



EPFL *u^b* **UNIVERSITÄT
BERN** **ETH** zürich
SWISS NATIONAL HACKATON

MATLAB Student Ambassadors

Victor Pennacino
Théophine Gurlie

victor.pennacino@epfl.ch
theophine.gurlie@epfl.ch



MathWorks Contact

Res Joehr

resjoehr@mathworks.com

MATLAB Student Ambassadors

Daniel Tran
Carina Käser

tranda@ethz.ch

cakaeser@ethz.ch

MathWorks Contact

Res Joehr

resjoehr@mathworks.com





MATLAB Student Ambassador

Amith Kamath amith.kamath@unibe.ch

MathWorks Contact

Res Joehr resjoehr@mathworks.com



SESSION OVERVIEW

6pm-6:45pm	Introduction to Deep Learning on MATLAB
6:45pm-7pm	Hackathon presentation
7pm-8:30pm	Pizza, Q&A + Beginning of Hackathon!

DEEP LEARNING IN MATLAB

Part I: *Intro to Deep Learning*

Neural networks

Deep learning

Machine Learning vs Deep Learning

Convolutional Neural Networks

Part II: *MATLAB Features*

Deep Learning applications

Neural Network Designer

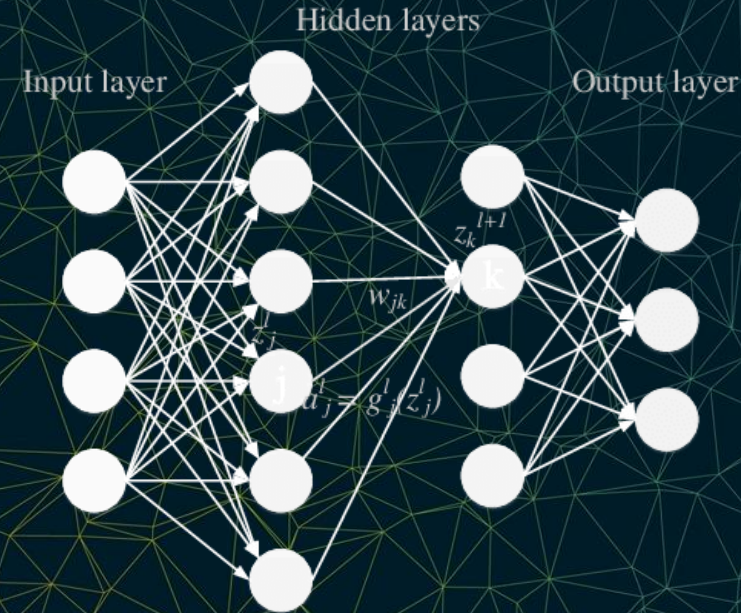
Transfer Learning

Part III: *Hackathon presentation*

Background info

Workflow

SIMPLE NEURAL NETWORK



Main points:

Composed of node layers simulating the human brain (Artificial Neural Network)
 Each node as a linear regression model
 Rely on training data to increase accuracy (modifies weights & thresholds using gradient decent on a cost function)

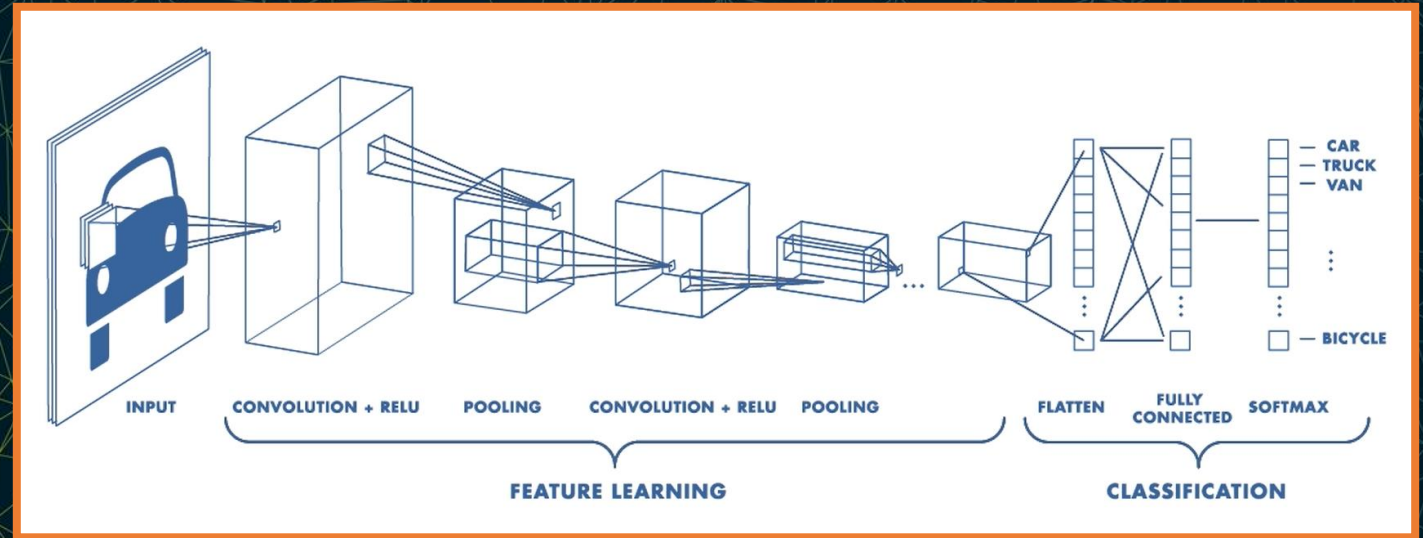
Weights and biases:

$\sum w_i x_i + \text{bias} = w_1 x_1 + w_2 x_2 + w_3 x_3 + \text{bias}$
 output = $f(x) = 1$ if $\sum w_1 x_1 + b \geq 0$; 0 if $\sum w_1 x_1 + b < 0$

Architecture:

Data passed between nodes as a feed forward network
 Different types of architectures for other purposes (CNN for pattern recognition, RNN for retaining information)

DEEP LEARNING



Applications:

Machine vision, Robotics, Generative models (NLP...), Regression ect.

Main idea:

ML technique that learns features from data (images, text, sounds...)
End to end learning -> Does not rely on intermediate handcrafted features

Justification:

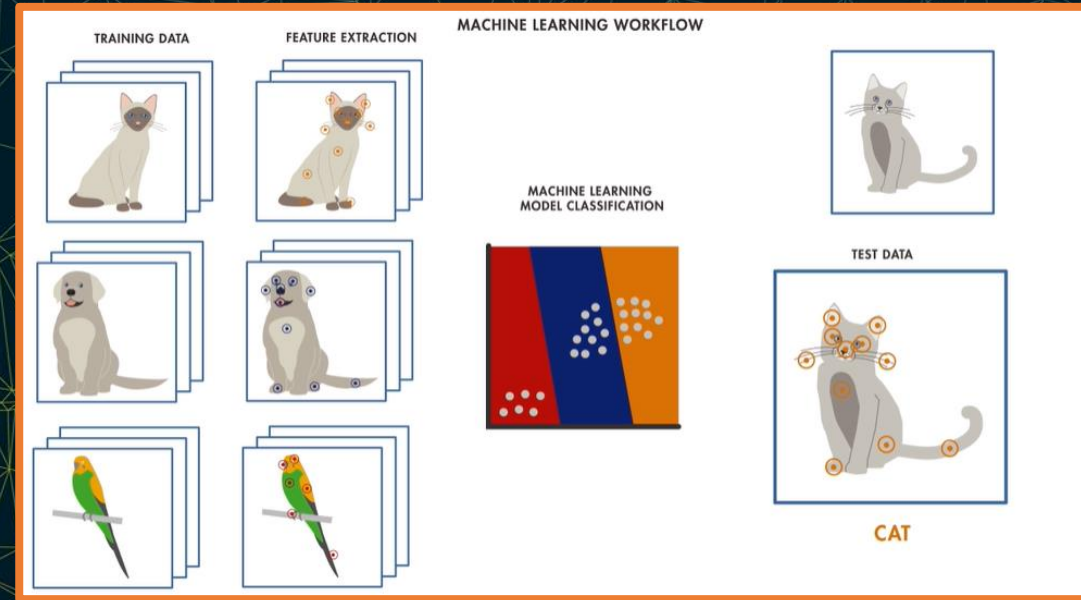
Higher precision than humans in certain classification tasks, less demanding feature engineering
More accessible computational hardware nowadays

Deep Learning refers to the number of hidden layers in the network -> 120 for GPT4, 1.8 trillion parameters!

To train and modify weights -> Backpropagation algorithm, but that's a little too long to explain right now

ML vs DL

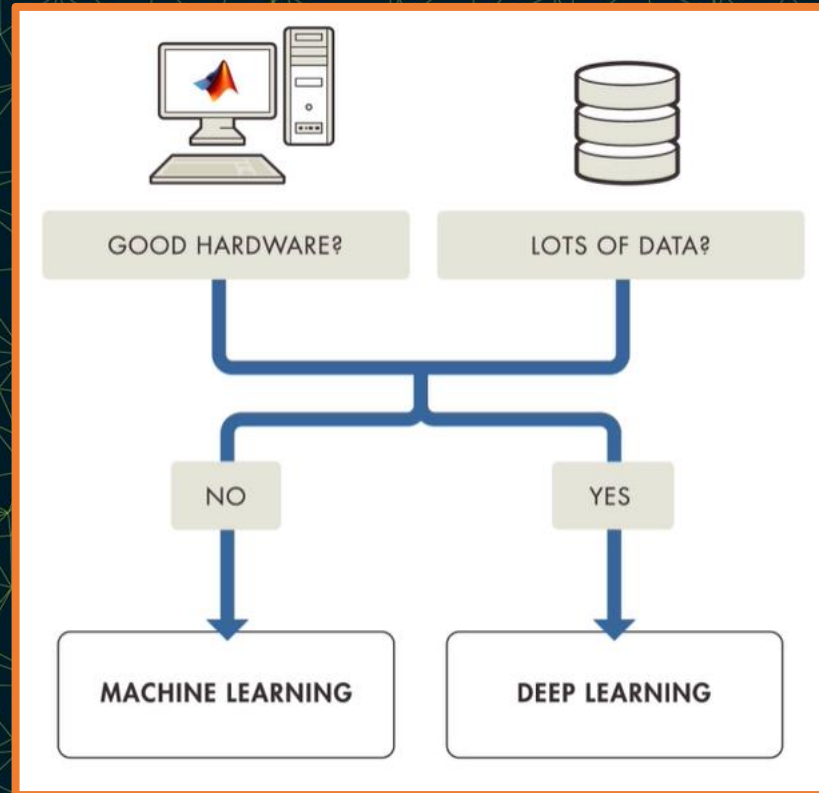
Image classification



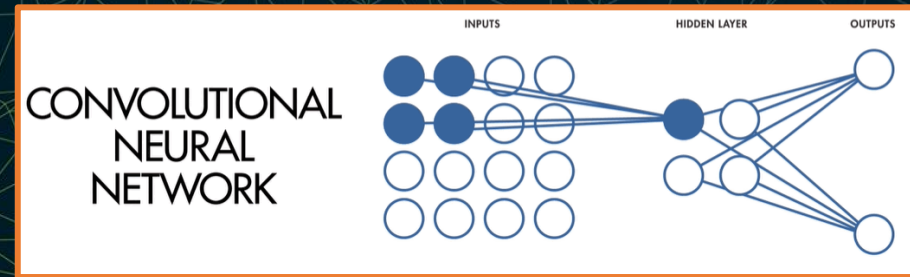
ML workflow: Manually select edges and features
 Train the model (KNN, SVM, K-means...)
 Model then references features for new objects

DL workflow: Skip manual feature extraction, DL takes care of it and can repeat after DL

	Machine Learning	Deep Learning
Training dataset	Small	Large
Choose your own features	Yes	No
# of classifiers available	Many	Few
Training time	Short	Long



CNN



In Machine Vision:

Scene classification
Object detection & segmentation (visualizing sub elements of a picture)
Image processing

Local receptor fields:

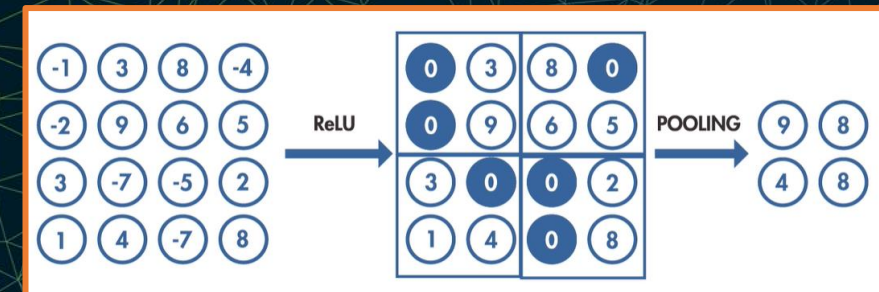
Small regions of input layers connected to regions of input layers
Receptive field convoluted across the image to extract features of image

Shared weights & Biases:

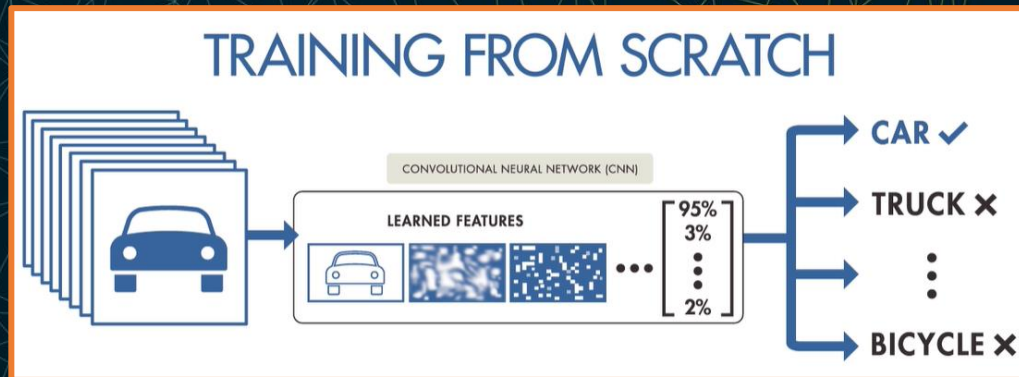
CNN weights and values are the same for each hidden layer detecting a specific feature
Test each region for the same trained feature (feature ID independent from translations)

Activation & pooling :

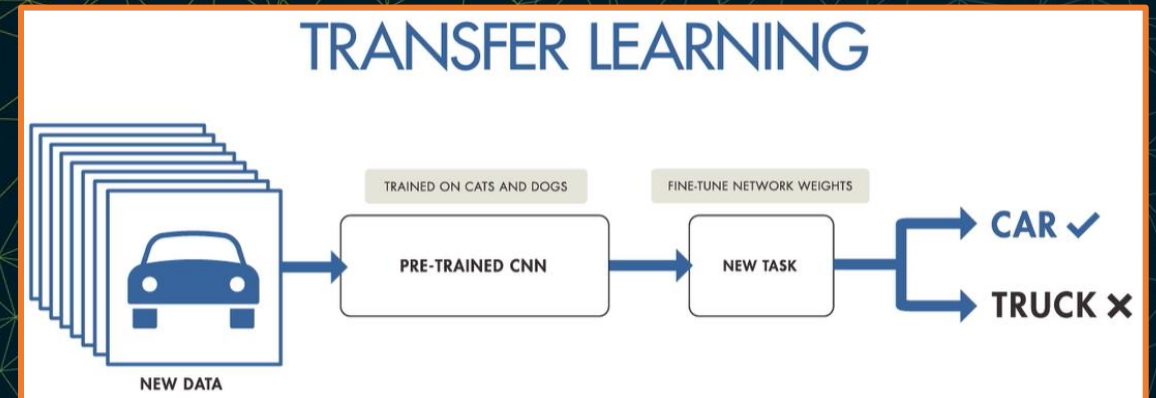
Simplifying the inputs
to facilitate feature
extraction



TRANSFER LEARNING



Classification for different objects share some common features
 Eg: NN used to differentiate animals -> NN to differentiate cars



MATLAB FEATURES

For you to discover

Data preprocessing

Deep Network Designer

Transfer learning

Image processing

Main image processing needs for DL

Facilitate NN design

Rely on a variety of pretrained networks

Any kind of image modification you can think of

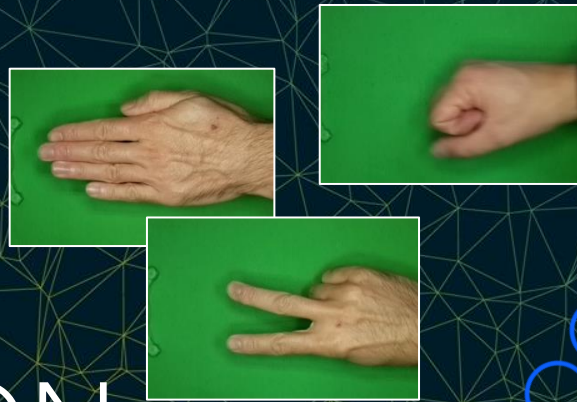
HACKATHON PRESENTATION

Part 1: *Problem definition*

- Resources
- Goal

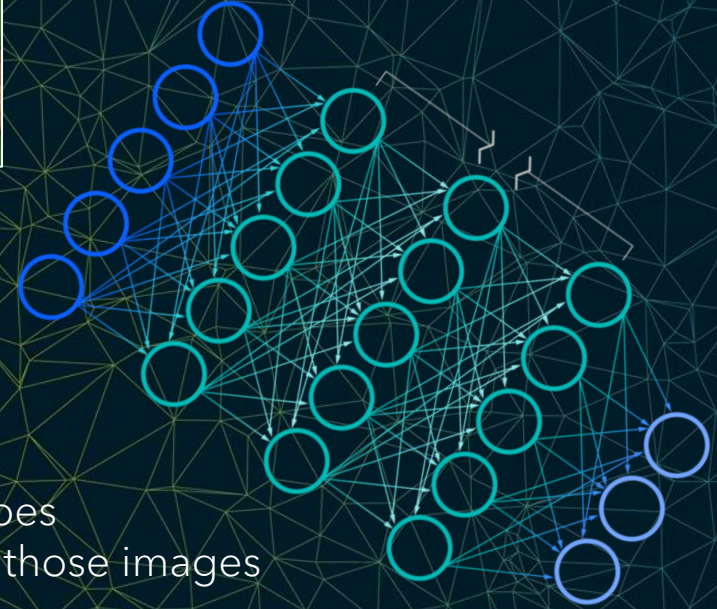
Part 2: *Basic information*

- Dates
- Teams
- MATLAB online



PROBLEM DEFINITION

- Goal:* Classify Rock-Paper-Scissors images
- Resources:* Green screen images of Rock, paper scissor hand shapes
A simple script to train and test an RS18 NN based on those images
MATLAB Deep learning toolbox
MATLAB Image processing toolbox
- Winner:* Best performance on a hidden set of images (real backgrounds, different illuminations...)
- Bonus points:* If you have developed an additional MATLAB application
eg: A visual interface for the data... Try using the MATLAB app builder!



Part III: Hackathon Presentation



HIDDEN TEST SET
SAMPLE



Part III: Hackathon Presentation

BACKGROUND INFO

<i>When:</i>	26 th of September-5 th of October (Online event)
<i>Testing your NN:</i>	Test your trained .mat file against our secret database using the provided script Results are uploaded Live to a Leaderboard -> Track your progress vs others!
<i>Teams:</i>	Max 4 people Financial prizes (if any) are to be shared between team members
<i>Prizes:</i>	<i>Top 1:</i> 200 .- in gift cards (to choose from ...) <i>Top 2:</i> 100 .- in gift cards (to choose from ...) <i>Top 3:</i> 50 .- in gift cards (to choose from ...) <i>Top 4-5:</i> MATLAB mug/shirt + cap <i>Top 5-10:</i> MATLAB goodies



Part III: Hackathon Presentation

NITTY-GRITTY

Scan this for access to the drive:

(Necessary data, intro script,
Info on MATLAB licenses...)

MISSING
BARCODE

WORKFLOW

- 1) Choose the base network
- 2) Import data to create Datastore
- 3) Setting up network (manually, or through Graphical Network Designer)
- 4) Train Network
- 5) Test Network (locally)
- 6) Test Network against secret database

Results

Validation accuracy: 99.08%
Training finished: Stopped manually

Training Time

Start time: 11-Aug-2023 08:59:51
Elapsed time: 23 min 45 sec

Training Cycle

Epoch: 2 of 4
Iteration: 16 of 40
Iterations per epoch: 10
Maximum iterations: 40

Validation

Frequency: 5 iterations

Other Information

Hardware resource: Single CPU
Learning rate schedule: Constant
Learning rate: 0.0001



QUESTIONS



REGISTER NOW





TEST PHASE

RESSOURCES

Covered during this presentation

[Overview on DL](#)

What is Deep Learning

Machine Learning vs Deep learning

Convolutional Neural Networks

Brief overview of MATLAB DL features

[Image processing](#)

[Neural Network Designer](#)

[Transfer learning](#)

[Neural networks](#)

Additional content

[Image processing example](#)

[Deep learning applications](#)

[Neural networks series by 3blue1brown](#)



THANK YOU FOR LISTENING
AND...
HAPPY CODING

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