DRIVES

Development and Research on Innovative Vocational Education Skills

U3 DEEP LEARNING AND NEURAL NETWORKS

U3.E7 DEEP LEARNING APPLICATIONS AND REAL-LIFE EXAMPLES

Artificial Intelligence Technician

March 2021, Version 1

Co-funded by the Erasmus+ Programme of the European Union

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LEARNING OBJECTIVES

The student is able to

AIT.U3.E7.PC1	Know different application domains of deep learning.
AIT.U3.E7.PC2	Explore and analyse several examples and applications of deep learning.
AIT.U3.E7.PC3	Understand the challenges surrounding deep learning approaches.
AIT.U3.E7.PC4	Identify the ingredients required to start a deep learning project.
AIT.U3.E7.PC5	Train a deep neural network.
AIT.U3.E7.PC6	Know how to deploy deep neural networks into applications.
AIT.U3.E7.PC7	Identify techniques for improving the performance of deep learning applications.
AIT.U3.E7.PC8	Recognize the challenges and the importance of deep learning.

DEEP LEARNING APPLICATION DOMAINS

Healthcare

Marketing

Military

Education

Finance

Retail

Healthcare

1. Drug Discovery
2. Medical Imaging
3. Insurance Fraud
4. Disease Prediction
5. Smart Health Record

Military

1. Warfare Platforms
2. Cybersecurity
3. Target Recognition
4. Combat Simulation and Training
5. Threat Monitoring & Situational Awareness

APPLICATIONS OF DEEP LEARNING

Finance

1. Price Forecasting
2. Credit Assessment
3. Fraud Detection
4. Portfolio Management
5. Customer Service

APPLICATIONS OF DEEP LEARNING

Marketing

1. Chatbots
2. Real Time Bidding
3. Speech Recognition
4. Automatic Image Captions
5. Translation services

APPLICATIONS OF DEEP LEARNING

Education

1. Personalized Learning
2. Evaluation Assessments
3. Education Analytics
4. Predict Carrers
5. Concluding Thoughts

APPLICATIONS OF DEEP LEARNING

Retail

1. Customer Segmentation
2. Predict Best Retail Location
3. Sentiment Analysis
4. Quality Assurance
5. Demand Forecasting

CHALLENGES IN DEEP LEARNING APPLICATIONS

- Healthcare:
  - Data Volume
  - Data Quality
  - Temporality
  - Interpretability
  - Privacy
- Military
  - Transparency
  - Vulnerabilities
  - Data
- Finances
  - Expectations
  - Computing Resources
  - Lack of Motivation
- Marketing
  - Data Quality
  - Cost
  - Lack of trust
  - Legal issues
  - Complexity
- Education
  - inclusion and equity assurance
  - Teachers' acceptance
  - Required quality inclusive systems
  - Transparency
- Retail
  - Data Limitations
  - Flexibility
  - Privacy
  - Data Diversity

REQUIREMENTS TO DEVELOP A DEEP LEARNING PROJECT

1. **Define the Objective:** You should be excited about the project. Create a marketable product.

2. **Collect the Data:** Systems cannot learn without data. You should have a very large data set. Prefferencially Real World Data.

3. **Data Scientist:** You will need to learn or have someone that is able to work and manage huge volumes of data.

4. **Business Comprehension of the Data:** It is very important to know if the data and the results make sense.

5. **Time:** Deep Learning is a long iterative process. The project will take its time.

HOW TO TRAIN A DEEP LEARNING MODEL?

Deep learning is an advanced form of machine learning that emulates the way the human brain learns through networks of connected neurons.

Read in the data

Split up the dataset into inputs and targets

Build the model

Compile the model

Train the model

The purpose of training a model is to progressively improve the model's ability to make a prediction

Very similar to what happens when we drive.
Our ability to react to unpredictable events while driving improves with practice

Let's see the formula for a straight line :

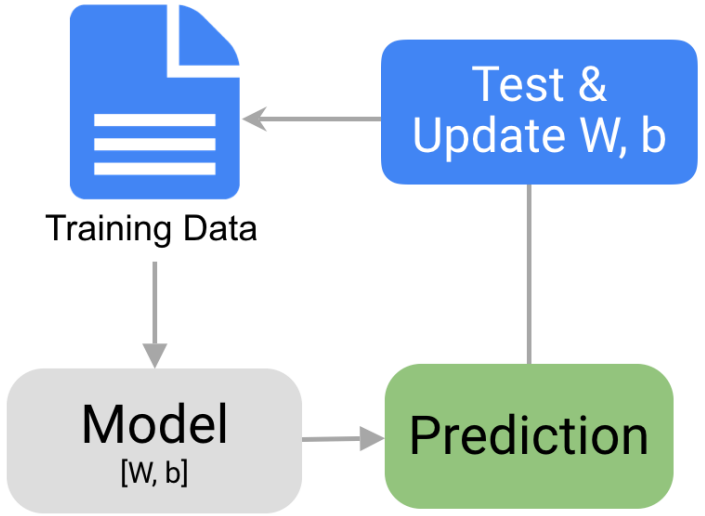
$$y = m \times x + b$$

- y: value of the line at the position x.
- m: slope
- x: input
- b: y-intercept

Values available to train the model

In Deep Learning there are many M's and many B's

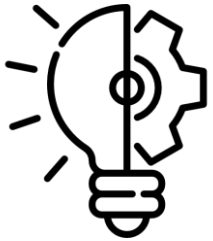
- The training process involves initializing some random values for W and b and therefore trying to predict the output with these values, and because of this the process can be a bit time consuming.
- To improve the prediction, we can compare the predictions of our model with the output it should produce and adjust the values for W and b so that we have a more correct prediction.



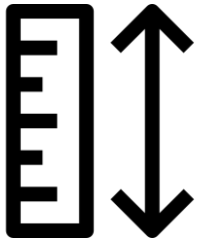
Option 1 : Improving Performance with Data

Get more data

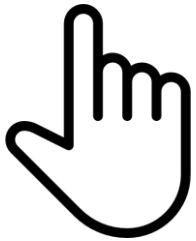
Invent more data



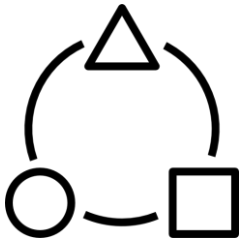
Rescale your data



Feature Selection



Transform your data



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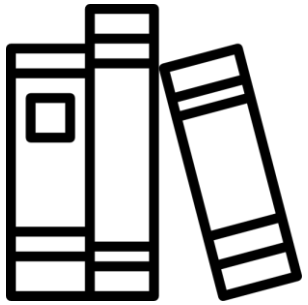
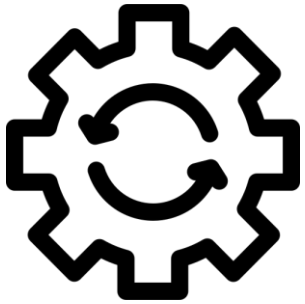
Option 2 : Improving Performance with Algorithm

Spot-Check Algorithms

Steal From Literature



Resampling Methods



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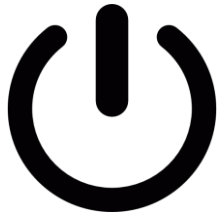
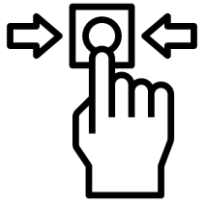
Option 3 : Improving Performance with Algorithm Tuning

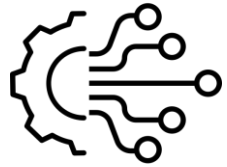
Activation Functions



Early Stopping



Network Topology



Learning Rate

Batches and Epochs

Optimization and Loss

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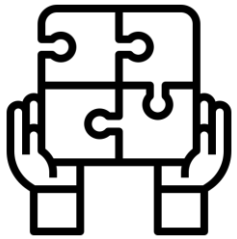
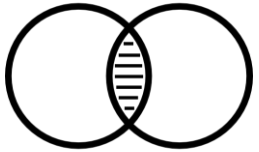
Option 3 : Improving Performance with Ensembles

Combine Models



Combine Views



Stacking

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REFERENCE TO AUTHORS

Regina Sousa

- PhD student in Biomedical Engineering
- Research Collaborator of the Algoritmi Research Center

0000-0002-2988-196X

Diana Ferreira

- PhD student in Biomedical Engineering
- Research Collaborator of the Algoritmi Research Center

0000-0003-2326-2153

José Machado

- Associate Professor with Habilitation at the University of Minho
- Integrated Researcher of the Algoritmi Research Center

0000-0003-4121-6169

REFERENCE TO AUTHORS

António Abelha

- Assistant Professor at the University of Minho
- Integrated Researcher of the Algoritmi Research Center

0000-0001-6457-0756

Victor Alves

- Assistant Professor at the University of Minho
- Integrated Researcher of the Algoritmi Research Center

0000-0003-1819-7051

REFERENCE TO AUTHORS

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Thank you for your attention

DRIVES project is project under **The Blueprint for Sectoral Cooperation on Skills in Automotive Sector**, as part of New Skills Agenda.

The aim of the Blueprint is **to support an overall sectoral strategy and to develop concrete actions to address short and medium term skills needs.**

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