The Institution of Engineering and Technology

NOKIA

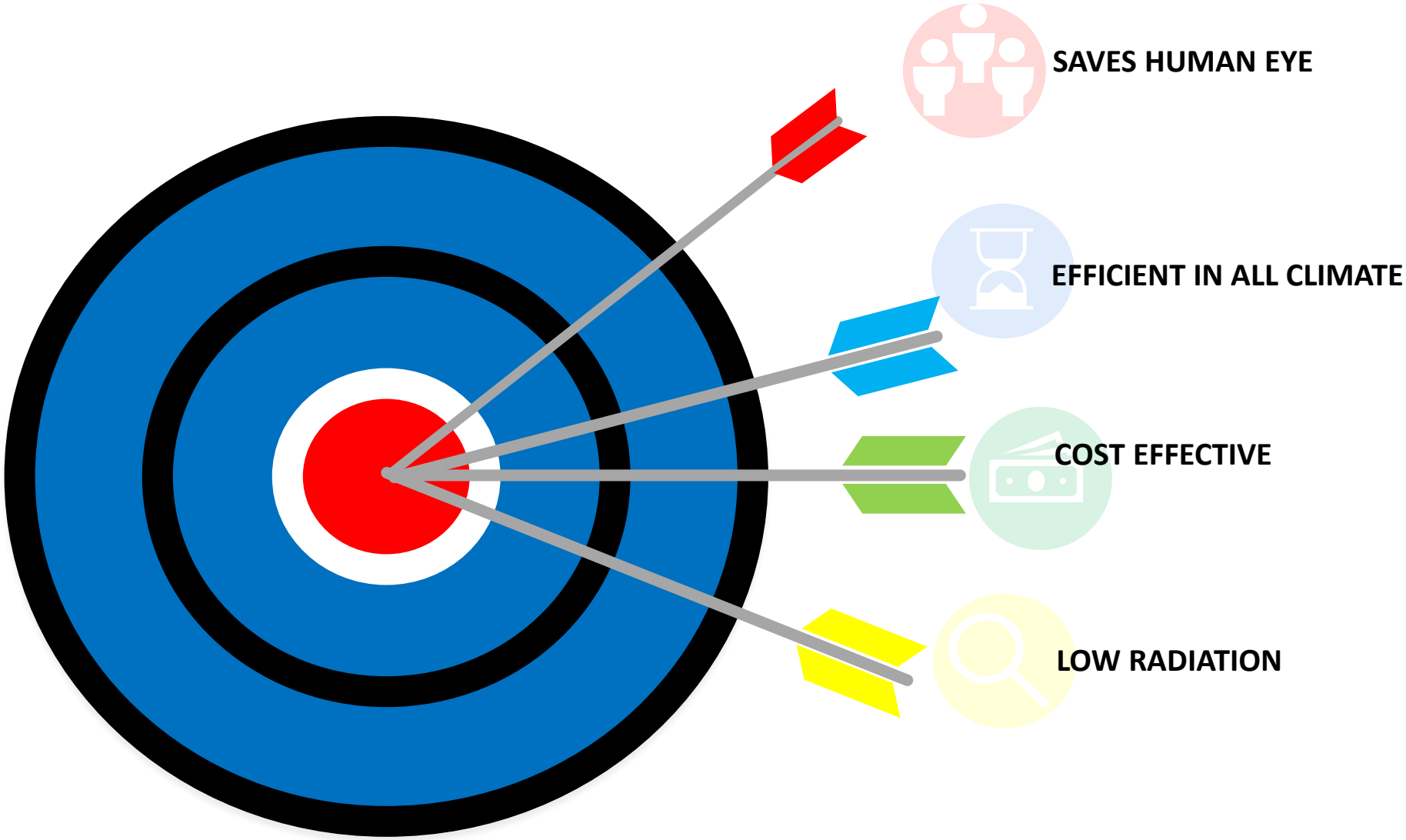
IET CLN SMART CITY CHALLENGE 2019

I-CAR

IETSC-14

Category: **Smart Transport**

Objective



SAVES HUMAN EYE

EFFICIENT IN ALL CLIMATE

COST EFFECTIVE

LOW RADIATION

Motivation

- ✓ Potential For Technology
- ✓ Inexpensive
- ✓ Should not have affect the human beings
- ✓ NO error
- ✓ Most major manufacturers like Tesla, GM, Ford, BMW, and Waymo/Google are working on building and testing different types of autonomous vehicles.

Motivation

ISSUES

- ✓ **Self-driving Uber** kills Arizona woman in first fatal crash involving pedestrian - **(Mon 19 Mar 2018 22.48 GMT)**
- ✓ **Tesla Motors** was the first to disclose a death involving a self-driving car in **2016** when the sensors of a Model S driving in autopilot mode failed to detect a large white 18-wheel truck and trailer crossing the highway. The car drove full speed under the trailer, causing the collision that killed the 40-year-old behind the wheel in the Tesla.
- ✓ When the **Uber** first began testing its **self-driving** cars in California in **2016**, the vehicles were caught running red lights, leading to a high-profile dispute between state regulators and the San Francisco-based corporation.

Problem Definition

01 AFFECTS HUMAN EYE IN CASES THE BEAM IS POWERFUL

02 ELEVATION ERRORS DUE TO INABILITY TO PENETRATE VERY DENSE FORESTS

03 INEFFECTIVE LOW HANGING CLOUDS

04 DEGRADED AT REFLECTIONS

05 INABILITY TO PENETRATE THICK VEGETATION

ABSTRACT

- ***Advanced control systems*** interpret sensory information to identify appropriate ***navigation paths , traffic signs and signals***.
- The ***car will understand*** the road surface and respond to all the ***curves and turns in the road***.
- These things are done ***with image processing, Recent advances in Deep Neural Networks (DNNs)*** have led to the development of DNN-driven autonomous cars (***I-CAR***).

Proposed Solution

I-CAR

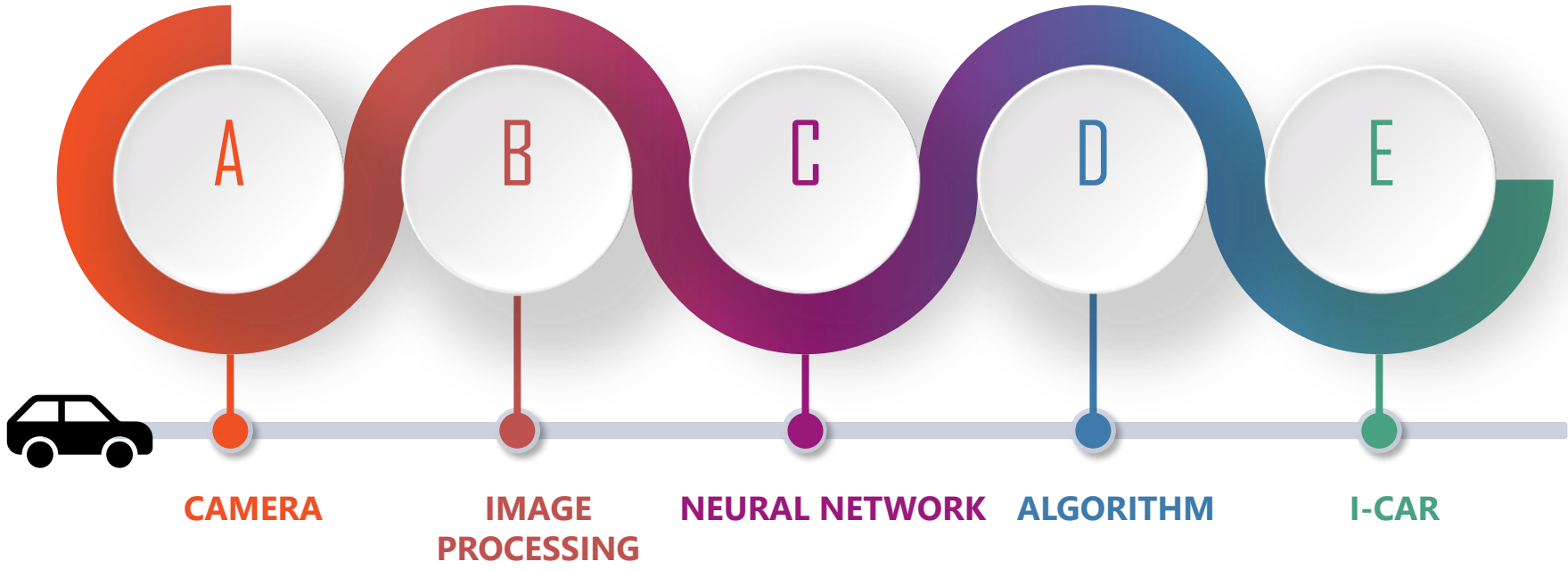


IMAGE PROCESSING

1. **COMPUTER VISION**
2. **THE PERCEPTRON**
3. **KERAS**

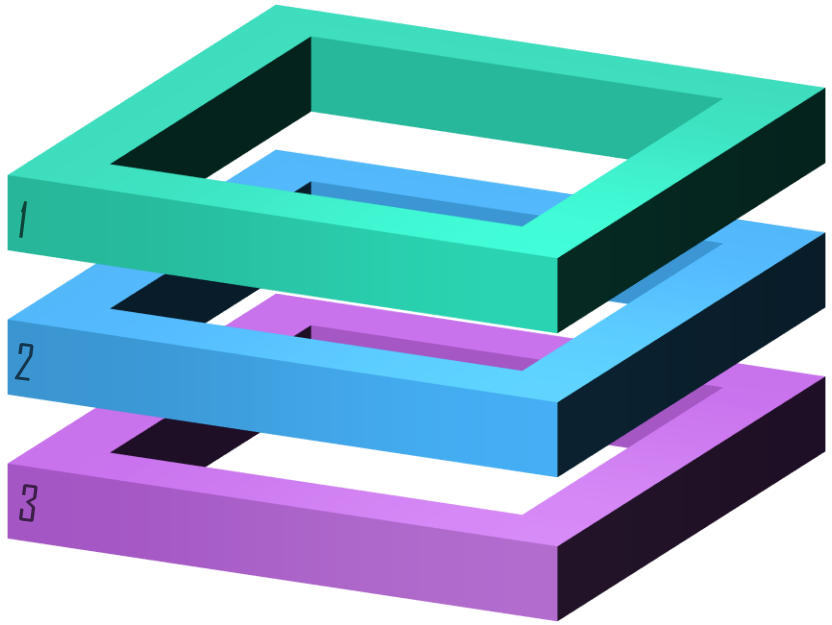
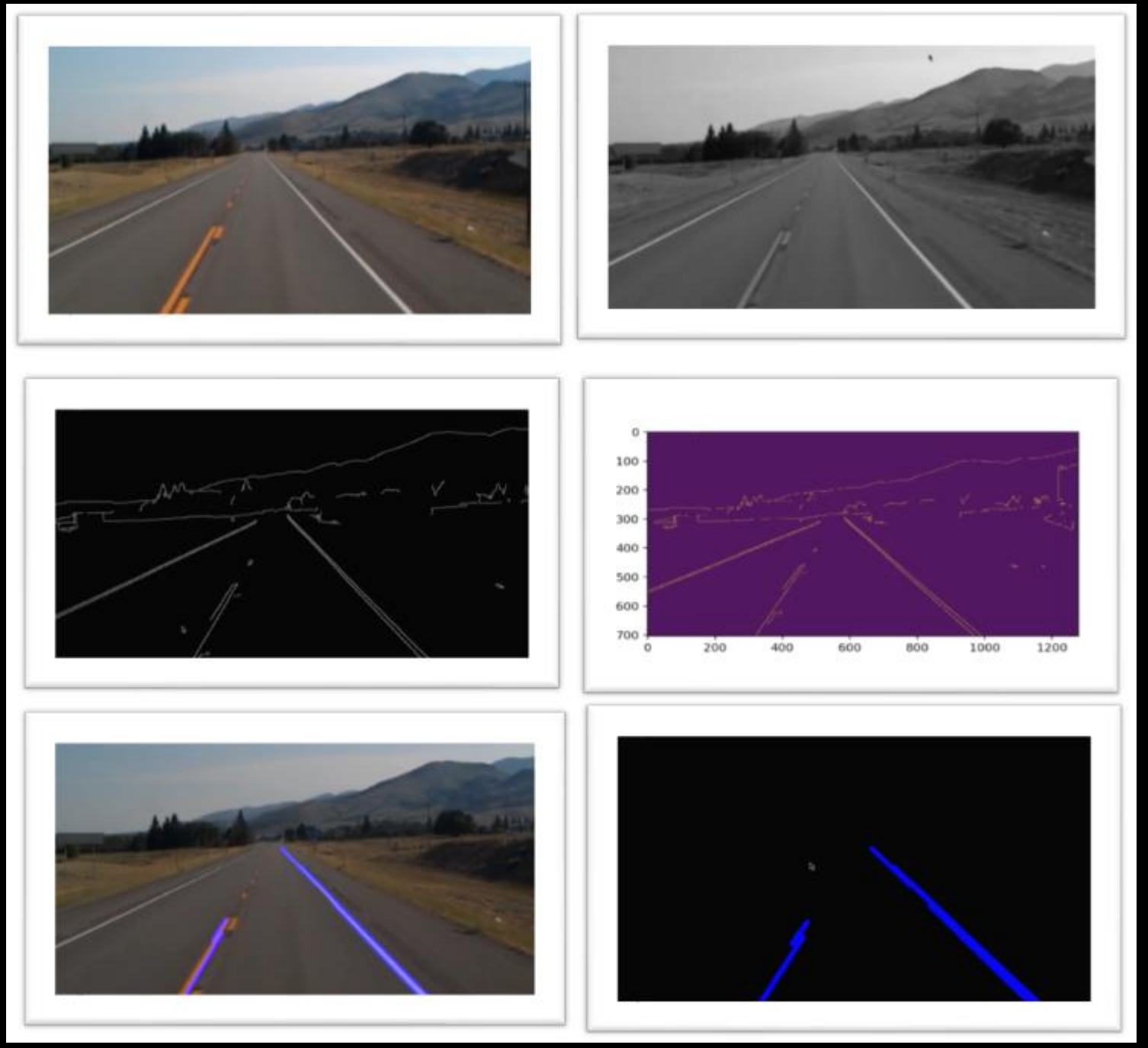


IMAGE PROCESSING



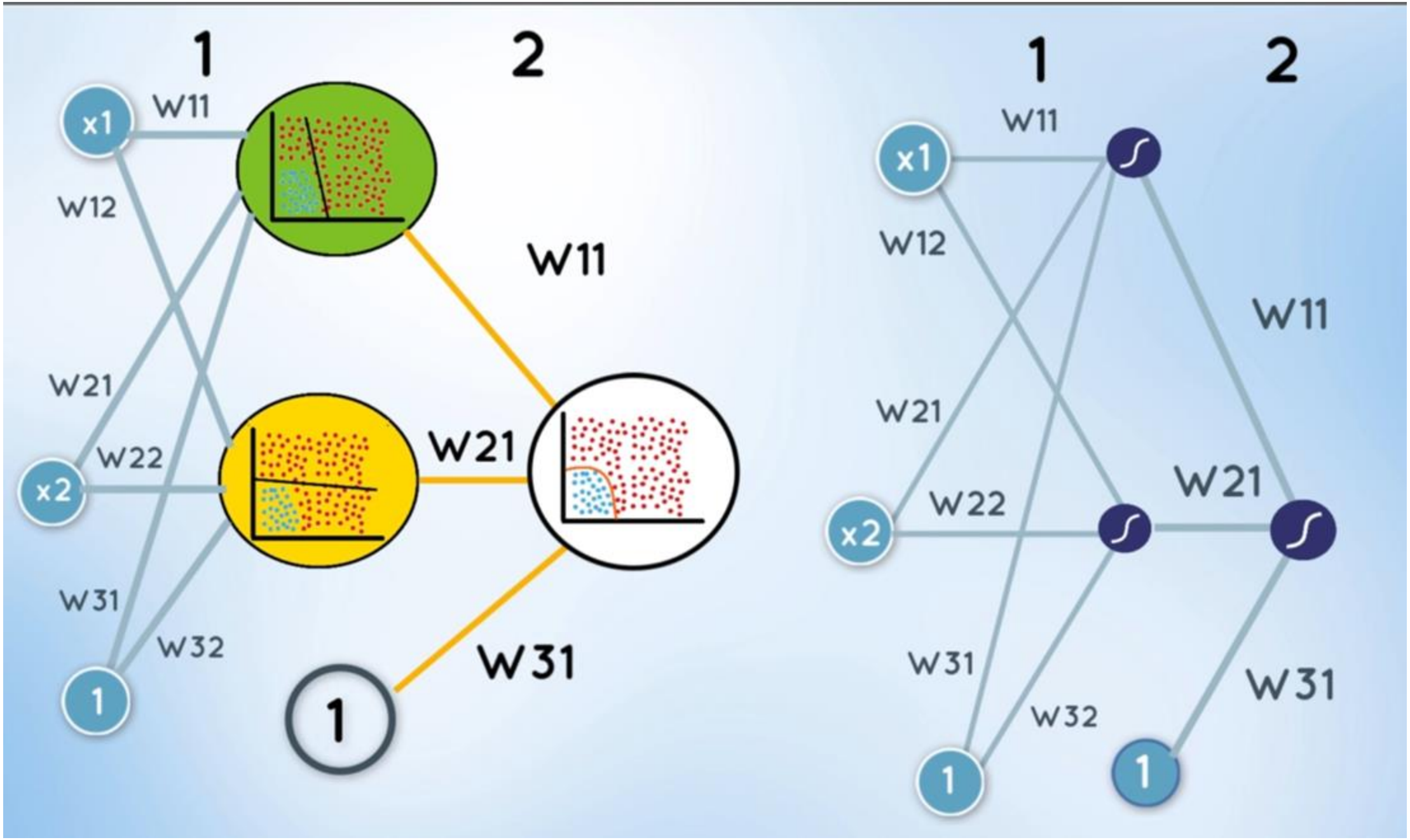
Proposed Solution

SMOOTH MAX

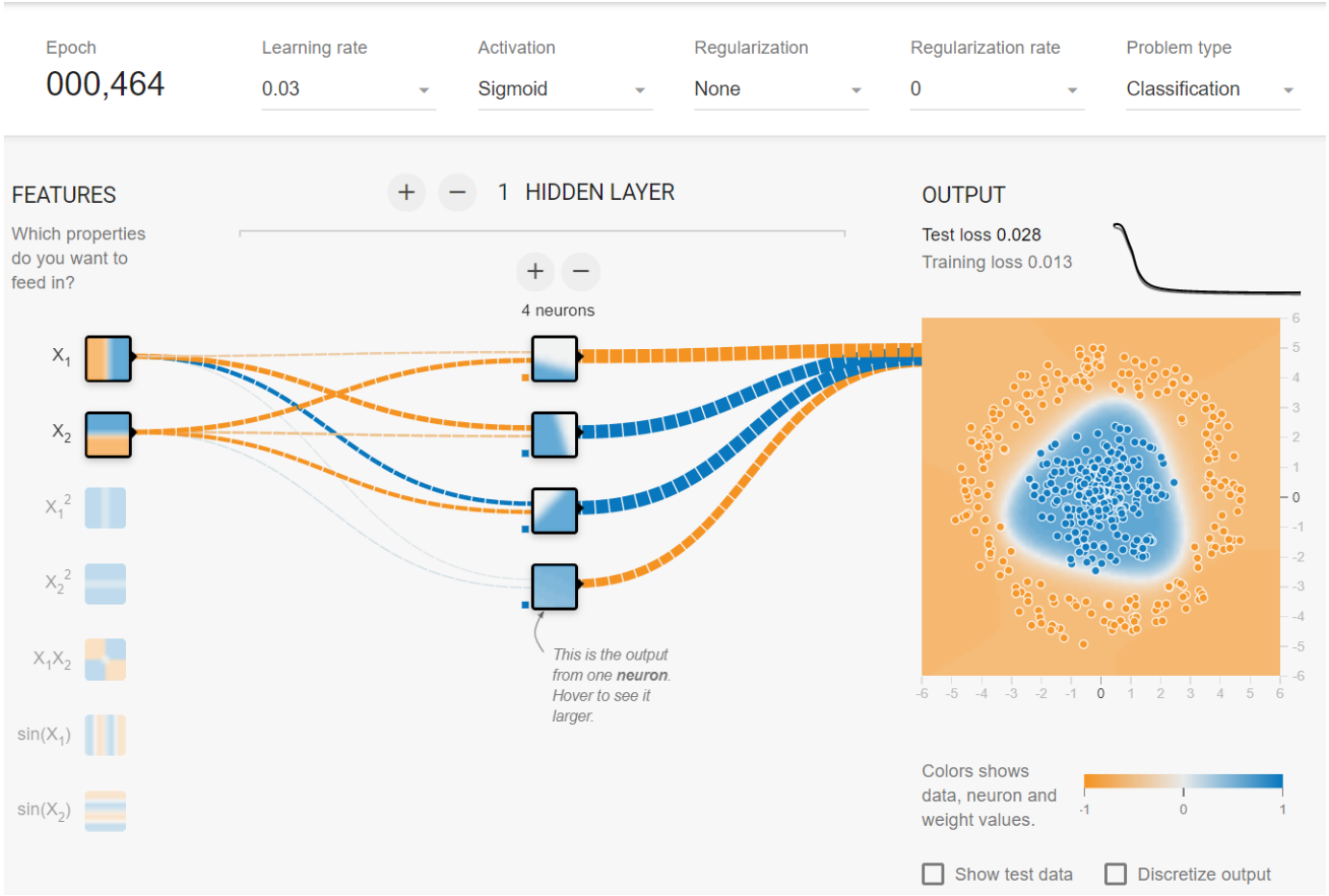
CROSS ENTROPY

MNIST

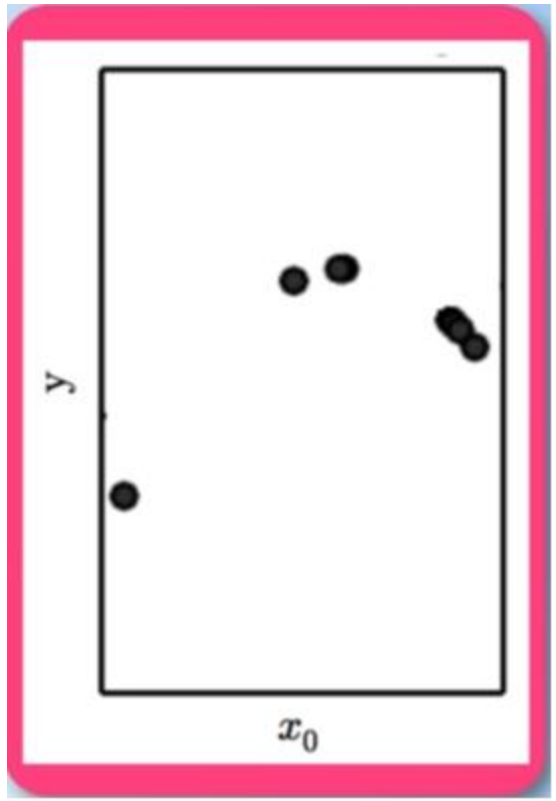
Le NET


1
2
x1
W11
W12
W21
W22
x2
W31
W32
1
W11
W21
W31
1
2
x1
W11
W12
W21
W22
x2
W31
W32
1
W11
W21
W31
1

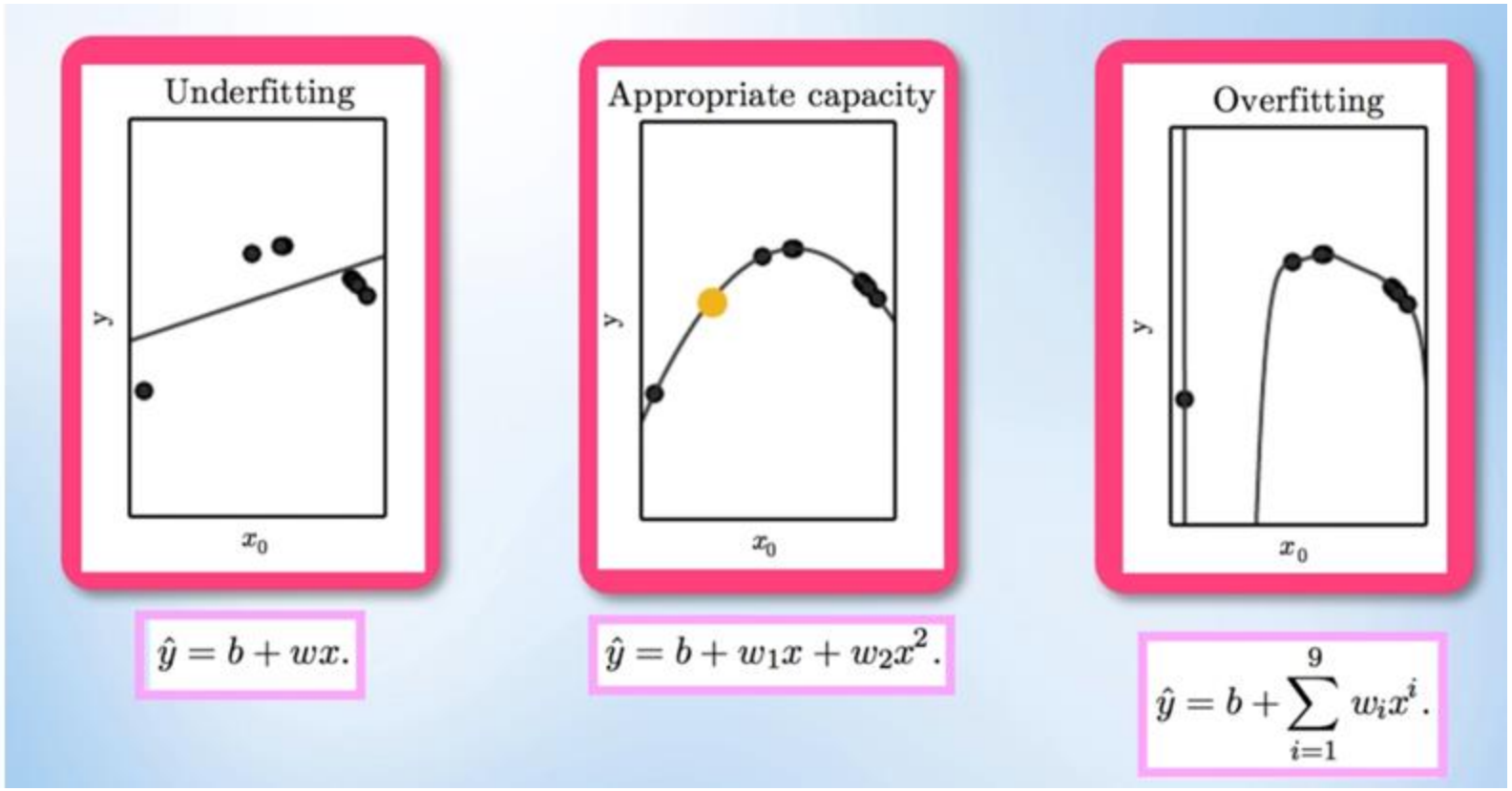
SMOOTH MAX


Epoch
000,464
Learning rate
0.03
Activation
Sigmoid
Regularization
None
Regularization rate
0
Problem type
Classification
FEATURES
Which properties do you want to feed in?
1 HIDDEN LAYER
4 neurons
X1
X2
X1²
X2²
X1X2
sin(X1)
sin(X2)
This is the output from one neuron. Hover to see it larger.
OUTPUT
Test loss 0.028
Training loss 0.013
Colors shows data, neuron and weight values.
-1
0
1
Show test data
Discretize output

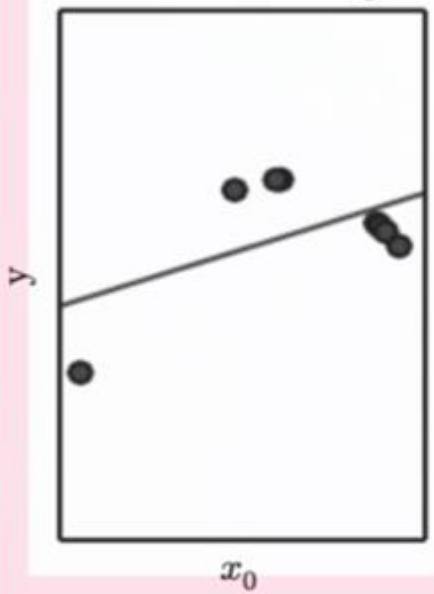
PROBLEM



METHODS TO SOLVE

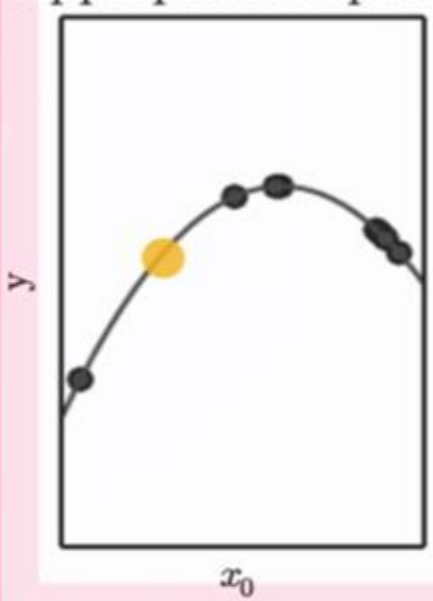


Underfitting



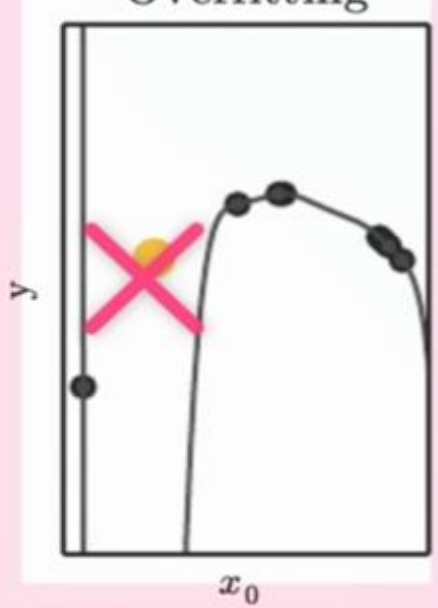
$$\hat{y} = b + wx.$$

Appropriate capacity



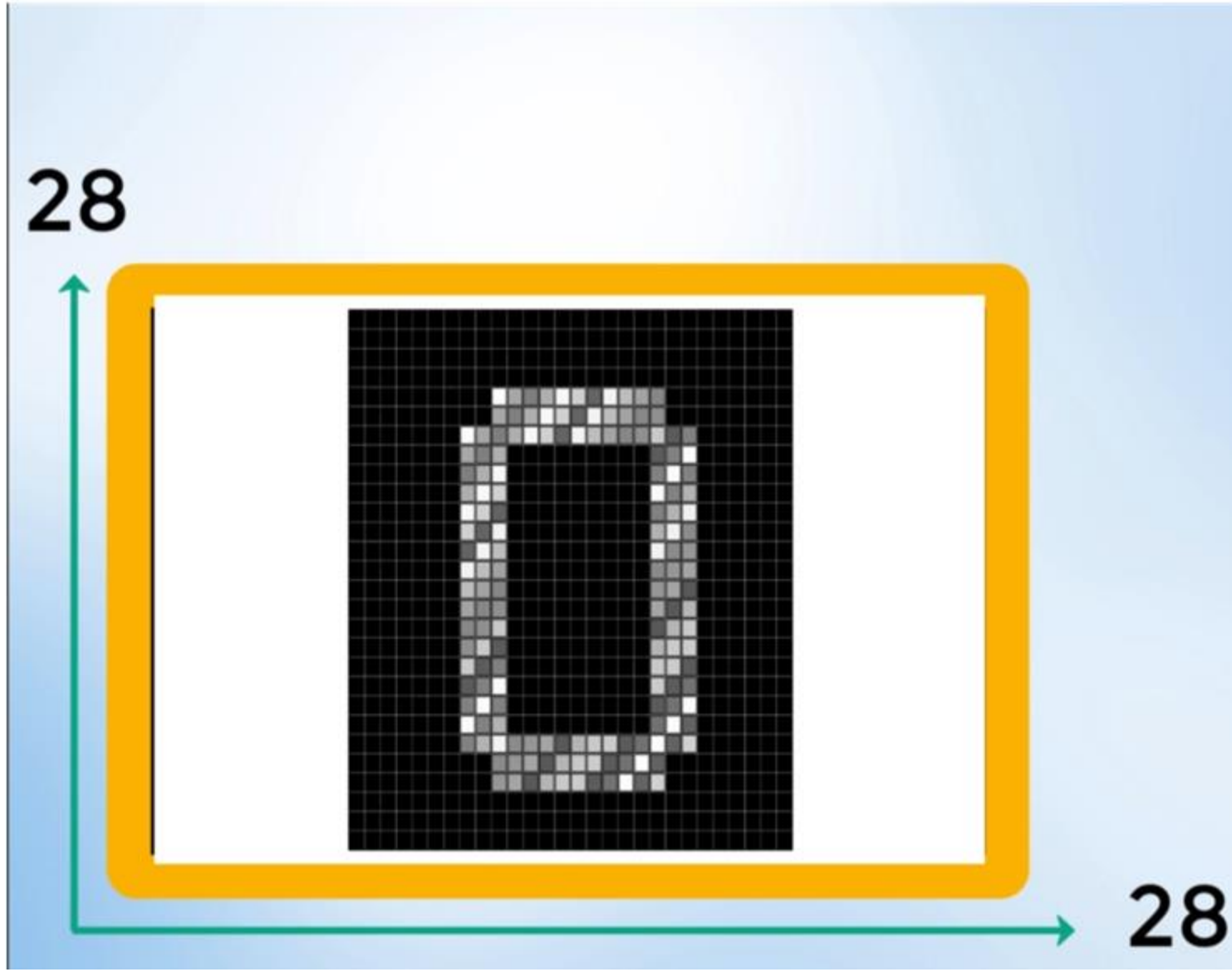
$$\hat{y} = b + w_1 x + w_2 x^2.$$

Overfitting

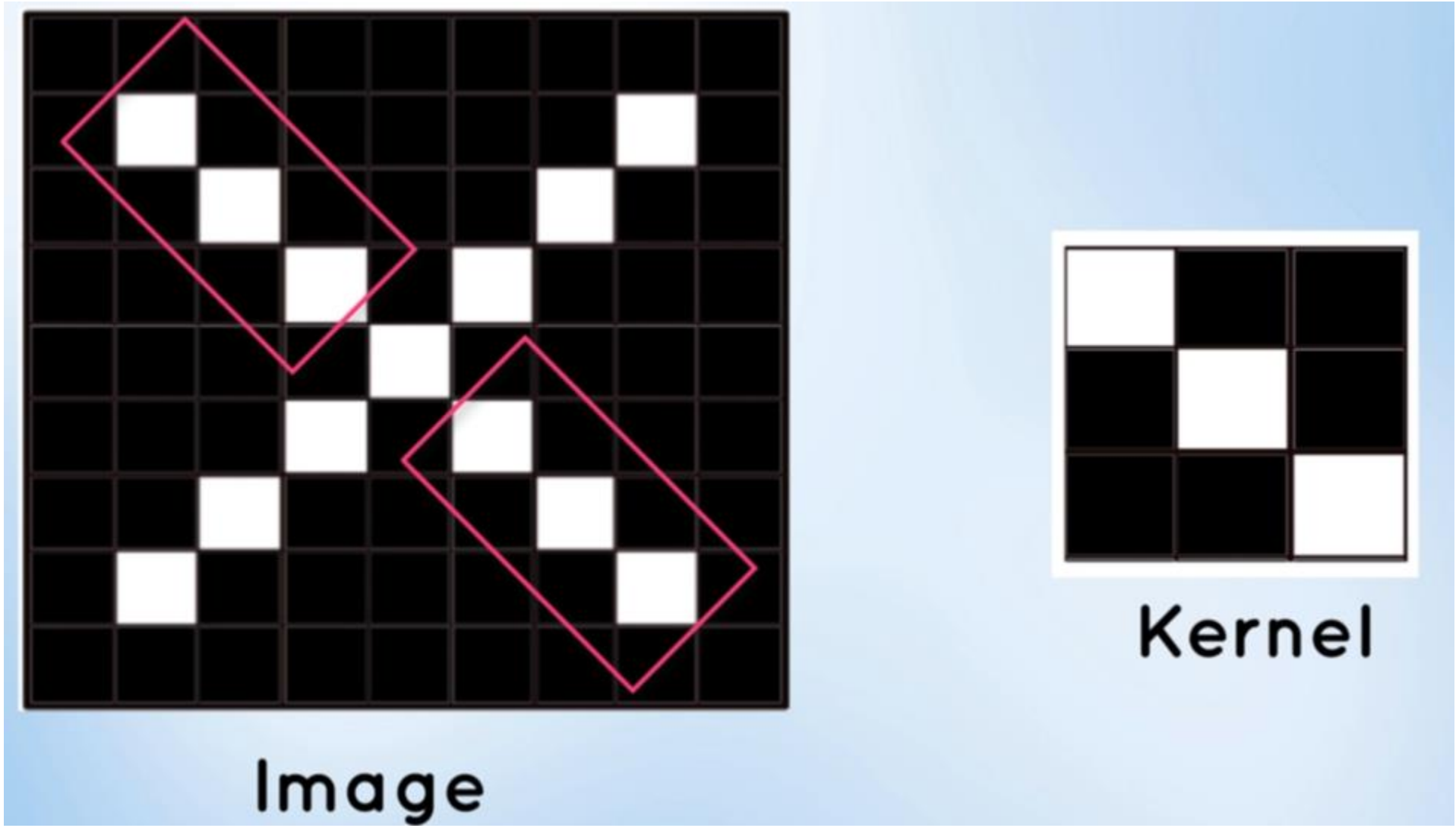


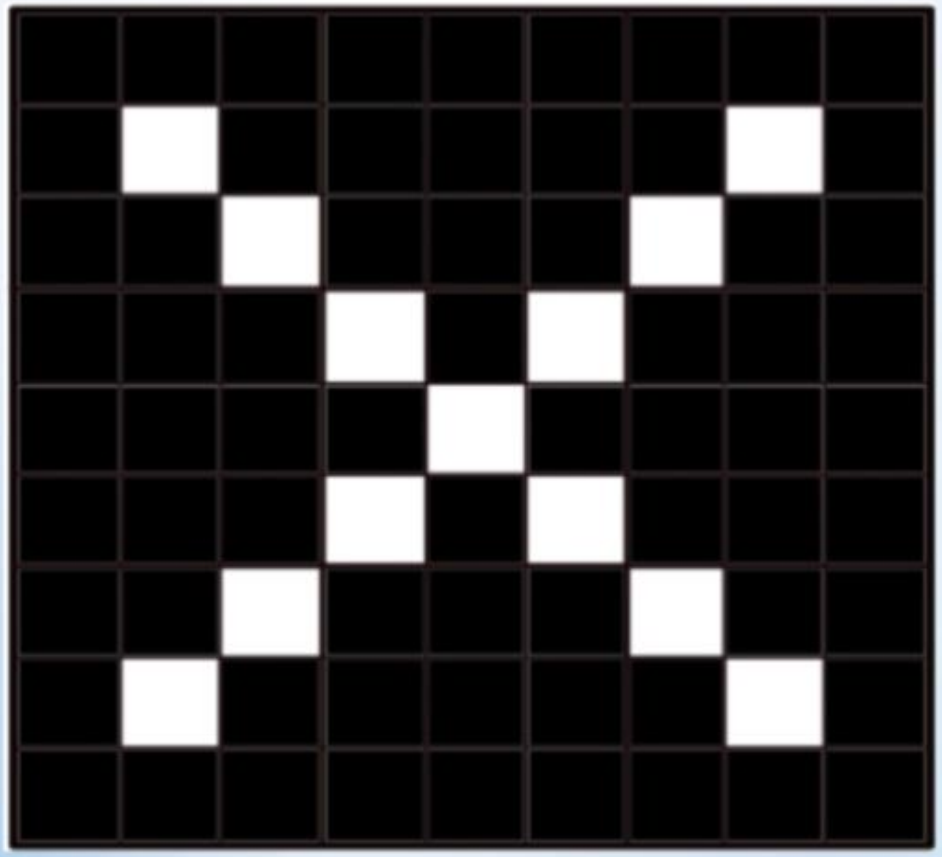
$$\hat{y} = b + \sum_{i=1}^{9} w_i x^i.$$

MNIST

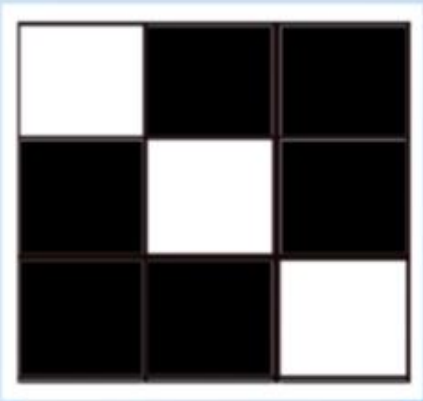

28
28

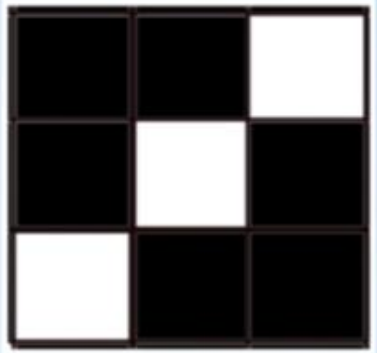
Le NET

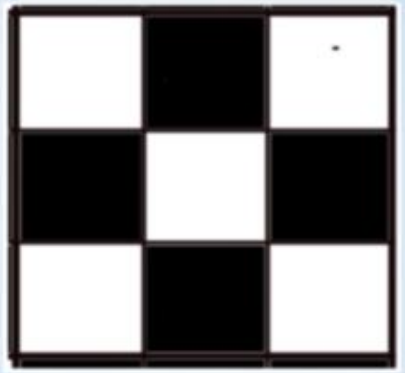


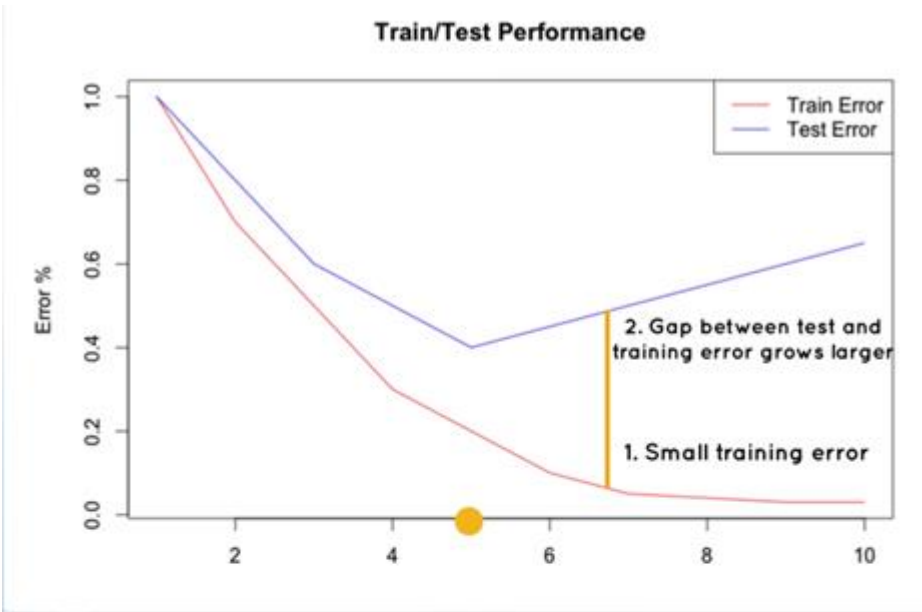


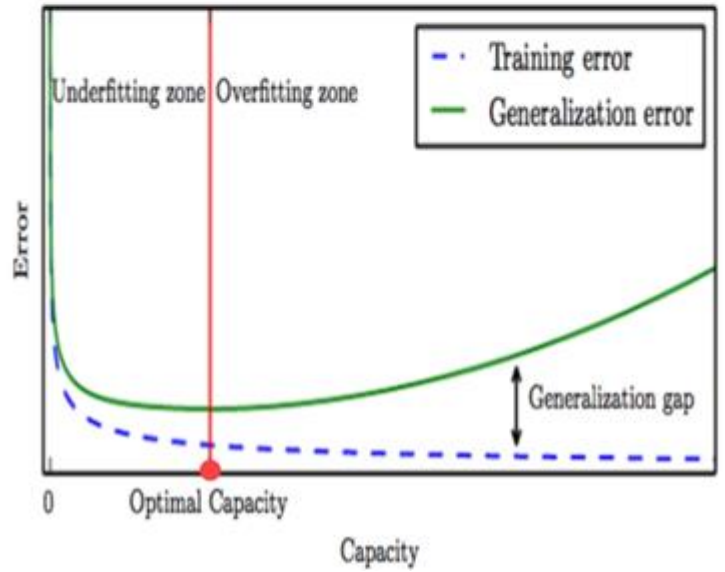
Image





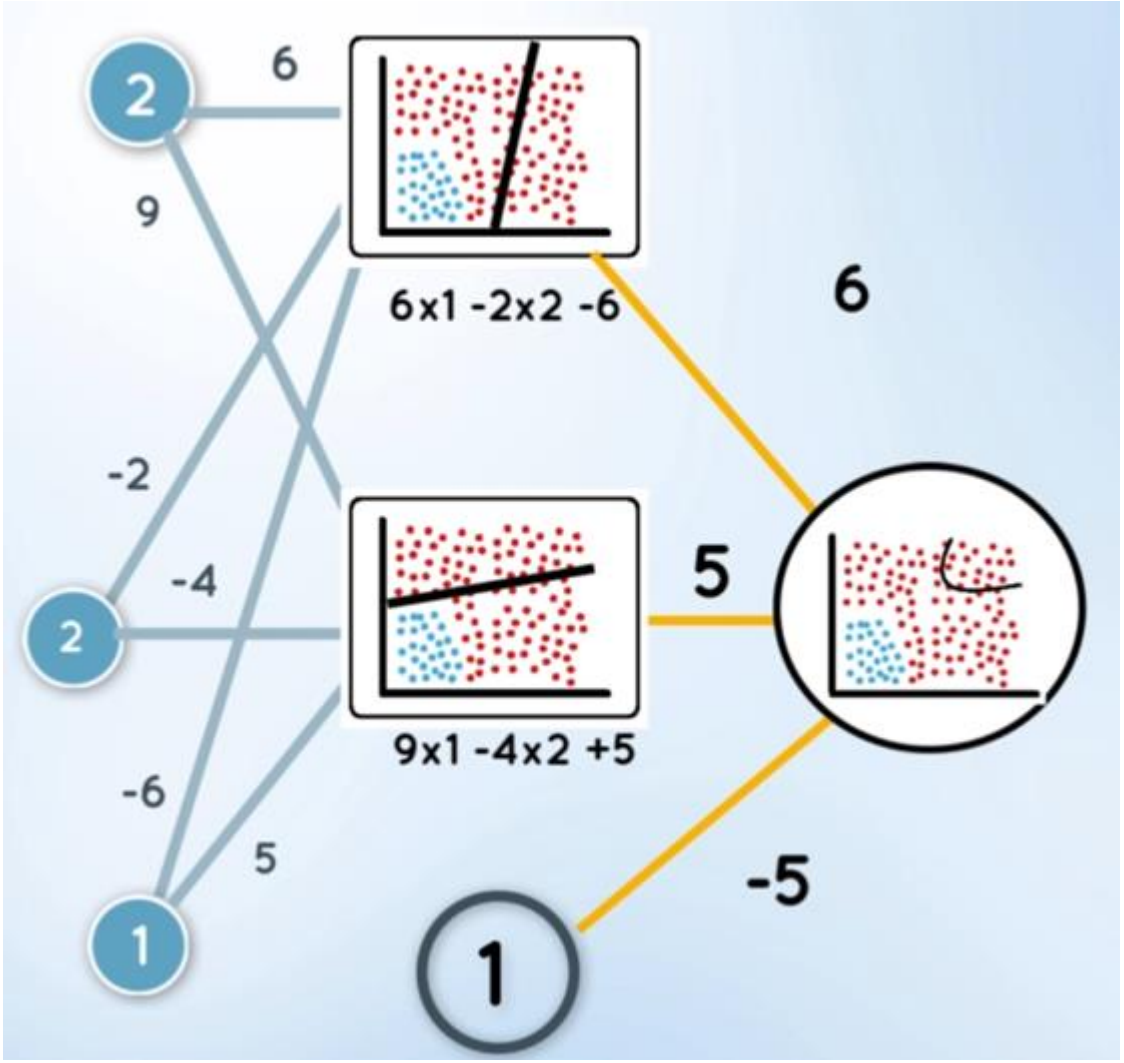


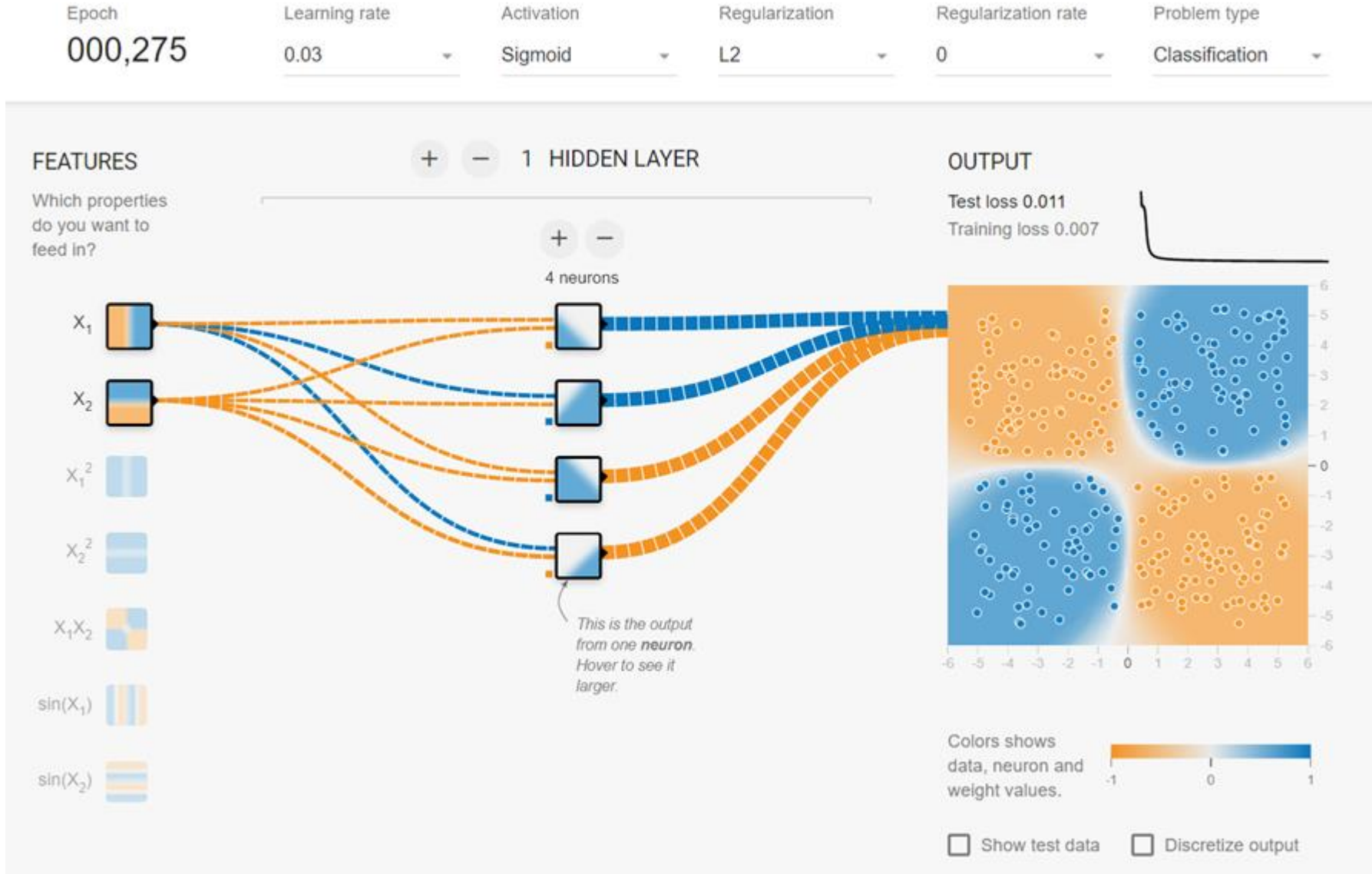

Train/Test Performance
Train Error
Test Error
Error %
0.0
0.2
0.4
0.6
0.8
1.0
2
4
6
8
10
2. Gap between test and training error grows larger
1. Small training error

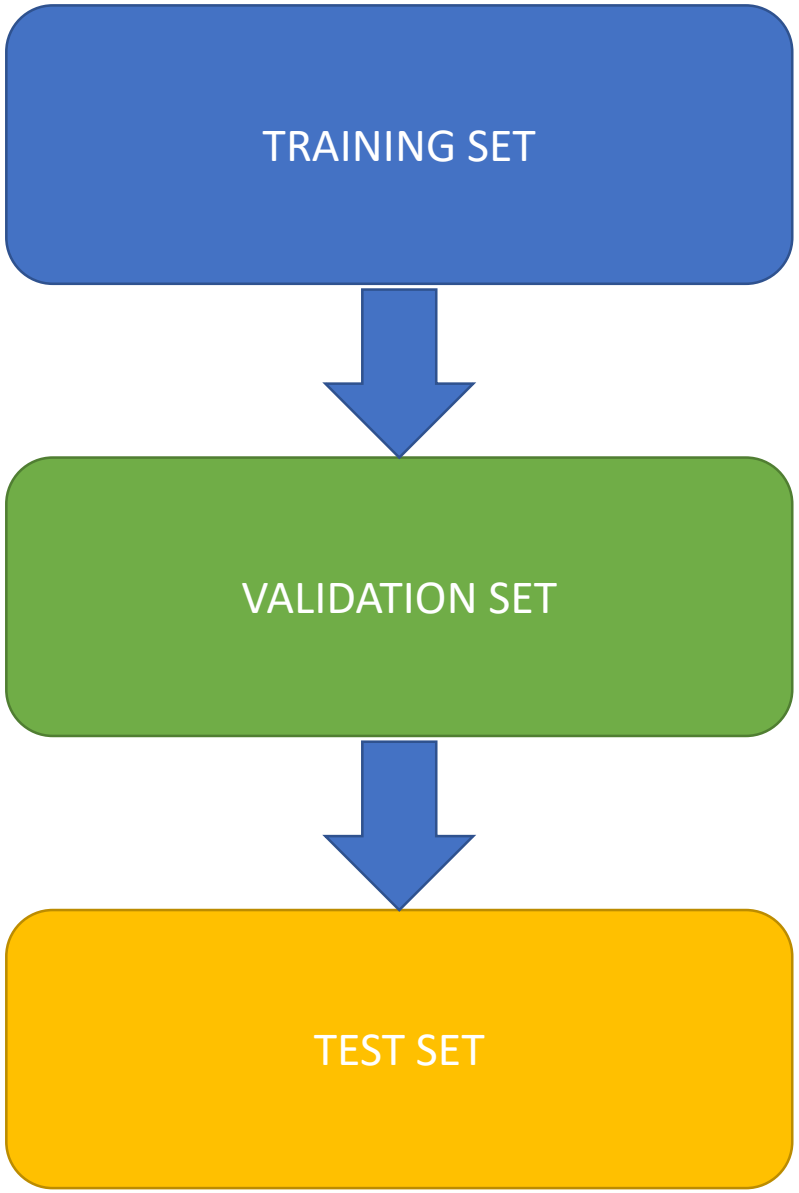

Training error
Generalization error
Underfitting zone
Overfitting zone
Error
Generalization gap
0
Optimal Capacity
Capacity

ERRORS

CROSS ENTROPHY




Epoch
000,275
Learning rate
0.03
Activation
Sigmoid
Regularization
L2
Regularization rate
0
Problem type
Classification
FEATURES
Which properties do you want to feed in?
1 HIDDEN LAYER
4 neurons
X1
X2
X1²
X2²
X1X2
sin(X1)
sin(X2)
This is the output from one neuron. Hover to see it larger.
OUTPUT
Test loss 0.011
Training loss 0.007
Colors shows data, neuron and weight values.
Show test data
Discretize output


TRAINING SET
VALIDATION SET
TEST SET

Proposed Solution

PREDICTED OUTPUT

Problem in Implementation

HIGHLY EFFICIENT CONTROL UNIT

HIGH DEFINITION CAMERA

THANK YOU

REFERENCE

- Goodall, Noah (June 2016). "Can you program ethics into a self-driving car?". *IEEE Spectrum*. **53** (6): 25–28. doi:10.1109/MSPEC.2016.7473149.
- *Maki, Sydney; Sage, Alexandria (19 March 2018). "Self-driving Uber car kills Arizona woman crossing street". Reuters. Retrieved 14 April 2019.*
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- Rosen, Rebecca (9 August 2012). "Google's Self-Driving Cars: 300,000 Miles Logged, Not a Single Accident Under Computer Control". *The Atlantic*. Retrieved 10 August 2012.