



# PPgEEC

# Special Topics in AI

# Deep Learning

## Outline Presentation

Lesson #01



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<https://github.com/ivanovitchm>



@ivanovitchm

# Your Pathway

## Vector & Matrices

- Matrices & Vector Arithmetics
- Types, Operations
- Factorization

## Calculus

- Derivatives

@ivanovitchm/imd0033\_2019\_1

## Exploratory Data Analysis

Measurements of Centrality (mean, mode, median, variance, std, z-score)

## Data Pipeline

Collect, clean, preparation, model, analysis, interpretation, viz  
Deploy, monitoring solution

@ivanovitchm/ppgeecmachinelearning2020.2

## Linear Algebra & Math

## Probability & Statistics

## Data Science

## Machine Learning

### Probability

- Conditional Probability
- Distributions
- Bayesian Probability

### Statistics

- Data Viz, Central Limit Theorem
- Hypothesis Tests, Correlation
- Resampling Methods

@ivanovitchm/datascience2020.6

### Supervised Learning

- KNN, Linear regression, Logistic Regression, Decision Tree, Random Forest, Ensemble, XGBoost, MLP

### Unsupervised Learning

- K-Means, PCA

# ARTIFICIAL INTELLIGENCE

## ARTIFICIAL INTELLIGENCE

Any technique which enables computer to mimic human behavior



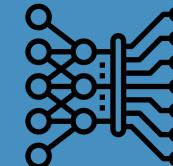
## MACHINE LEARNING

AI techniques that give computers the ability to learn without being explicitly programmed to do so



## DEEP LEARNING

A subset of ML which make the computation of multi-layer neural network feasible



TinyML

GNN

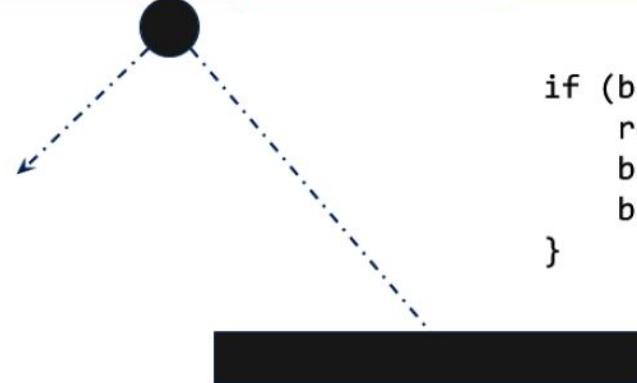
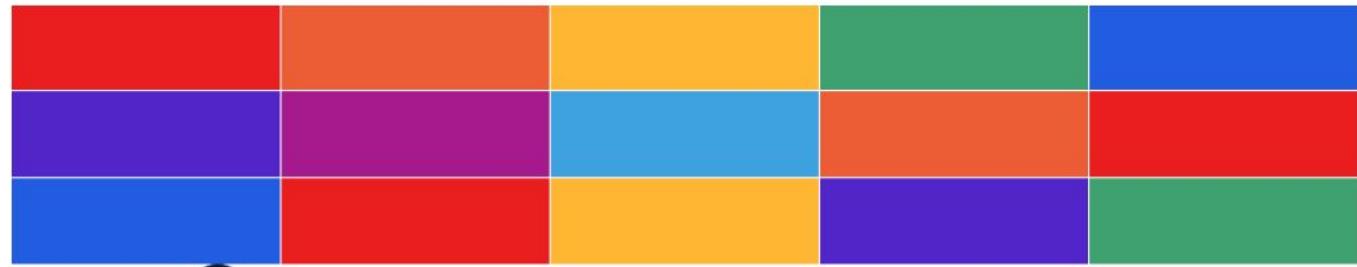
DATA SCIENCE

1950 - 1980

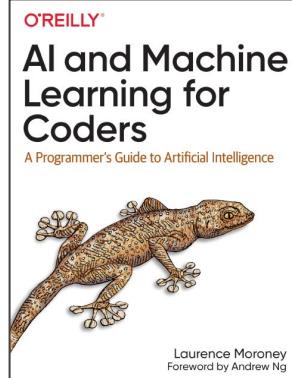
1980 - 2010

2010 - 2021

# What is Machine Learning?



```
if (ball.collide(brick)){
    removeBrick();
    ball.dx = 1.1*(ball.dx);
    ball.dy = -1*(ball.dy);
}
```



# Limitations of traditional programming

<activity detection>



```
if(speed<4){  
    status=WALKING;  
}
```



```
if(speed<4){  
    status=WALKING;  
} else {  
    status=RUNNING;  
}
```

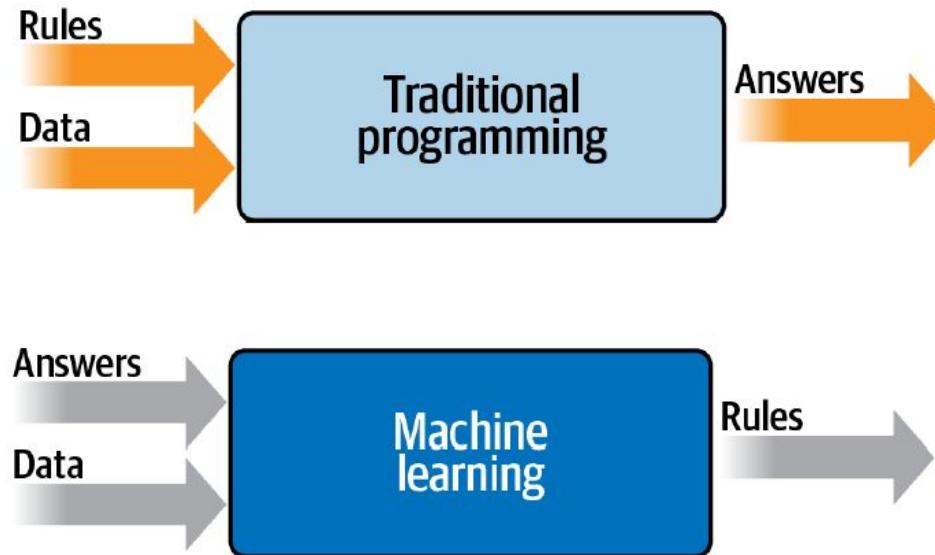


```
if(speed<4){  
    status=WALKING;  
} else if(speed<12){  
    status=RUNNING;  
} else {  
    status=BIKING;  
}
```



// ???

# From programming to learning



# From coding to ML

<gathering and label data>



0101001010100101010  
1001010101001011101  
0100101010010101001  
0101001010100101010

1010100101001010101  
0101010010010010001  
001001111010101111  
1010100100111101011

1001010011111010101  
1101010111010101110  
1010101111010101011  
1111110001111010101

111111111010011101  
0011111010111110101  
0101110101010101110  
1010101010100111110

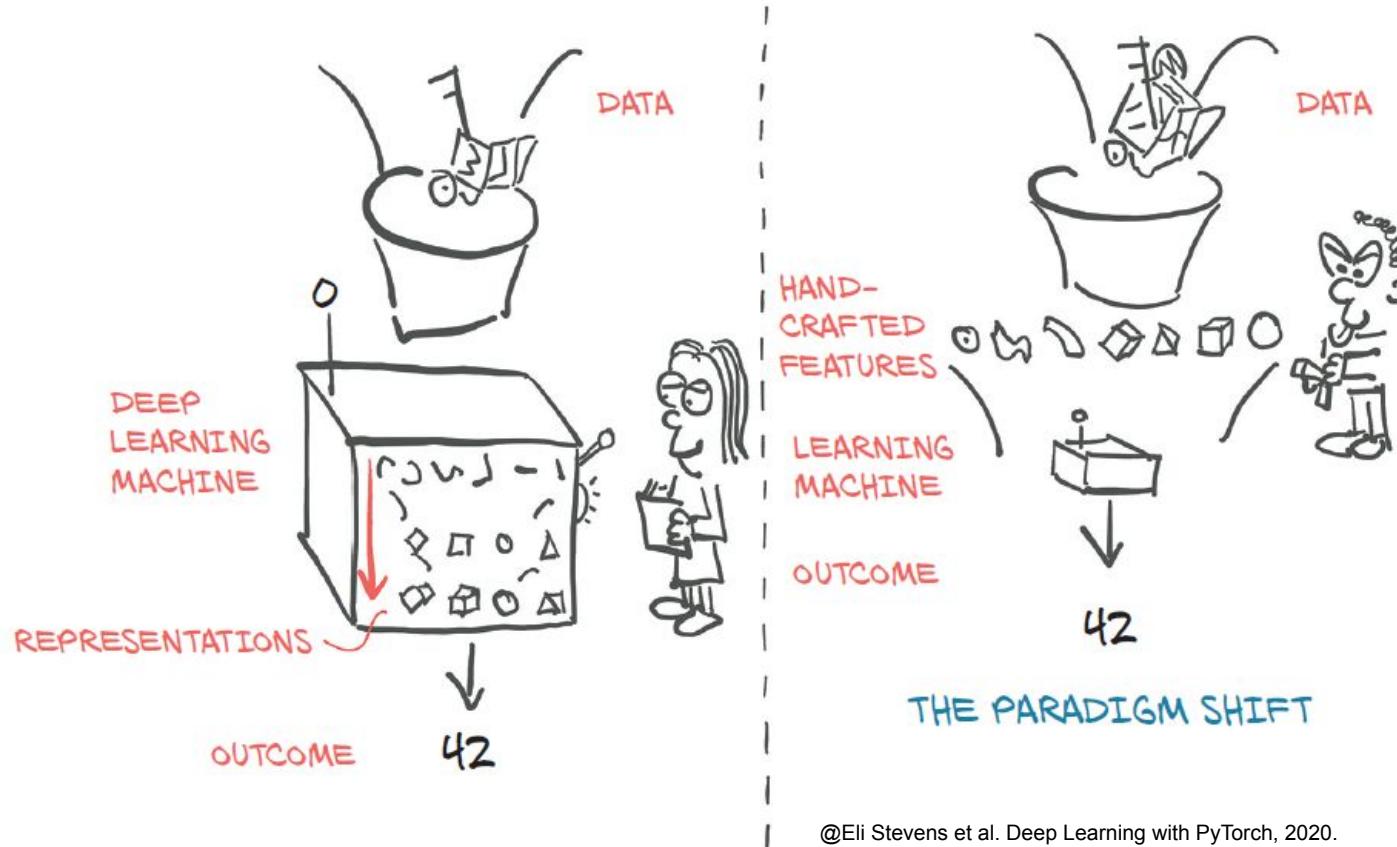
Label = WALKING

Label = RUNNING

Label = BIKING

Label = GOLFING

# Why Deep Learning?



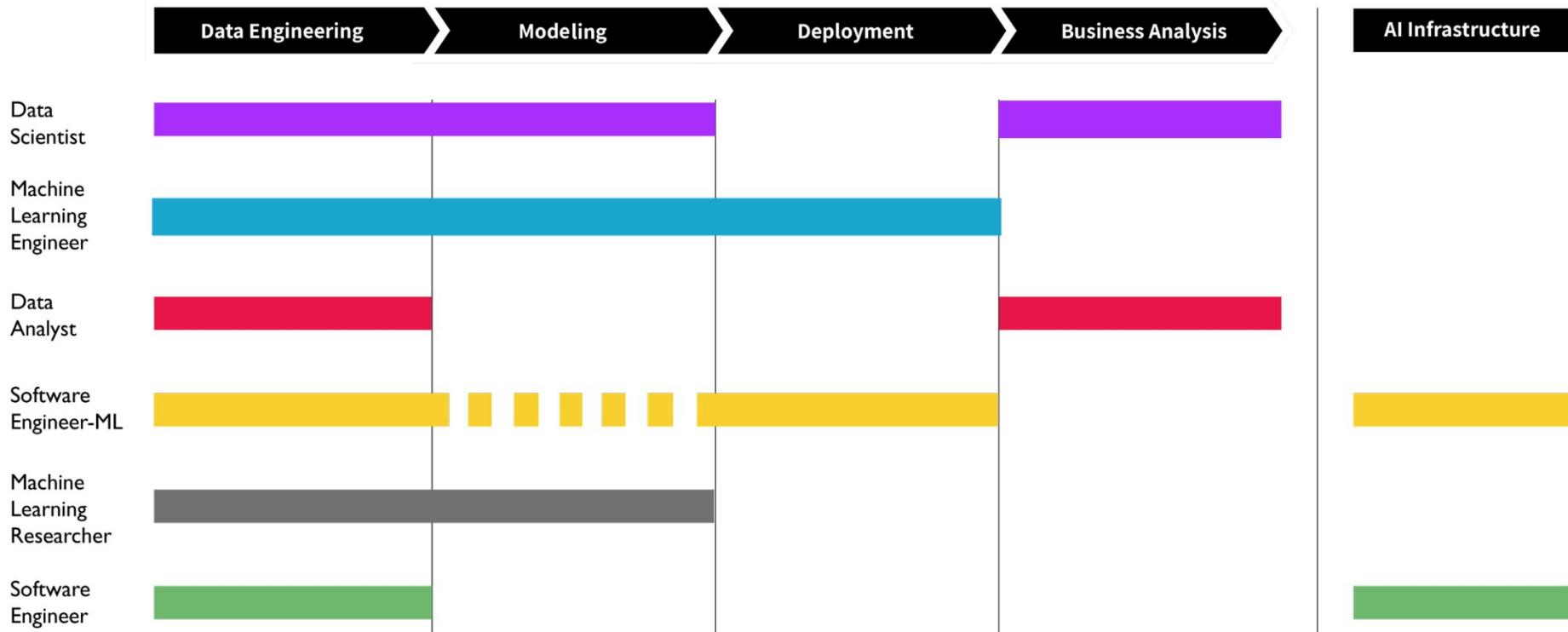
# Roles of an AI Team





# WORKERA

a deeplearning.ai company



# Defining the Skills

## Mathematics

People with mathematics skills demonstrate the ability to solve problems using linear algebra (for instance, matrix vector operations, eigenvalues, eigenvectors, and combinatorics), calculus (derivatives, integrals, and so on) and mathematical functions (simple functions, min/max/argmin/argmax, and so on).

## Algorithmic coding

People with algorithmic coding skills demonstrate the ability to understand algorithms written with code, implement classic algorithms like sorting and search, and use classic data structures like trees, dictionaries and arrays.

## Software engineering

People with software engineering skills demonstrate the ability to use a variety of computer science and software methods such as object-oriented programming, internet protocols, HTTP requests, agile/scrum methodologies, databases, version control (such as Git), containers, and unit testing.

## Machine learning

People with machine learning skills demonstrate the ability to use classic machine learning models (for example, PCA, K-means, K-NNs, SVM, Logistic Regression, Linear Regression, and Decision Tree learning), methods to train them (such as initialization, optimization, regularization, and hyperparameter tuning), and techniques to strategize machine learning projects.

## Deep learning

People with deep learning skills demonstrate the ability to use classic deep learning models (such as fully connected networks, convolutional neural networks, recurrent neural networks, and layers), methods to train them (such as initialization, regularization, optimization, and transfer learning), and techniques to strategize deep learning projects.

## Data science

People with data science skills demonstrate the ability to use probabilities (including distributions, conditional probabilities, independence, Bayes theorem, etc.), statistics (including hypothesis testing, bias/variance tradeoffs, mean, variance, and mode) and data analysis (including preprocessing, visualization and metrics such as accuracy, R-squared, residuals, precision, and recall).

slido

# Which AI role do you fit best?

- ⓘ Start presenting to display the poll results on this slide.



What?  
How?  
Change  
(people/science)?  
Next?

# Who's talking about your research?

Thousands of conversations about scholarly content happen online every day.

Altmetric tracks a range of sources to capture and collate this activity, helping you to monitor and report on the attention surrounding the work you care about.

[For Publishers](#)[For Institutions](#)[For Researchers](#)[For Funders](#)[For R&D](#)

Taylor &amp; Francis



WILEY

Have you done scientific dissemination of  
your work on social networks?

- ⓘ Start presenting to display the poll results on this slide.

## Publishing in High Quality Scientific Journals

**Mubashir Husain Rehmani**

Mubashir.Rehmani@cit.ie

Delivered To

**FAST – National University of Computer and Emerging Sciences**

Karachi, Pakistan

**29<sup>th</sup> December 2020**



# arXiv.org

[Login](#)     
[Help | Advanced Search](#)

arXiv is a free distribution service and an open-access archive for 1,833,415 scholarly articles in the fields of physics, mathematics, computer science, quantitative biology, quantitative finance, statistics, electrical engineering and systems science, and economics. Materials on this site are not peer-reviewed by arXiv.

**Subject search and browse:**   **News**

Read about recent news and updates on [arXiv's blog](#). (View the former "what's new" pages here). Read [robots beware](#) before attempting any automated download.

## Physics

- **Astrophysics (astro-ph new, recent, search)**  
includes: [Astrophysics of Galaxies](#); [Cosmology and Nongalactic Astrophysics](#); [Earth and Planetary Astrophysics](#); [High Energy Astrophysical Phenomena](#); [Instrumentation and Methods for Astrophysics](#); [Solar and Stellar Astrophysics](#)
- **Condensed Matter (cond-mat new, recent, search)**  
includes: [Disordered Systems and Neural Networks](#); [Materials Science](#); [Mesoscale and Nanoscale Physics](#); [Other Condensed Matter](#); [Quantum Gases](#); [Soft Condensed Matter](#); [Statistical Mechanics](#); [Strongly Correlated Electrons](#); [Superconductivity](#)
- **General Relativity and Quantum Cosmology (gr-qc new, recent, search)**
- **High Energy Physics – Experiment (hep-ex new, recent, search)**
- **High Energy Physics – Lattice (hep-lat new, recent, search)**
- **High Energy Physics – Phenomenology (hep-ph new, recent, search)**
- **High Energy Physics – Theory (hep-th new, recent, search)**
- **Mathematical Physics (math-ph new, recent, search)**
- **Nonlinear Sciences (nlin new, recent, search)**  
includes: [Adaptation and Self-Organizing Systems](#); [Cellular Automata and Lattice Gases](#); [Chaotic Dynamics](#); [Exactly Solvable and Integrable Systems](#); [Pattern Formation and Solitons](#)

**COVID-19 Quick Links**

See COVID-19 SARS-CoV-2 preprints from

- [arXiv](#)
- [medRxiv](#) and [bioRxiv](#)

**Important:** e-prints posted on arXiv are not peer-reviewed by arXiv; they should not be relied upon without context to guide clinical practice or health-related behavior and should not be reported in news media as established information without consulting multiple experts in the field.

# Have you published a pre-print yet?

- ⓘ Start presenting to display the poll results on this slide.

What area do you intend to invest in your research?

- ① Start presenting to display the poll results on this slide.



# Papers With Code

<https://paperswithcode.com/>

# Computer Vision



Semantic  
Segmentation

80 benchmarks

1462 papers with code



Image  
Classification

184 benchmarks

1275 papers with code



Object  
Detection

299 benchmarks

1076 papers with code



Image  
Generation

134 benchmarks

509 papers with code



Denoising

95 benchmarks

467 papers with code

[See all 965 tasks](#)

# Medical



Medical Image  
Segmentation

171 benchmarks

131 papers with code



Drug  
Discovery

14 benchmarks

105 papers with code



Lesion  
Segmentation

5 benchmarks

75 papers with code



Brain Tumor  
Segmentation

7 benchmarks

44 papers with code



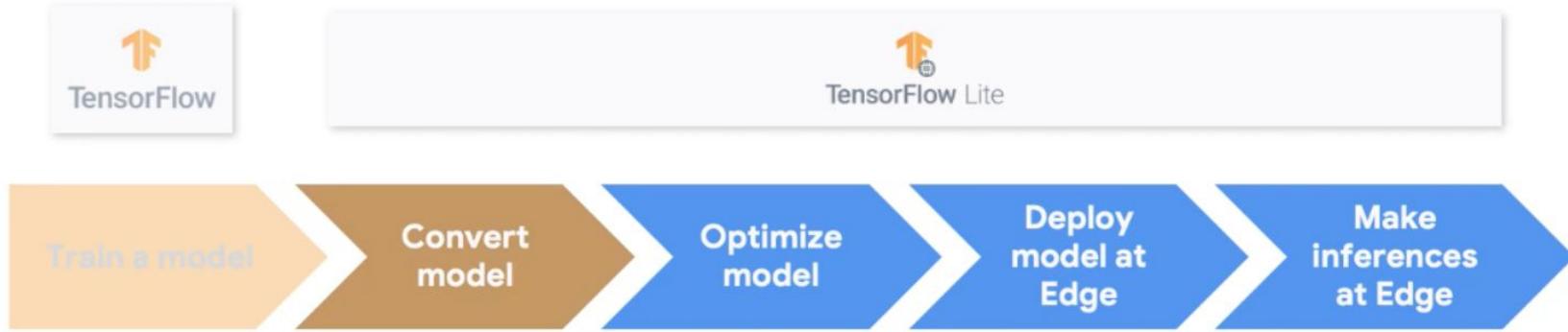
COVID-19  
Diagnosis

40 papers with code

[See all 199 tasks](#)

@paperwithcode





Portenta Vision Shield



Portenta H7



FPGA + Arduino Nano

# TinyML

A woman with short brown hair, wearing a dark, high-collared dress, stands in a dimly lit, grand hall with stone steps and railings. She is looking upwards and slightly to her right with a surprised or concerned expression. In the background, a man with long, wavy hair and a beard, dressed in a long, light-colored coat, stands on the steps, looking down at her. The lighting is dramatic, with strong highlights and shadows.

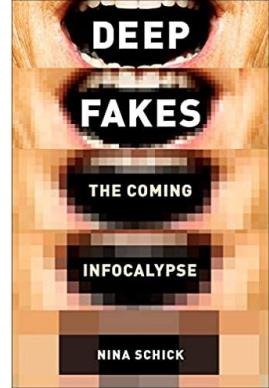
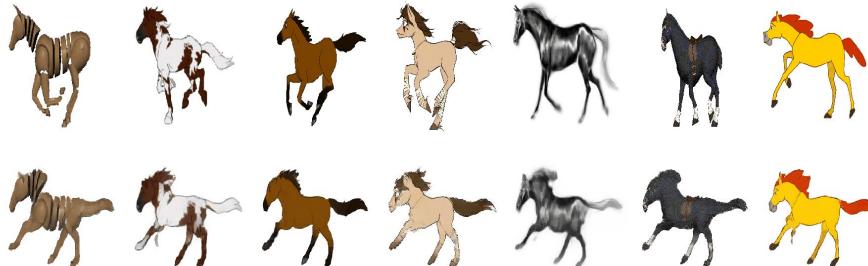
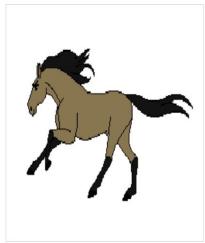
WELCOME TO

DEEPFACE**CO**LAB

<https://github.com/cherwonij/DFL-Colab>



<https://github.com/AliaksandrSiarohin/first-order-model>



<https://abre.ai/deepfake-vacina>

# Natural Language Processing



Machine  
Translation

56 benchmarks

977 papers with code



Language  
Modelling

19 benchmarks

962 papers with code



Question  
Answering

66 benchmarks

863 papers with code



Sentiment  
Analysis

50 benchmarks

584 papers with code



Text  
Generation

49 benchmarks

416 papers with code

[See all 363 tasks](#)

## Graphs



Link Prediction

52 benchmarks

304 papers with code



Node  
Classification

61 benchmarks

249 papers with code



Graph  
Embedding

1 benchmark

168 papers with code



Graph  
Classification

46 benchmarks

139 papers with code



Community  
Detection

12 benchmarks

107 papers with code

[See all 63 tasks](#)

@paperwithcode





# +100k papers



## COVID-19: A scholarly production dataset report for research analysis

Breno Santana Santos<sup>a,b,\*</sup>, Ivanovitch Silva<sup>a</sup>, Marcel da Câmara Ribeiro-Dantas<sup>c</sup>, Gislainy Alves<sup>a</sup>, Patricia Takako Endo<sup>d</sup> and Luciana Lima<sup>a</sup>

<sup>a</sup> Universidade Federal do Rio Grande do Norte (UFRN), Rio Grande do Norte, Brazil

<sup>b</sup> Núcleo de Pesquisa e Prática em Inteligência Competitiva (NUPIC), Universidade Federal de Sergipe (UFS), Itabaiana/SE, Brazil

<sup>c</sup> Institut Curie (UMR168), Sorbonne Université (EDITE), Paris, France

<sup>d</sup>Universidade de Pernambuco (UPE), Pernambuco, Brazil

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### ARTICLE INFO

**Keywords:**

COVID-19

SARS-CoV-2

Pandemic

Data Science

Bibliometrics

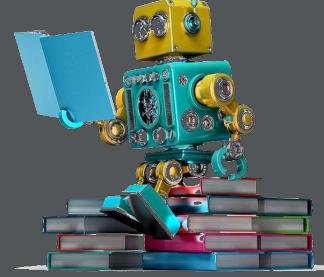
Scientometrics

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### ABSTRACT

COVID-19 has been recognized as a global threat, and several studies are being conducted in order to contribute to the fight and prevention of this pandemic. This work presents a scholarly production dataset focused on COVID-19, providing an overview of scientific research activities, making it possible to identify countries, scientists and research groups most active in this task force to combat the coronavirus disease. The dataset is composed of 40,212 records of articles' metadata collected from Scopus, PubMed, arXiv and bioRxiv databases from January 2019 to July 2020. Those data were extracted by using the techniques of Python Web Scraping and pre-processed with Pandas Data Wrangling. In addition, the pipeline to preprocess and generate the dataset are versioned with the Data Version Control tool (DVC) and are thus easily reproducible and auditable.





NLP +  
Generative Transformer Model +  
Google Colab + GPU K80 +  
OpenAI GPT-2

```
pip install gpt-2-simple
```

Brazil is one of the most densely populated countries in the world. The outbreak has affected more than 600,000 people and put the country on the front line of the global pandemic. As the outbreak continues to spread, the health and socioeconomic reforms of the president and his government have been criticised for being overly harsh. This analysis attempts to understand the reasons behind the policies and why they are being so harshly criticised, and how the institutional changes and the administration have been ineffective in dampening the disease. In particular, the reasons for the policies are discussed. It is argued that the policies are overly harsh not only because of the lack of economic growth but also because of the lack of social and health security, making it difficult to pay the healthcare bill. The authors conclude that the policies are counterproductive and the policies need to be reformed. This study provides a framework for analysing the policies of the government and the subsequent failure in their implementation.



Created by GPT-2

# Who would be the author of that text?



100%  
Unique

0%  
Plagiarism

# What if?

Instituto Nacional da Propriedade Industrial

Buscar no Site



MARCAS

PATENTES

DESENHOS  
INDUSTRIALIS

INDICAÇÕES  
GEOGRÁFICAS

PROGRAMAS DE  
COMPUTADOR

TOPOGRAFIAS  
DE CIRCUITOS  
INTEGRADOS

CONTRATOS DE  
TECNOLOGIA E  
DE FRANQUIA

ACADEM  
DO INP

Alguma dúvida?



Chatbot

Alguma dúvida?  
Chatbot do INPI  
DISPONÍVEL 24/7

DE  
MAIS

VALOR

À SUA  
CRIAÇÃO!

DE  
MAIS

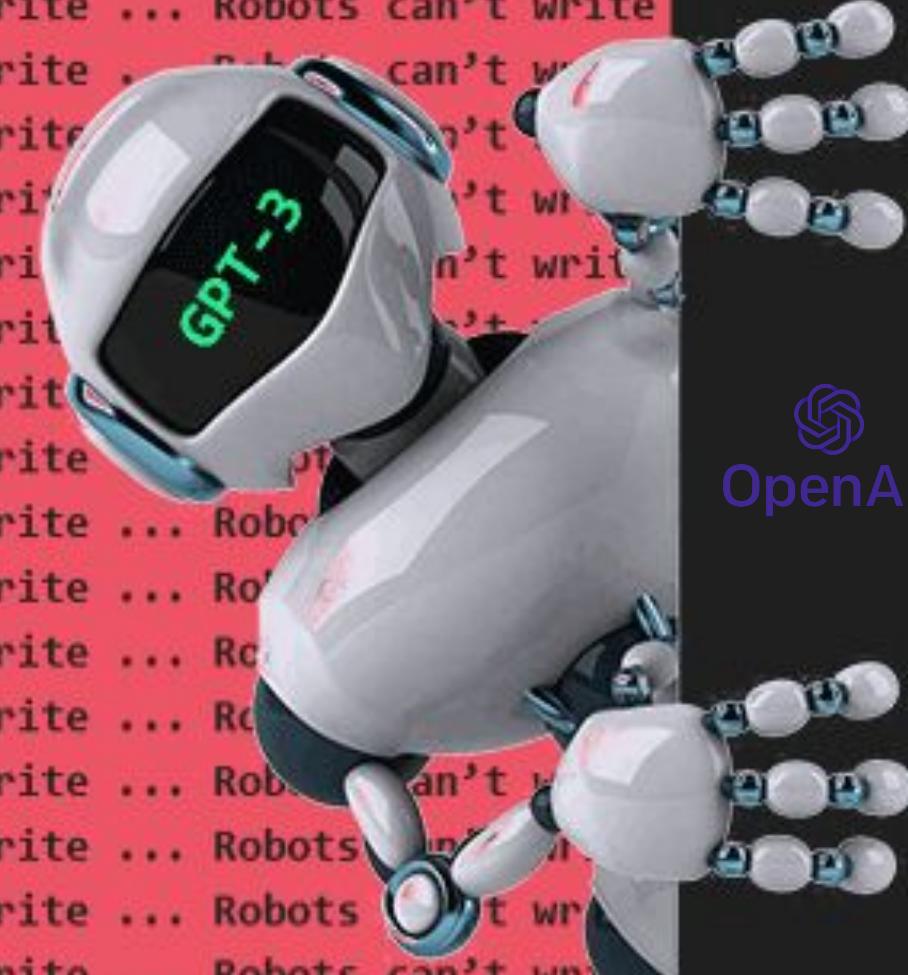
## Top publications

<https://abre.ai/ranking-googlescholar>

Categories &gt; Engineering &amp; Computer Science &gt; Engineering &amp; Computer Science (general) ▾

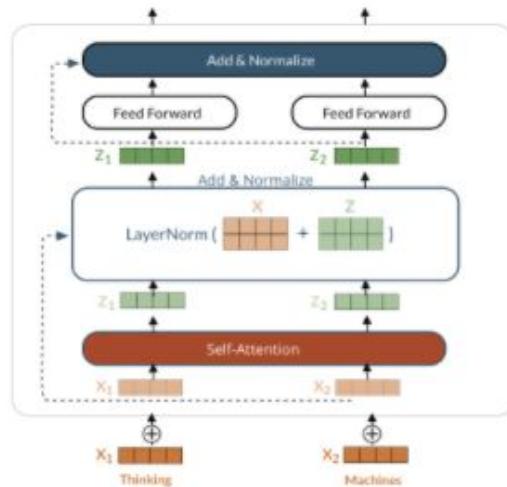
Publication	<u>h5-index</u>	<u>h5-median</u>
1. Chemical engineering journal	<u>134</u>	171
2. IEEE Transactions on Industrial Electronics	<u>129</u>	174
3. IEEE Access	<u>119</u>	177
4. Sensors	<u>104</u>	151
5. Information Sciences	<u>102</u>	133
6. ACS Energy Letters	<u>98</u>	143
7. ACS Sustainable Chemistry & Engineering	<u>97</u>	123
8. Fuel	<u>96</u>	123
9. ACM Computing Surveys (CSUR)	<u>90</u>	141
10. IEEE Transactions on Industrial Informatics	<u>90</u>	120
11. Proceedings of the IEEE	<u>84</u>	148
12. IEEE Transactions on Information Theory	<u>84</u>	142
13. Procedia Computer Science	<u>84</u>	111
14. International Journal of Information Management	<u>83</u>	130
15. Mechanical Systems and Signal Processing	<u>83</u>	121

175B vs 1.5B  
355GPU/y  
4.6M U\$



 OpenAI

the HUSTLE



# GPT-Neo

GPT-Neo is the code name for a series of transformer-based language models loosely styled around the GPT architecture that we plan to train and open source. Our primary goal is to replicate a GPT-3 sized model and open source it to the public, for free.

Along the way we will be running experiments with [alternative architectures](#) and [attention types](#), releasing any intermediate models, and writing up any findings on our blog.

Our models are built in Tensorflow-mesh, which will allow us to scale up to GPT-3 sizes and beyond using simultaneous model and data parallelism.

## Progress:

- We have the bulk of the model built, GPT-2 size models trained, and several experimental architectures implemented.
- Our current codebase should be able to scale up to GPT-3 sized models

## Next Steps:

- We are currently working on wrapping up GPT-2-sized model replication, looking mostly at evaluations there.
- The largest model we've gotten to train for a single step so far has been 200B parameters.

<https://www.eleuther.ai/projects/gpt-neo/>

# Google trained a trillion-parameter AI language model

Kyle Wiggers

@Kyle\_L\_Wiggers

January 12, 2021 10:36 AM

f t in

<https://venturebeat.com/2021/01/12/google-trained-a-trillion-parameter-ai-language-model/>



# Por que a demissão de pesquisadora negra do Google se transformou em escândalo global

O silenciamento e a saída de Timnit Gebru geram novas dúvidas sobre o compromisso das grandes empresas de tecnologia com seus propósitos éticos



 **Jeff Dean (@)**   
@JeffDean

On behalf of the entire Google Research & [@GoogleAI](#) communities, I'm excited to share an overview of some of our research in 2020.

Thanks to everyone who helped make this work possible!

Google Research: Looking Back at 2020, and Forward to 2...  
Posted by Jeff Dean, Senior Fellow and SVP of Google Research and Health, on behalf of the entire Google ...  
[ai.googleblog.com](https://ai.googleblog.com)

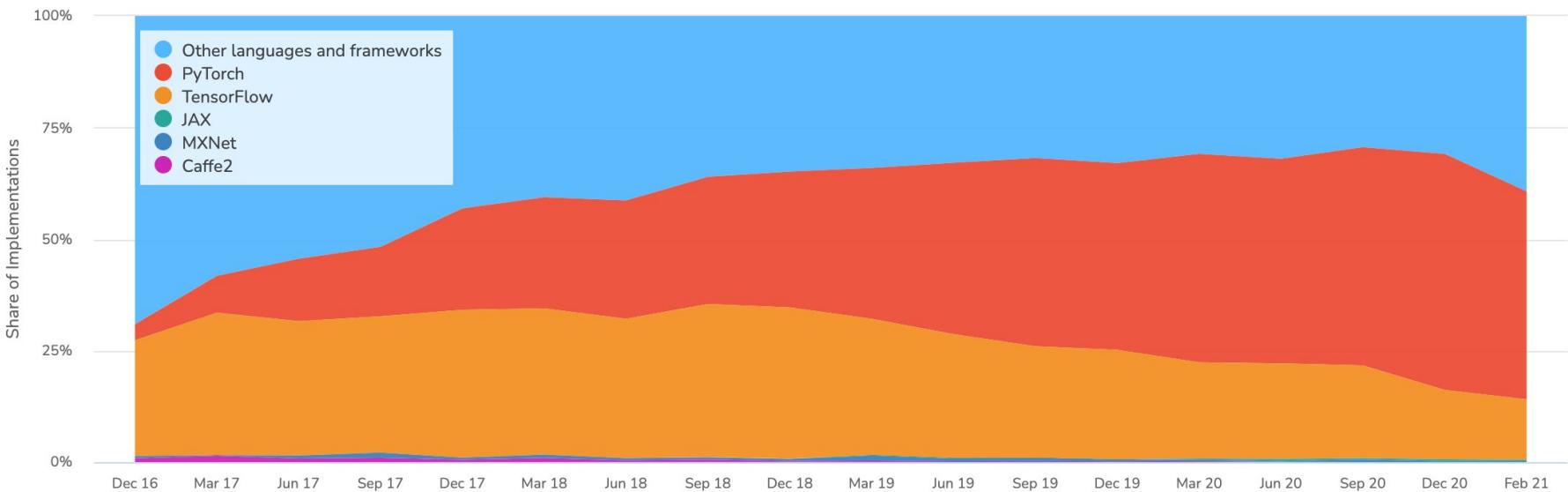
5:40 PM · Jan 12, 2021 · Twitter Web App

333 Retweets 82 Quote Tweets 1.5K Likes

# Trends

## Frameworks

Paper Implementations grouped by framework



@paperwithcode





**Soumith Chintala**   
@soumithchintala



Debates on PyTorch vs TensorFlow were fun in 2017.  
There was healthy competition to innovate, and  
philosophical differences like Theano vs Torch, Emacs vs  
vim, or android vs iOS.  
Now both products look exactly the same, the debates  
are nonsense and boring. Please stop.

12:27 PM · May 22, 2020 · [Twitter Web App](#)

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**121** Retweets and comments    **866** Likes





# Developer tools for machine learning

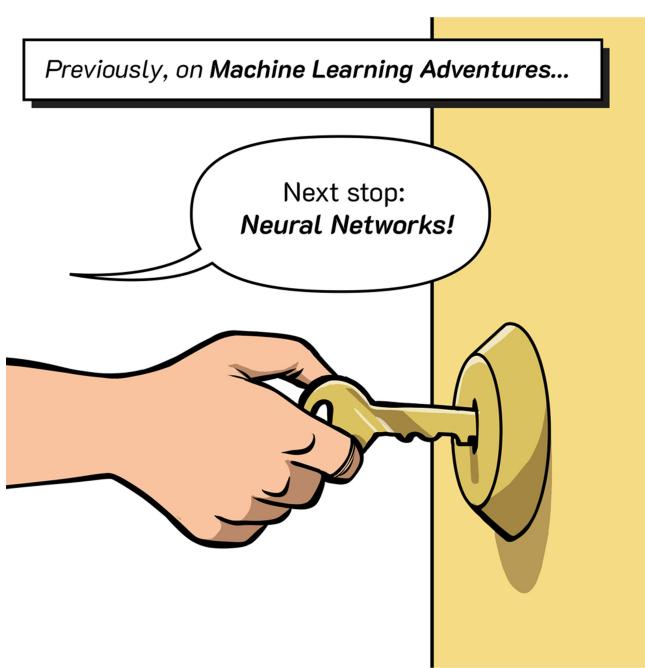
Experiment tracking, hyperparameter optimization,  
model and dataset versioning

[Create a free account](#)[Request a demo](#)[Try a live notebook](#)

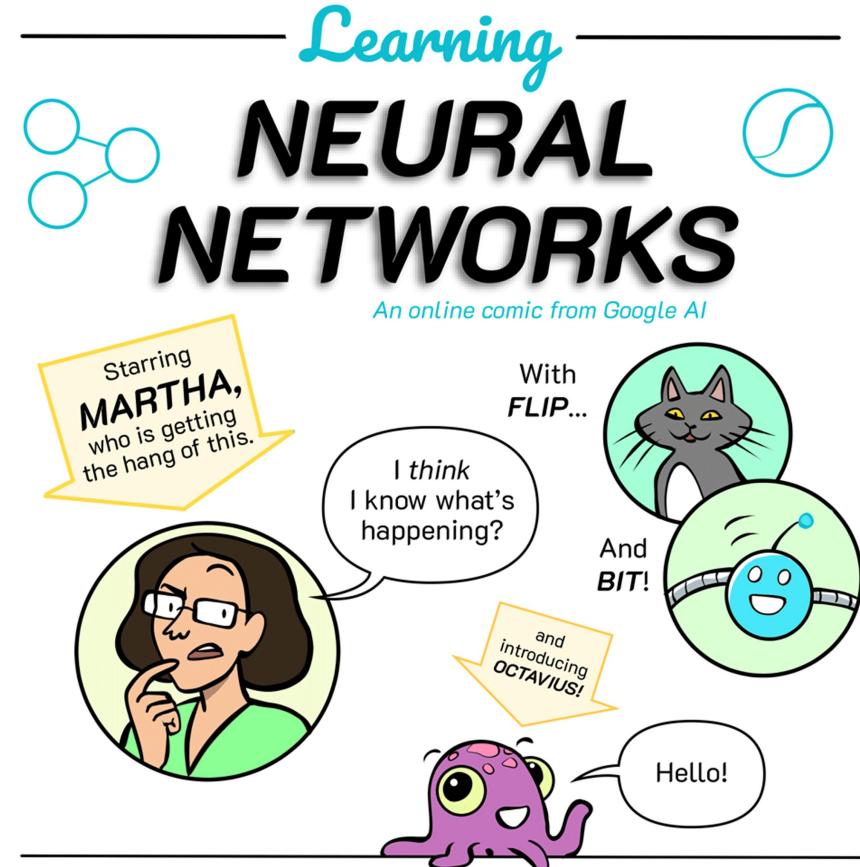
Track, compare, and visualize ML experiments with 5 lines of code.

<https://wandb.ai>

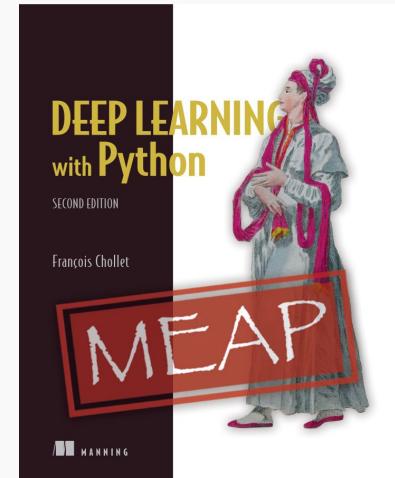
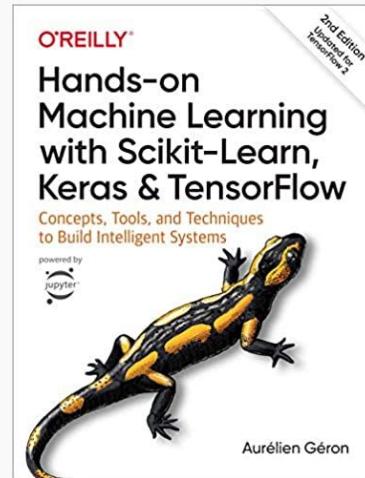
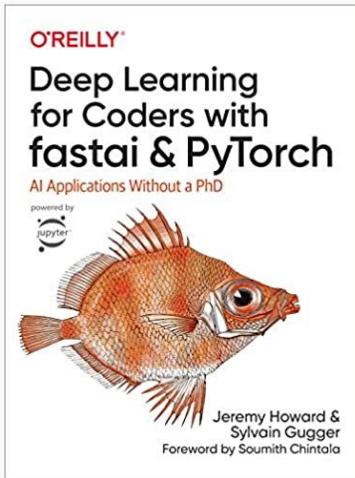
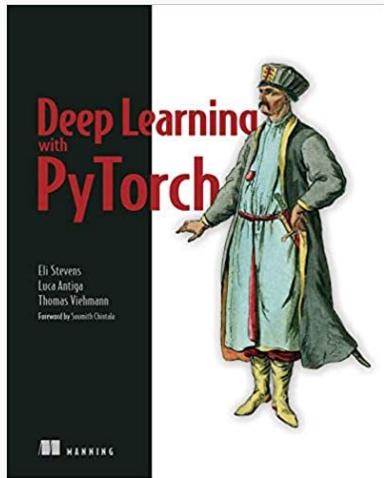
# References



<https://cloud.google.com/products/ai/ml-comic-1>

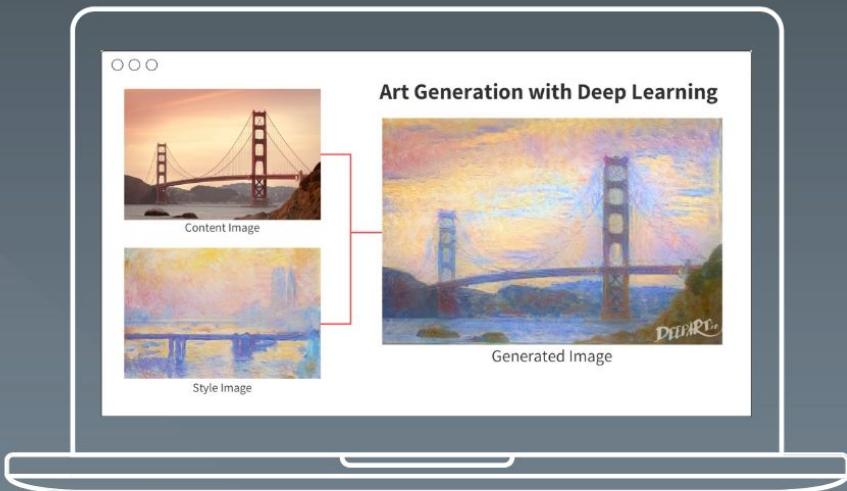


<https://cloud.google.com/products/ai/ml-comic-2>



# Break Into AI

Whether you want to build algorithms or build a company, deeplearning.ai's courses will teach you key concepts and applications of AI.

[Take the Deep Learning Specialization](#)

# Meet Andrew Ng Competition

Workera has released our new [Data Literacy assessment](#), and to commemorate the occasion we're providing 4 members of the Workera community with an opportunity to have a virtual coffee chat with Andrew Ng! Here's how it works:

- Complete any [Workera assessment](#) (either the assessment for technical AI practitioners or the Data Literacy assessment for non-technical AI practitioners) between January 13, 2021 and February 13, 2021.
- Once you've successfully completed the assessment, share your Workera badge on LinkedIn using the [#Workera](#) hashtag.
- Winners will be selected on February 15, 2021. We'll select the two individuals with the highest score, and two individuals will be selected at random. If you're selected, you'll receive an email from us with next steps!
- If you're not selected, you will receive an email from us by February 27, 2021 and we'll keep you posted on future opportunities to meet Andrew Ng and participate in other Workera events.
- This competition is open to new and existing users of Workera assessments.

**Join the Meet Andrew Ng Competition now!**

[Join the competition](#)

<https://workera.ai/announcement/>



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PAPERS

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**Reminder: February 11 Talk on Reproducibility in ML & Systems Research  
with Grigori Fursin**

If you haven't done so already, [register now](#) for the next free ACM TechTalk, "Reproducing 150 Research Papers and Testing Them in the Real World: Challenges and Solutions," presented on **Thursday, February 11, at 12:00 PM ET/9:00 AM PT** by **Grigori Fursin**, President of the cTuning Foundation, Founder of cKnowledge.io and member of the ACM Taskforce on Reproducibility. **Peter Mattson**, ML Metrics lead at Google and President of MLCCommons will moderate the questions and answers session following the talk.

Leave your comments and questions with our speaker now and any time before the live event on [ACM's Discourse Page](#). And check out the page after the webcast for extended discussion with your peers in the computing community, as well as further resources on reproducibility.

*(If you'd like to attend but can't make it to the virtual event, you still need to register to receive a recording of the TechTalk when it becomes available.)*

**Note:** You can stream this and all ACM TechTalks on your mobile device, including smartphones and tablets.

In this talk, Grigori Fursin describes his 10-year effort to solve numerous reproducibility issues in ML and systems research and make it easier to use it in the real world. He will share his experience reproducing 150+ research papers during artifact evaluation at multiple ACM conferences. This tedious experience motivated him to develop the Collective Knowledge framework and the cKnowledge.io portal to bring DevOps principles to CS research. He will also present portable CK workflows with plug & play components to package and share research artifacts and results with common Python APIs, reusable automation actions and unified meta descriptions. Such workflows can be used to automatically build, benchmark and validate research techniques across continuously evolving technology stacks.

Fursin will conclude with several practical use-cases of this technology to automate benchmarking, optimization, and co-design of efficient computer systems in collaboration with Arm, IBM, General Motors, ACM, the Raspberry Pi foundation, and MLPerf. His long-term goal is to help researchers share their new research techniques as portable and production-ready packages along with published papers that can be quickly validated by volunteers and adopted by industry.

**Duration:** 60 minutes (including audience Q&A)

<https://abre.ai/eventoml>



# Reproducibility



# Learn to peer review with confidence

The Publons Academy: your free peer review training course

[GO TO COURSE](#)

<https://publons.com/community/academy/>

# Course Outline



A close-up, low-angle shot of Iron Man's head and upper torso. He is wearing his iconic red and gold suit, which is highly reflective and metallic. His helmet is off, showing his face, and he is looking down and slightly to the side with a serious expression. The background is dark and blurred, suggesting a futuristic or industrial environment with some glowing blue and orange lights.

## Course Expectation

This class won't  
teach you how to  
do this!!!



## Course Expectation

This class will teach you how to build something like this :-)

# Unit 01

The perceptron  
Building neural networks  
Applying neural networks  
Training neural networks  
Neural networks in practice  
Hyperparameter Tuning  
Batch Normalization  
Multiclass classification  
Structuring DL Projects

# Unit 02

Convolutional Neural Networks  
Recurrent Neural Networks





# jupyter x aws



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Fevereiro 2021						
Wk	Dom	Seg	Ter	Qua	Qui	Sex
5		1	2	3	4	5
6	7	8	9	10	11	12
7	14	15	16	17	18	19
8	21	22	23	24	25	26
9	28					

Março 2021						
Wk	Dom	Seg	Ter	Qua	Qui	Sex
	9		1	2	3	4
	10	7	8	9	10	11
	11	14	15	16	17	18
	12	21	22	23	24	25
	13	28	29	30	31	

Abril 2021						
Wk	Dom	Seg	Ter	Qua	Qui	Sex
	13				1	2
	14	4	5	6	7	8
	15	11	12	13	14	15
	16	18	19	20	21	22
	17	25	26	27	28	29
						30

Maio 2021						
Wk	Dom	Seg	Ter	Qua	Qui	Sex
17						1
18	2	3	4	5	6	7
19	9	10	11	12	13	14
20	16	17	18	19	20	21
21	23	24	25	26	27	28
22	30	31				29

Junho 2021						
Wk	Dom	Seg	Ter	Qua	Qui	Sex
	22		1	2	3	4
	23	6	7	8	9	10
	24	13	14	15	16	17
	25	20	21	22	23	24
	26	27	28	29	30	

○ NN Fundamentals

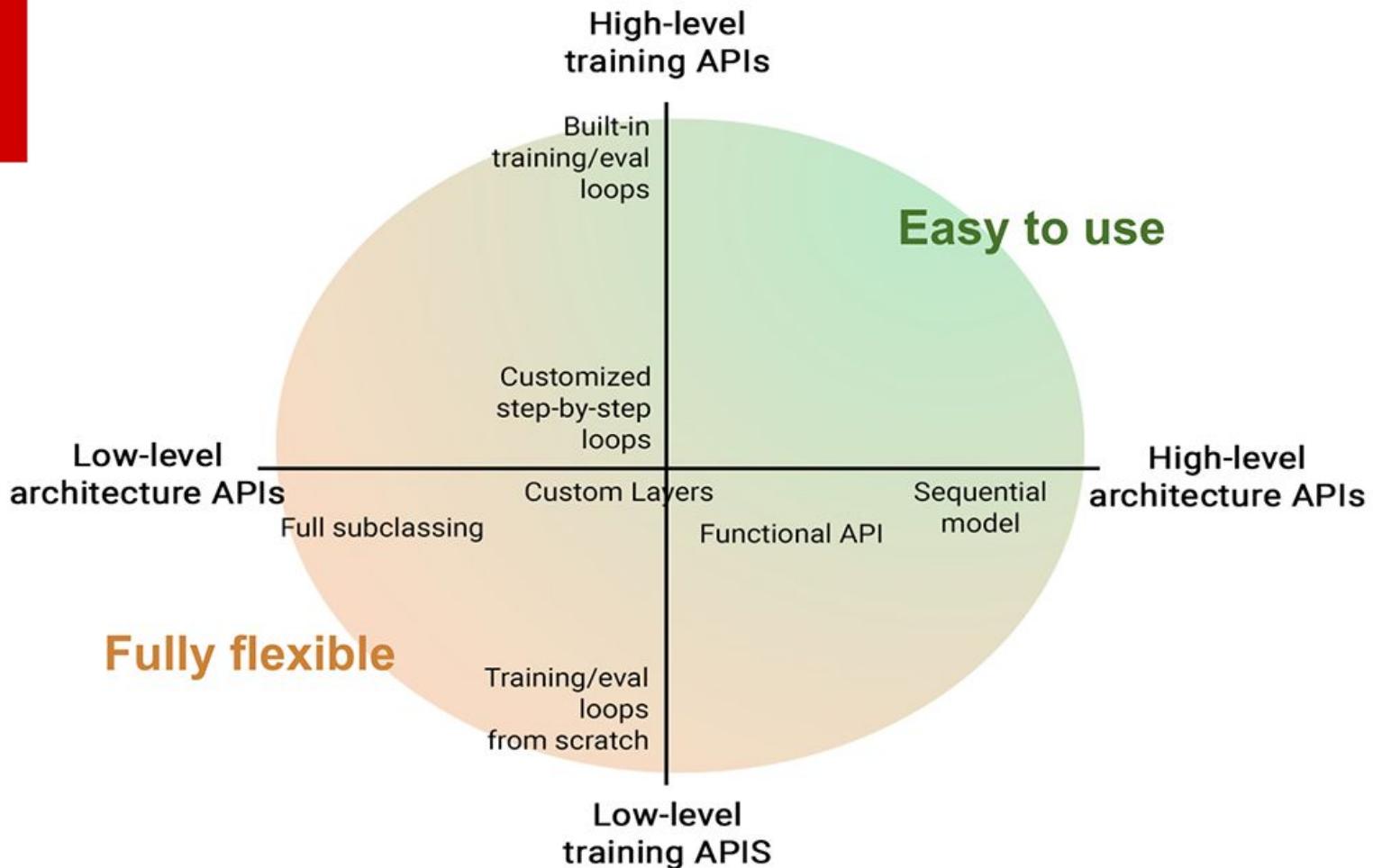
○ Project

○ CNN Fundamentals

○ Project

○ Sequence Models

○ Project







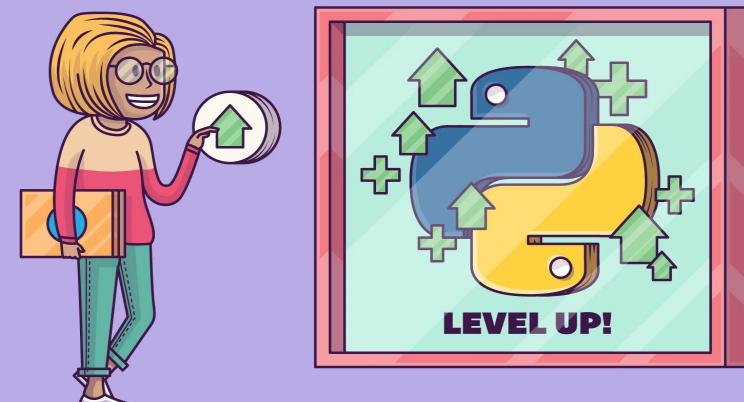
Real Python



Real Python



Real Python



Real Python



5min





Next ....

[ppgeec.ufrn.br](http://ppgeec.ufrn.br)

<https://github.com/ivanovitchm/eec2003>