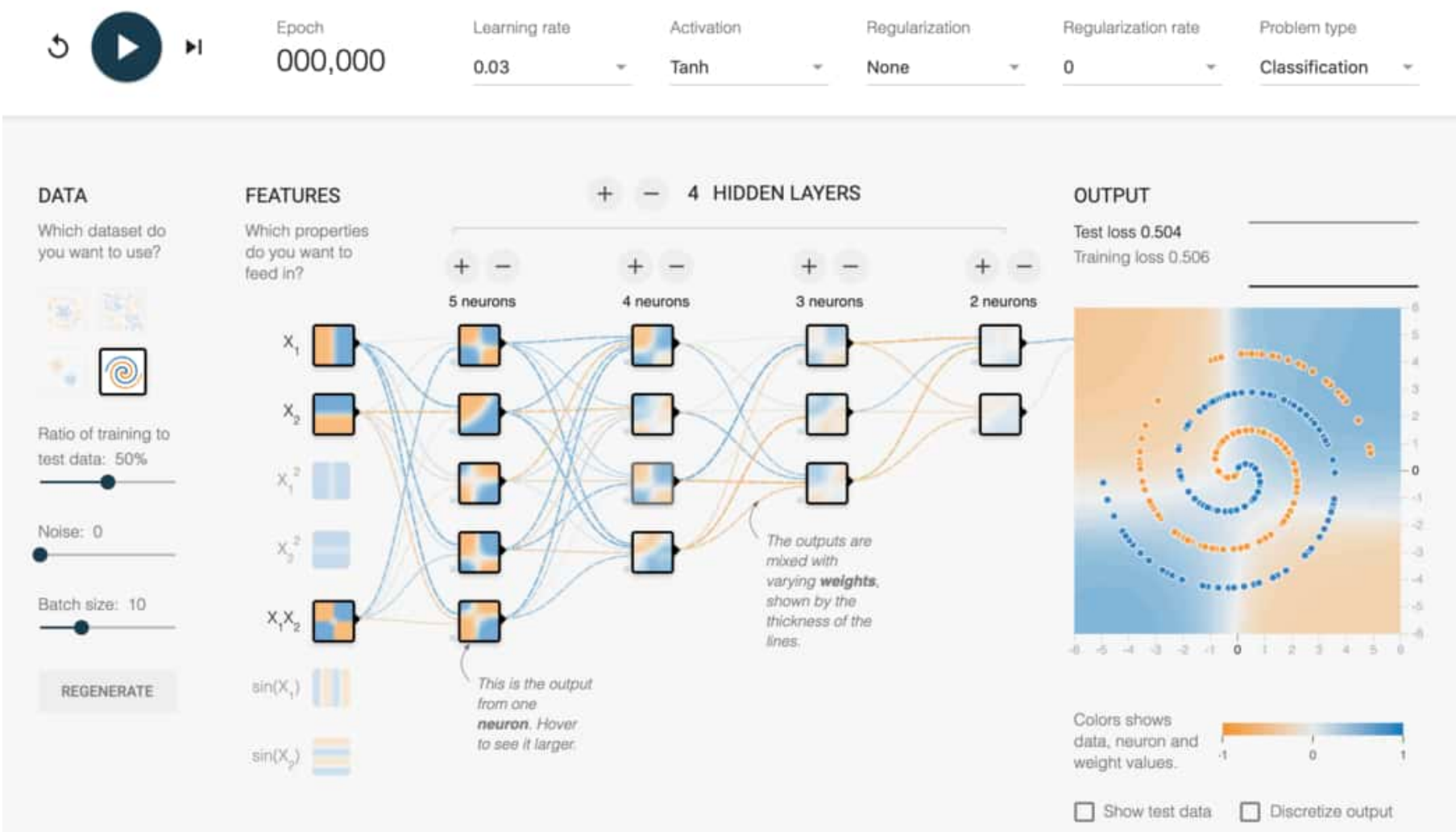

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Thank you

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