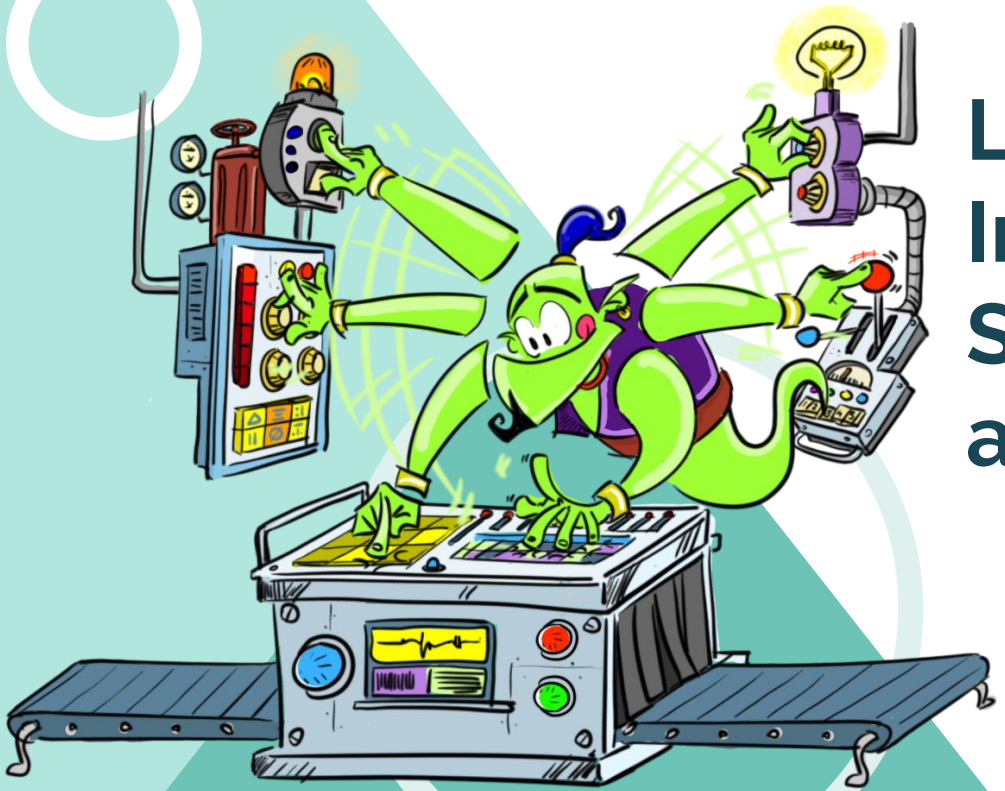
(cc) BY-NC-SA



Learning Artificial Intelligence at School with Scratch and LearningML

Juan David Rodríguez García

@juandalibaba

Imagen del genio por Roberto Marcano Ganzo

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KGBL-III

https://kgblll.github.io/

KinderGarten and Beyond and LifeLong Learning

Jesús Moreno León

Programamos

@J_MorenoL

Marcos Román González

UNED

@elpsycomago

Gregorio Robles

URJC

@gregoriorobles

By Juan David Rodríguez García

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What I'm going to talk about

01 Some reasons to teach AI at school

02 Machine Learning in a nutshell

03 But... ¿can we teach AI and ML at school?. LearningML can help us

04 LearningML Research

By Juan David Rodríguez García

01
Some reasons to teach AI at school

Vector School by freepik - www.freepik.es

REASON 1.

TO LIVE IN A DIGITAL SOCIETY

By Juan David Rodríguez García
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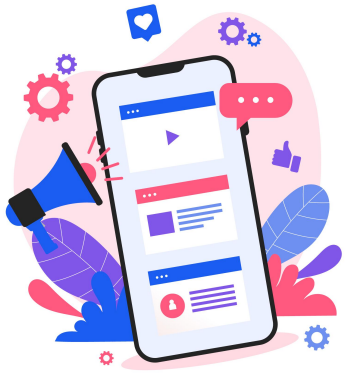
As citizen, we have to know digital technologies **as well as possible** and demand the development and use of accountable, transparent and fair digital tools.

transparent

fair

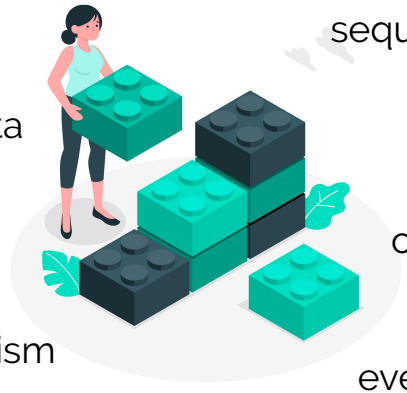


accountable

loops

sequences

data



operators

parallelism

events

conditionals

Knowing the fundamentals of Computer Science will be very helpful.

Vector de Diseño creado por freepik - www.freepik.es

REASON 1.

WE ARE ALL USING ARTIFICIAL INTELLIGENCE

By Juan David Rodríguez García
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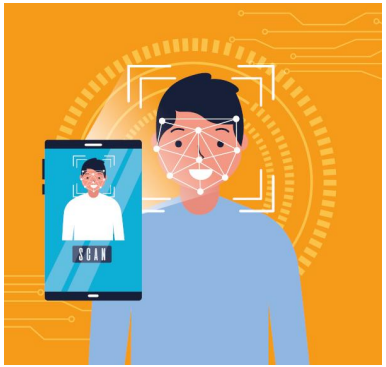
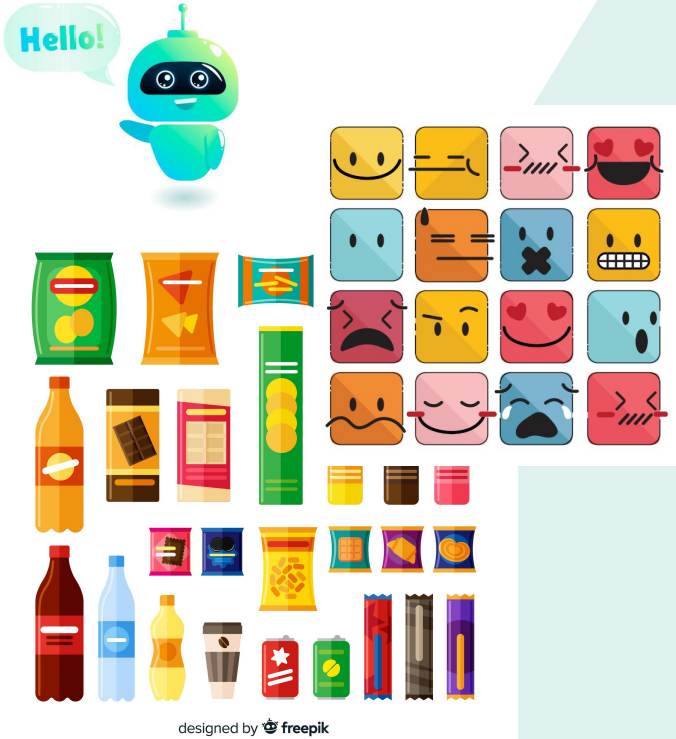
It is all around us, closer that we can imagine.





Vector de Diseño creado por freepik - www.freepik.es Sentimental Vectores por Vecteezy

RAZÓN 1.

STRONG IMPACT ON SOCIETY OF AI

By Juan David Rodríguez García
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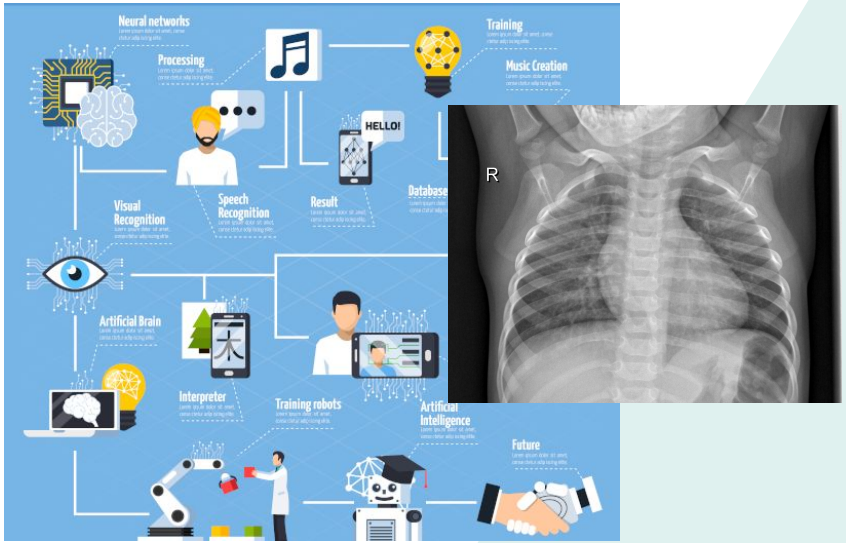
AI has a strong impact in every aspect of society …
… and will have even more in the near future.

justice

Medical applications



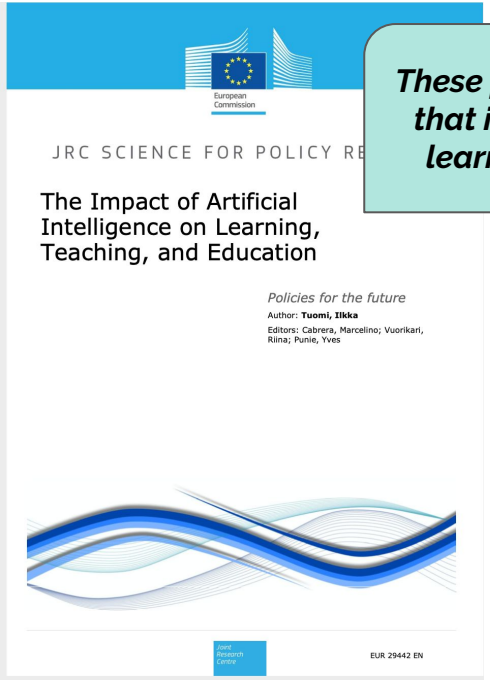
Sentimental Vectores por Vecteezy

REASON 2.

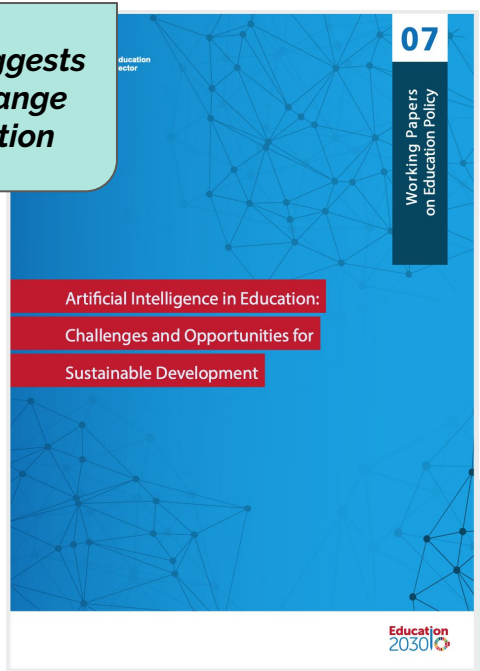
INSTITUTIONAL CONCERN

By Juan David Rodríguez García (cc) BY-NC-SA

These policy foresight report suggests that in the next years AI will change learning, teaching, and education



Tuomi, I. (2019). *The Impact of Artificial Intelligence on Learning, Teaching, and Education*. Joint Research Centre (JRC). European Union. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC113226/jrc113226_j



Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development. Education Sector. UNESCO.

REASON 3.

TO FOSTER COMPUTATIONAL THINKING

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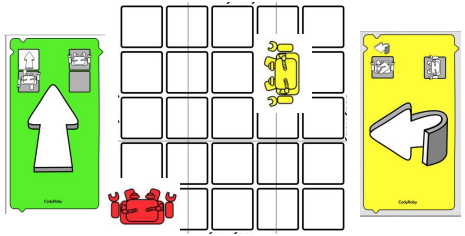
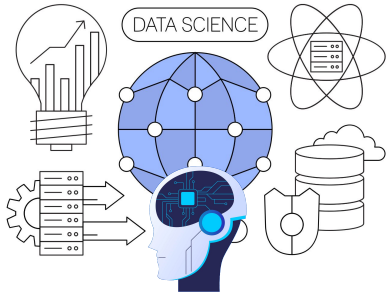
Instrumental competence

Coding



Unplugged activities



AI and Data Science

Cognitive ability

REASON 3.

NEW DIMENSIONS OF COMPUTATIONAL THINKING

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By Juan David Rodriguez Garcia

	Concepts	Practices	Perspectives
Brennan & Resnick CT Framework dimensions	Sequences Loops Events Parallelism Conditionals Operators Data	Being incremental and iterative Testing and debugging Reusing and remixing Abstracting and modularizing	Expressing Connecting Questioning
AI extension of Brennan & Resnick CT Framework dimensions	Classification Prediction Generation	Training Validating Testing	Evaluating

Brummelen, J. V., Shen, J. H., & Patton, E. W. (2019). The Popstar, the Poet, and the Grinch: Relating Artificial Intelligence to the Computational Thinking Framework with Block-based Coding. *Proceedings of International Conference on Computational Thinking Education 2019. Hong Kong: The Education University of Hong Kong*, 2

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02
Machine Learning in a nutshell

Image by [AI4K12.org](AI4K12.org)

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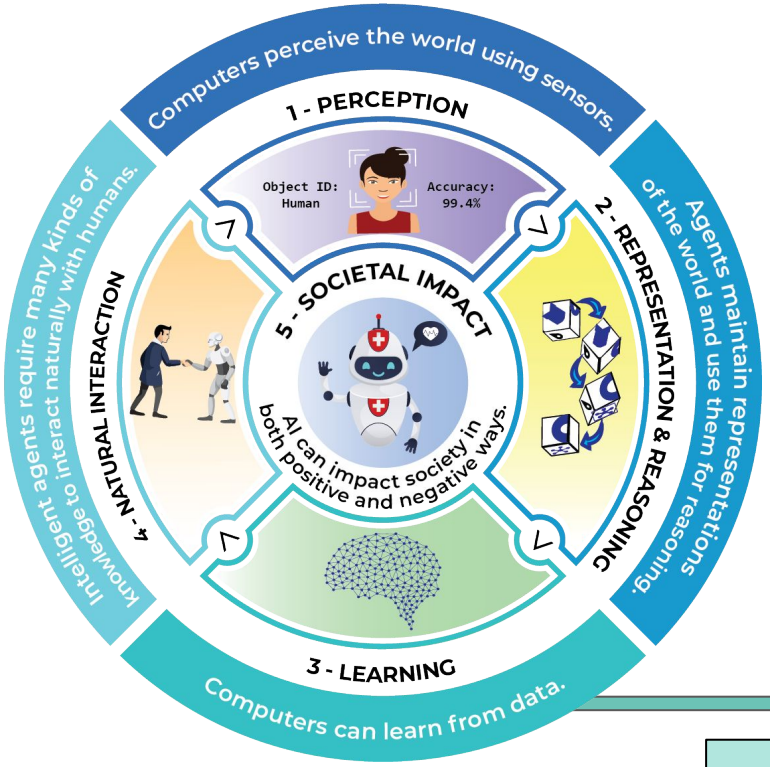
ARTIFICIAL INTELLIGENCE & MACHINE LEARNING



AI is not the same than **ML**

Machine Learning

5 BIG IDEAS about AI
AI4K12, CSTA and AAAI

But it is common to use the term AI when we really mean ML

Touretzky, D., Gardner-McCune, C., Martin, F., & Seehorn, D. (2019). Envisioning AI for K-12: What Should Every Child Know about AI? *Proceedings of the AAAI Conference on Artificial Intelligence*, *33*, 9795–9799. https://doi.org/10.1609/aaai.v33i01.33019795

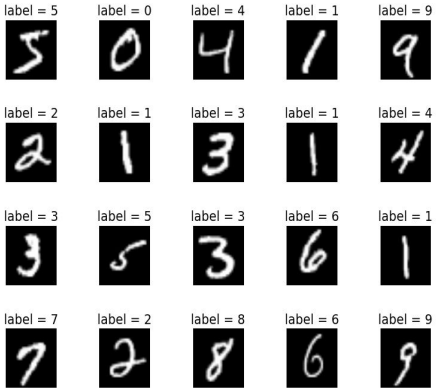
Image by AI4K12.org

By Juan David Rodríguez García (cc) BY-NC-SA

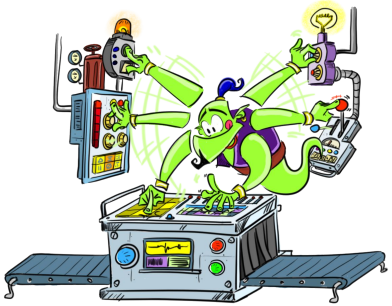
SO, WHAT'S MACHINE LEARNING

When we do not have an algorithm able to be applied to our problem, but **we have lots of data** related with its solution, we can deal with the problem from another perspective:
we can use these data to infer possible solutions.

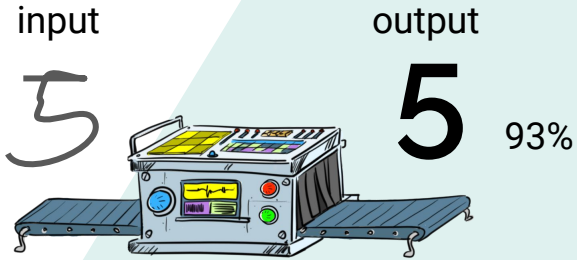
Gather data samples and label it (training dataset)



Feed ML algorithm and run it to build a **model**



Use de **model** to classify or predict new samples



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A NEW WAY TO SOLVE COMPUTING PROBLEMS

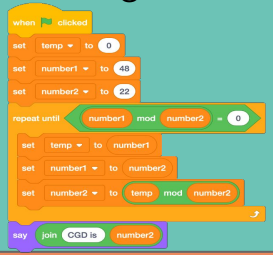
Traditional programming

- Problem analisys
- Rules deduction
- Program coding

Rules

Data

Program



Solution

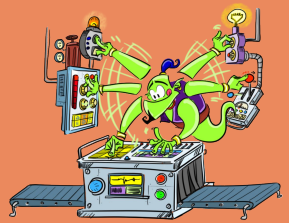
ML oriented programming

- Gather and label sample data
- Feed and run ML algorithm
- Use induced rules to code a Program

Data

Solution

ML Algorithm



Rules

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DIFFERENT TYPES OF MACHINE LEARNING

SUPERVISED

data from which an inference model is to be built must be classified manually (by a human being). Afterwards these data are used by the ML algorithm to build a model that serves as well when other data is used.

UNSUPERVISED

those algorithms intended to extract some patterns from a set of unlabeled data. Therefore, a classification "by hand" is not required. Sometimes this kind of algorithms is used to perform an initial automatic data labelling.

REINFORCED

build their models by testing possible solutions; those that maximize some reward function are maintained while those that score low according to that function are eliminated. Here, too, labeled data is not necessary.

Data is the key

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03
¿But… ¿can we teach AI and ML at school?. LearningML can help us

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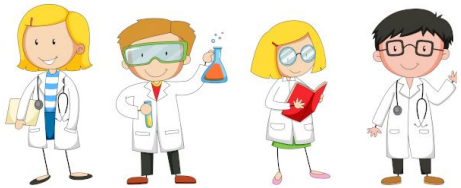
LEARNINGML

A platform to teach and learn ML by doing, designed on the principles of "***low floor, high ceiling and wide walls***"

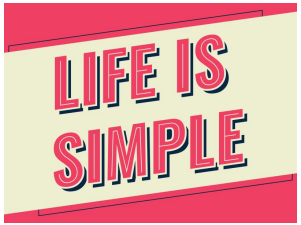
K12 (age 10 - 17)

Undergraduate students and professionals which need to understand ML fundamentals



People interested in learning ML and other geeks

Easy to use



No registration required

But you can register and then cloud storage and project sharing is available

Vectores por Vecteezy

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THE LEARNINGML PLATFORM IS COMPOSED BY

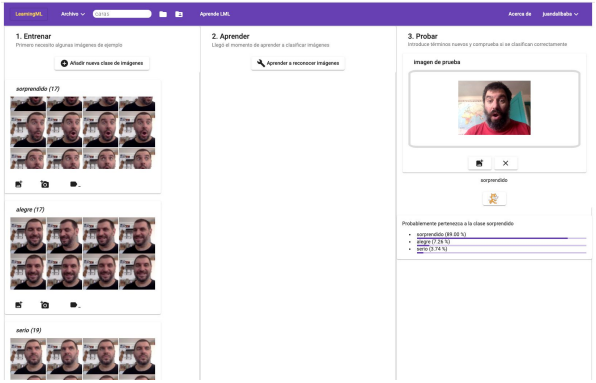
The web site

https://learningml.org

The ML Editor

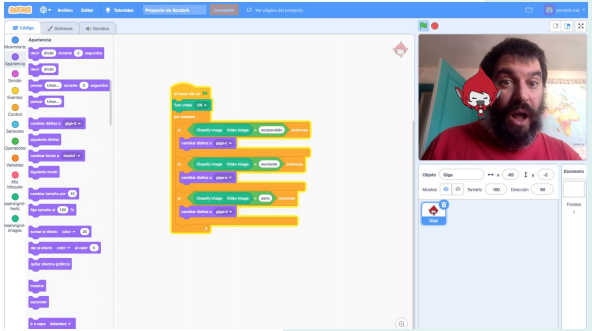
https://learningml.org/editor

Text and images models



The programming platform

https://learningml.org/scratch/



Rodríguez García, J. D., Moreno-León, J., Román-González, M., & Robles, G. (2020). LearningML: A *Tool to Foster Computational Thinking Skills Through Practical Artificial Intelligence Projects*. *Revista De Educación a Distancia (RED)*, *20*(63). https://doi.org/10.6018/red.410121

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04
LearningML research

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PAPERS

Rodríguez-García, J. D., Moreno-León, J., Román-González, M., & Robles, G. (2019). Developing Computational Thinking at School with Machine Learning: An exploration. In 2019 International Symposium on Computers in Education (SIIE) (pp. 1-6). IEEE. https://doi.org/10.1109/SIIE48397.2019.8970124

Rodríguez García, J. D., Moreno-León, J., Román-González, M., & Robles, G. (2020). LearningML: A *Tool to Foster Computational Thinking Skills Through Practical Artificial Intelligence Projects*. *Revista De Educación a Distancia (RED)*, *20*(63). https://doi.org/10.6018/red.410121

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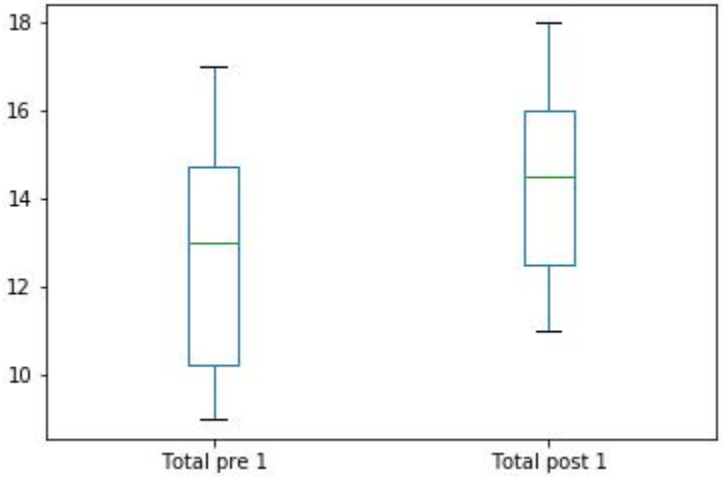
RESEARCH - FIRST RESULTS

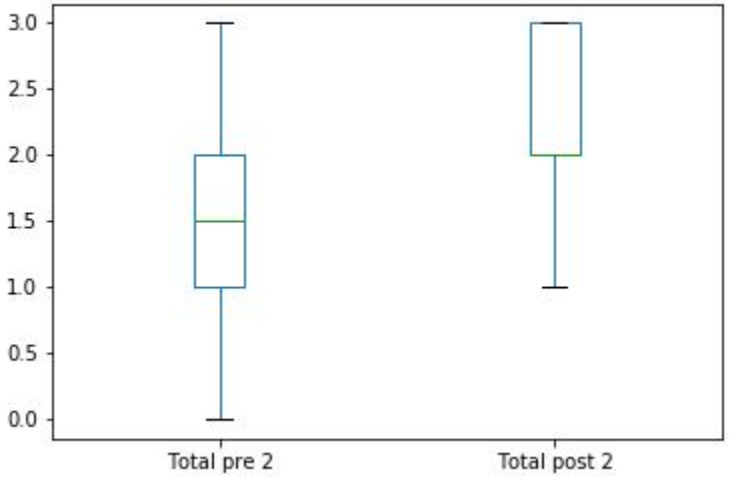
Workshop on December 2019, 14 participants about 20 years old

4 Likert-style questions



effect size **0.675**, moderate

3 multiple choice questions



effect size **0.852**, big

Rodríguez García, J. D., Moreno-León, J., Román-González, M., & Robles, G. (2020). LearningML: A *Tool to Foster Computational Thinking Skills Through Practical Artificial Intelligence Projects*. *Revista De Educación a Distancia (RED)*, *20*(63). https://doi.org/10.6018/red.410121

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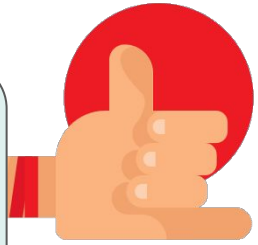
RESEARCH - NEXT STEPS

Validation

Instructional

Students learn something about ML and AI when using LearningML?



Face

Is LearningML a tool easy to use and engaging enough?

Results of this research will be very helpful to improve the tool.

Vectores por Vecteezy

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RESEARCH ON-LINE

SCHEDULE

https://programamos.es/quieres-aprender-a-crear-proyectos-de-inteligencia-artificial-participa-en-esta-investigacion-online/

	1 June - 6 June	8 June	9 June - 16 June
PRE Test	1 June - 6 June		
On-line workshop		8 June	
Activity			9 June - 16 June
Test			9 June - 16 June

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¡Thank you!

I'll see you in Q&A!

@juandalibaba

https://learningml.org

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DEMO

LearningML - ML Editor

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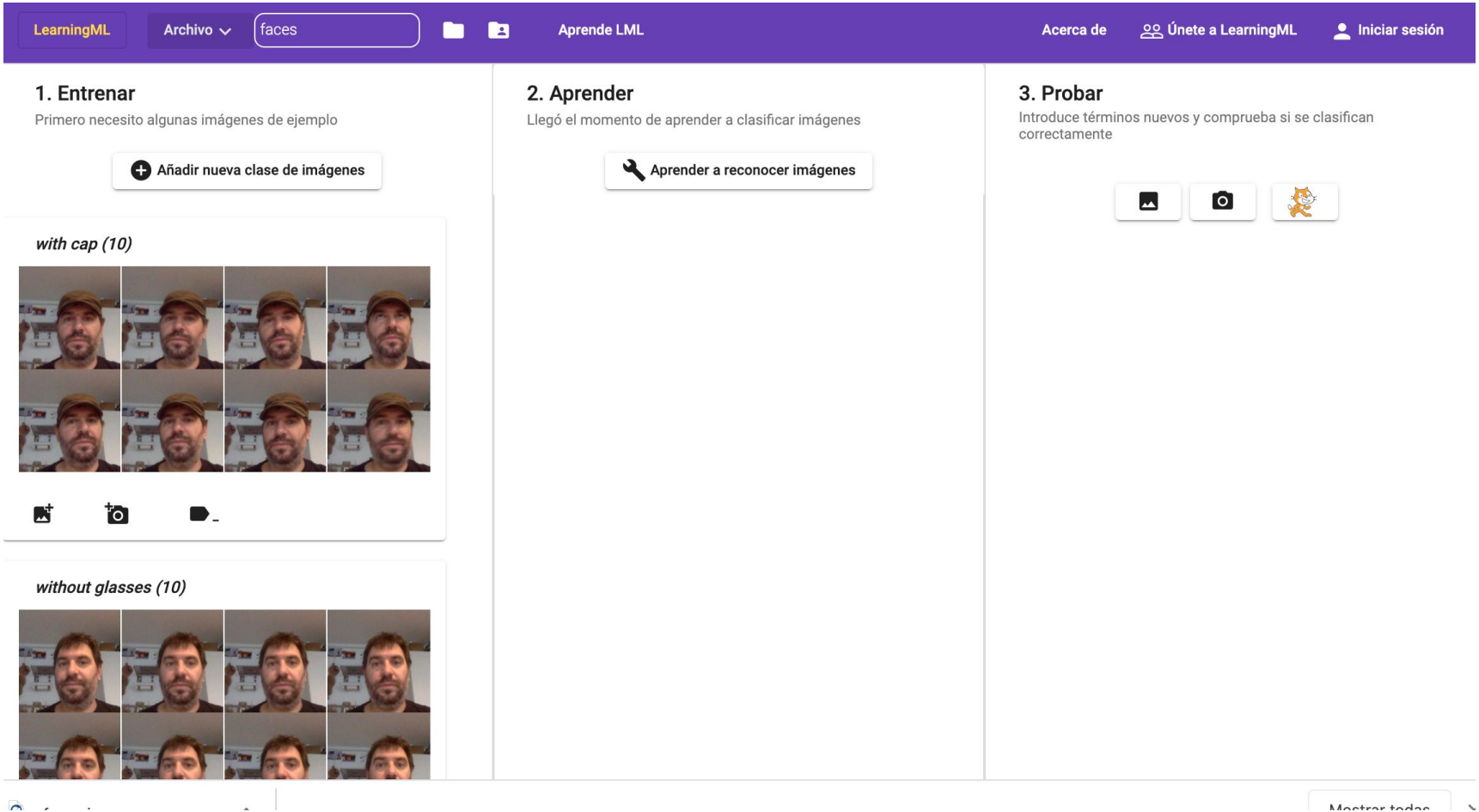
LearningML - ML Editor - Step 1. Gathering training dataset



LearningML - ML Editor - Step 2. Learning

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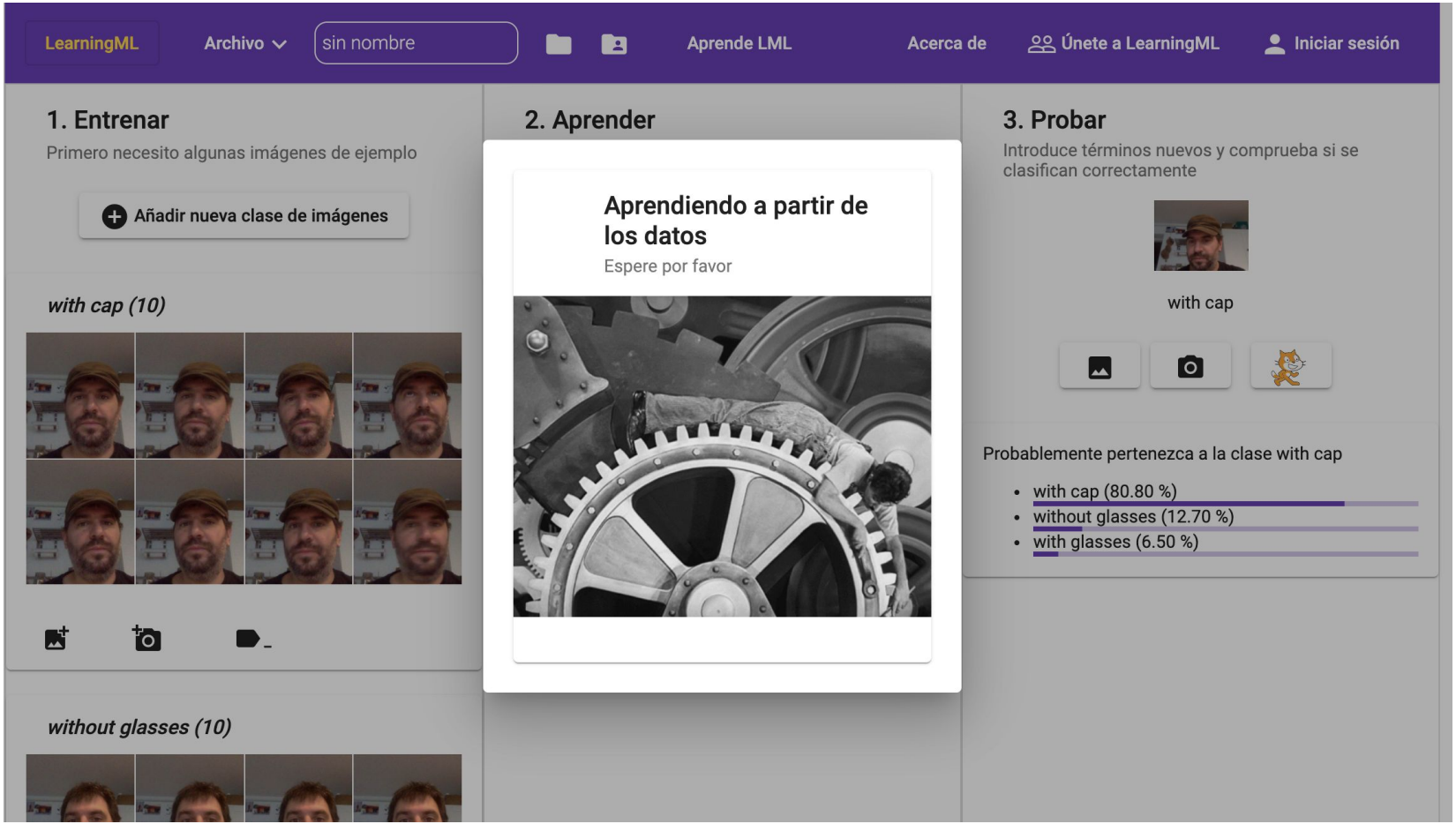

LearningML - ML Editor - Step 3. Evaluating model

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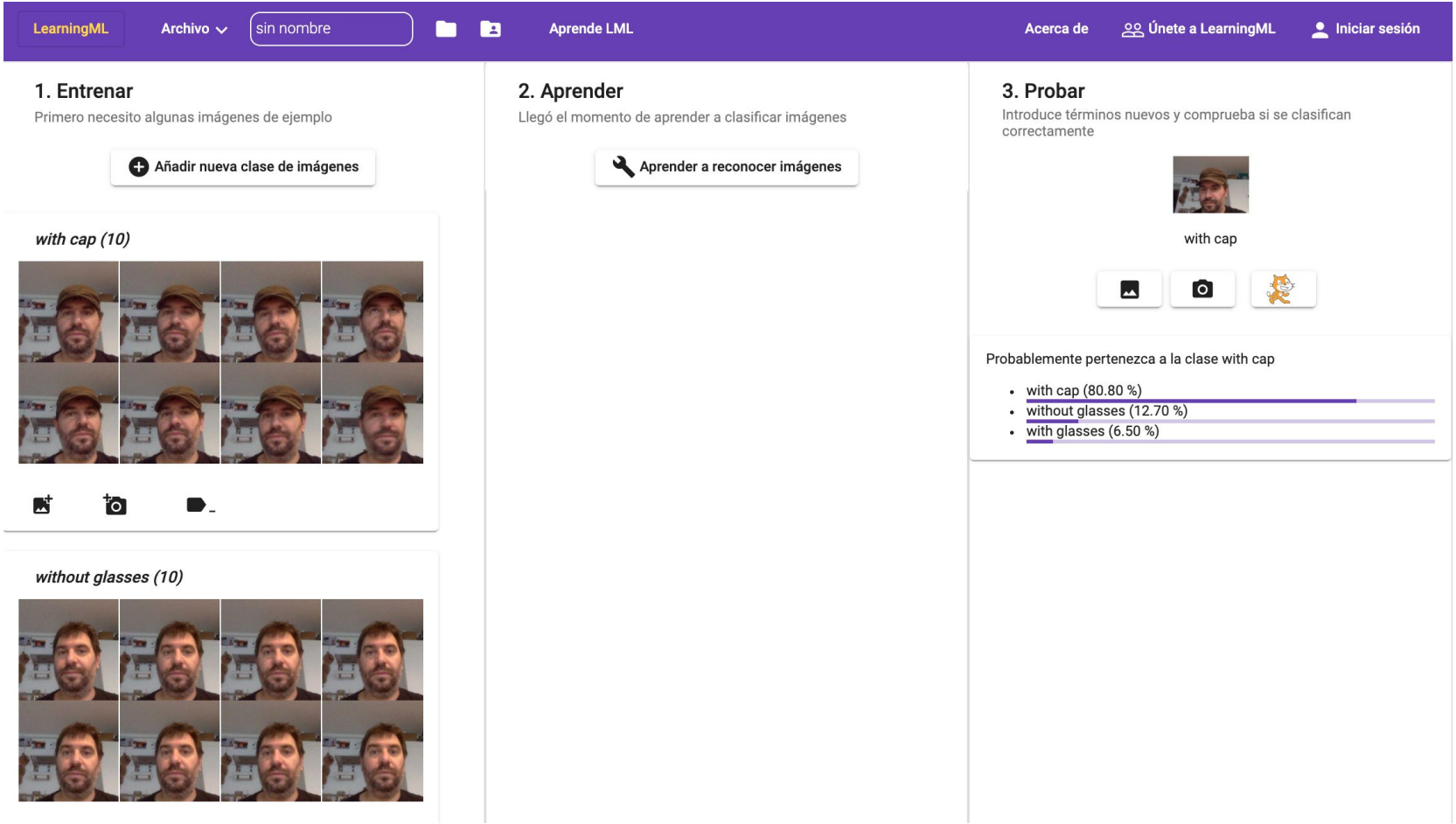

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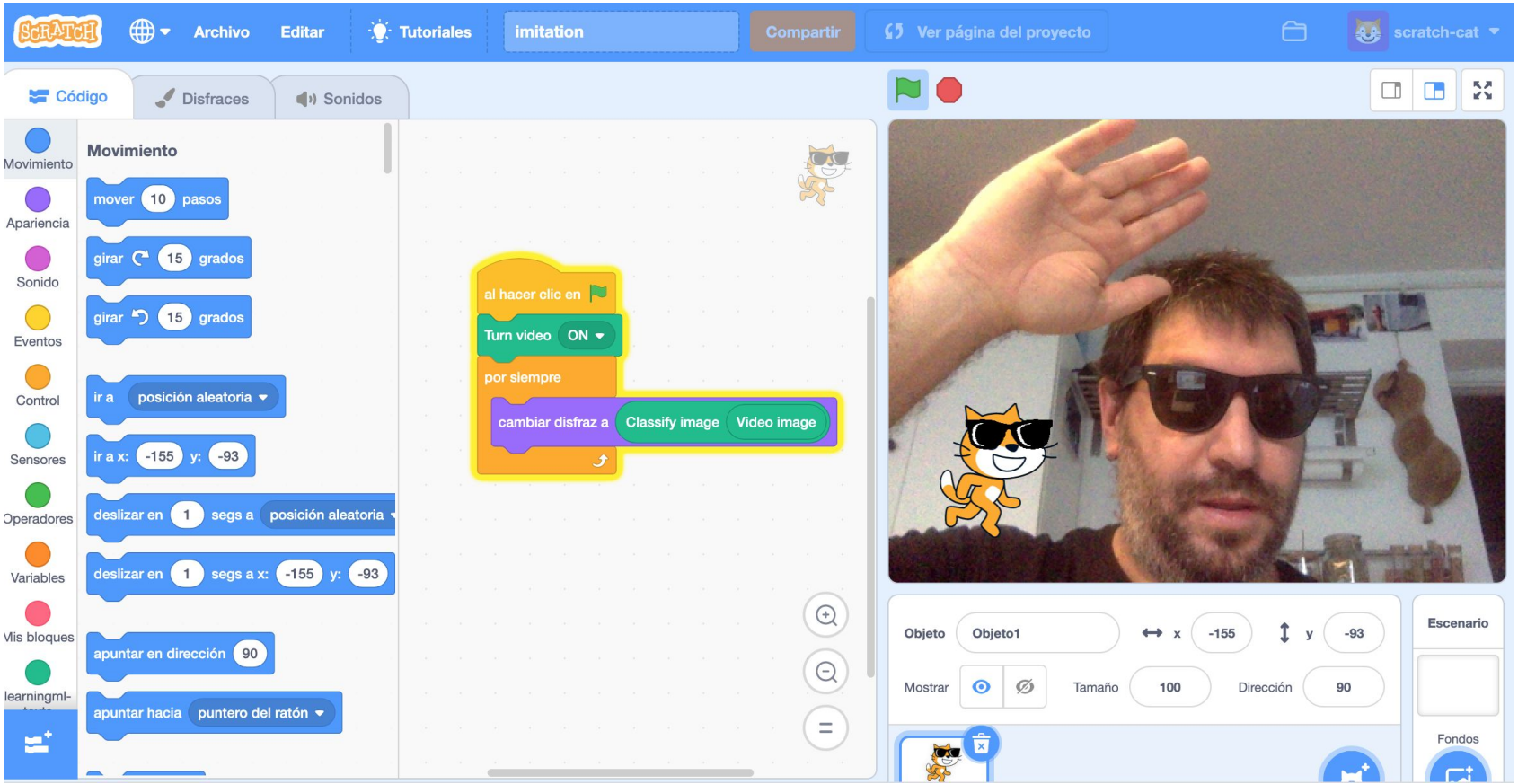
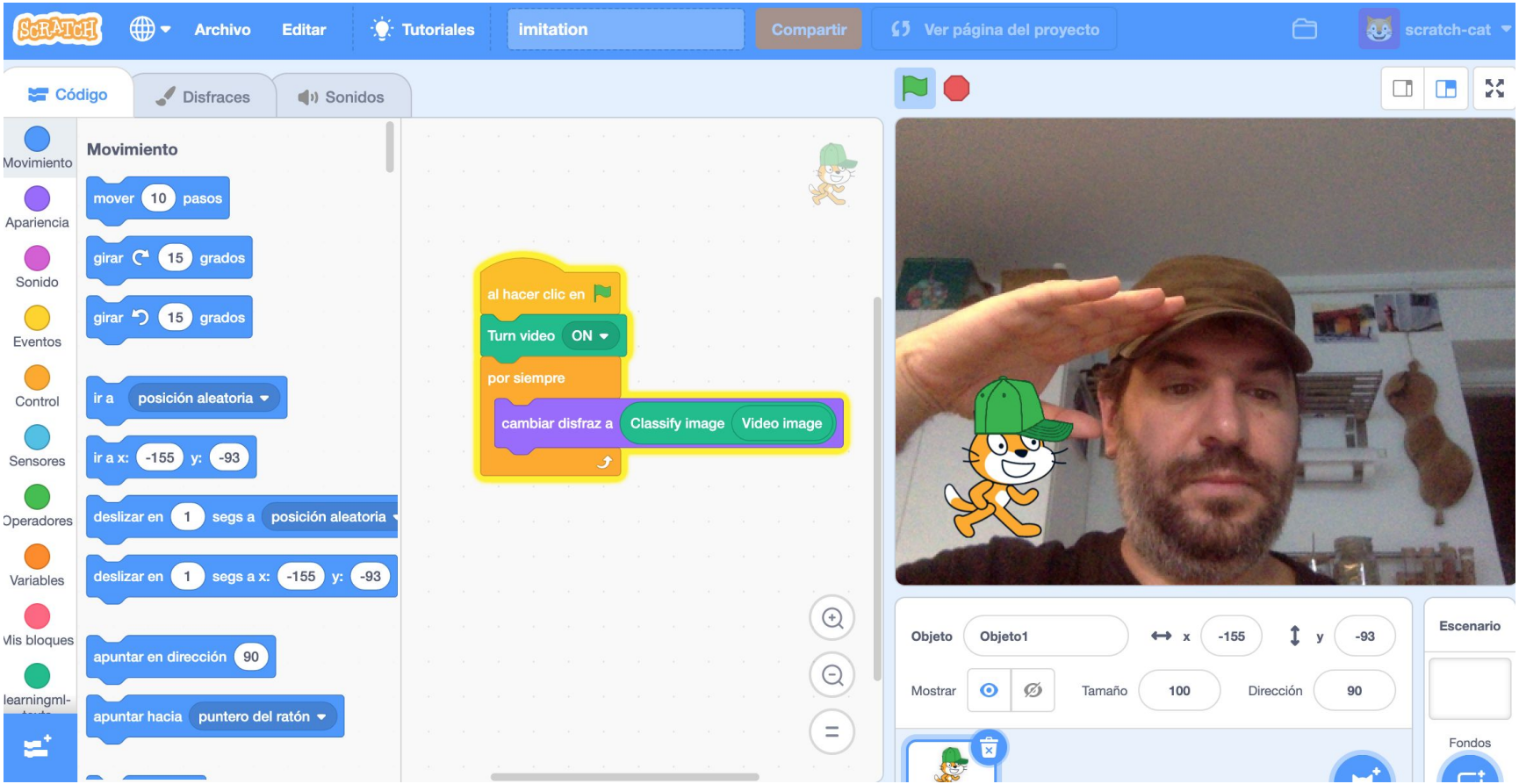
LearningML - Programming platform. Building and running a program that uses the ML model



By Juan David Rodríguez García (cc) BY-NC-SA

LearningML - Programming platform. Building and running a program that uses the ML model