

PPGEEC2318

# Machine Learning

Course Outline

Ivanovitch Silva

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## REFORMA CURRICULAR DO PROGRAMA DE PÓS-GRADUAÇÃO EM ENGENHARIA ELÉTRICA E DE COMPUTAÇÃO (PPgEEC)

Natal, RN, dezembro de 2022.

### 6. Organização Curricular:

Disciplinas Básicas do Programa:

Código	Denominação	Créditos	Áreas
PPGEEC2301	Metodologia do Ensino Superior	04	AS, EC, TEL
PPGEEC2302	Metodologia da Pesquisa Científica	04	AS, EC, TEL
PPGEEC2303	Sistemas Lineares	04	AS
PPGEEC2304	Sistemas de Controle	04	AS
PPGEEC2305	Eletrônica de Potência	04	AS
PPGEEC2306	Instrumentação Eletrônica	04	AS
PPGEEC2316	Algoritmos de Engenharia	04	EC
PPGEEC2317	Sistemas Probabilísticos	04	EC, TEL
<b>PPGEEC2318</b>	<b>Aprendizado de Máquina</b>	<b>04</b>	<b>EC</b>
PPGEEC2330	Ondas Guiadas	04	TEL
PPGEEC2331	Engenharia de Micro-Ondas	04	TEL
PPGEEC2332	Teoria de Antenas	04	TEL
PPGEEC2333	Comunicações Móveis	04	TEL

(\*) EC = Engenharia de Computação, AS = Automação e Sistemas, TEL = Telecomunicações



# Ice Breaker

runway

Text to Image  
Image, Text to Image  
Text to Video  
Image, Text to Video

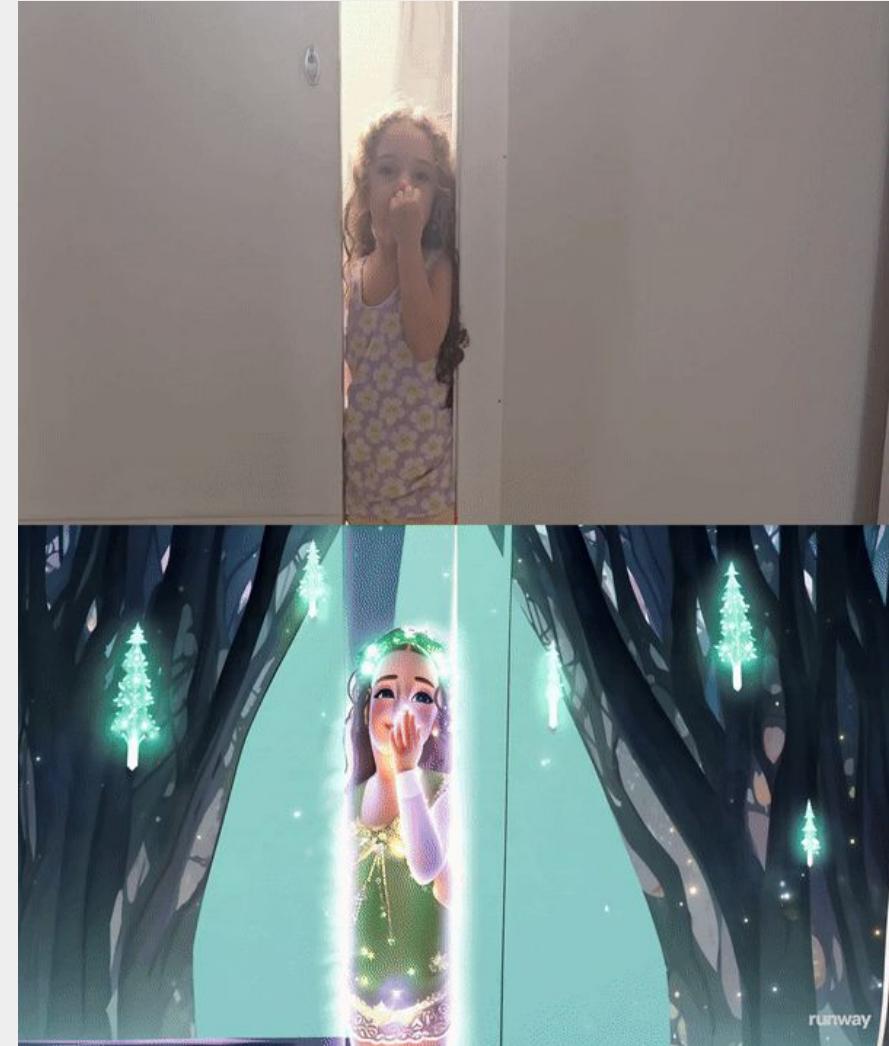
AI-Generated  
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# What challenges do you envision in this reality?

Text, Video to Video

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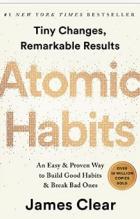
★★★★★  
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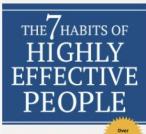
## Best Productivity Books



Atomic Habits  
James Clear

An Easy & Proven Way  
to Build Good Habits  
& Break Bad Ones

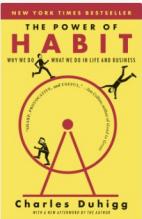
4.35 ★★★★★



The 7 Habits of  
Highly Effective  
People  
Stephen R. Covey

Infographics Edition  
Power Lessons in Personal  
Change

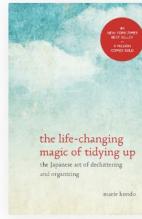
4.16 ★★★★★



The Power of Habit  
Charles Duhigg

Why We Do What We Do in  
Life and Business

4.13 ★★★★★



The Life-Changing  
Magic of Tidying Up  
Marie Kondo

The Japanese Art of  
Decluttering and Organizing

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VOICE CLONING

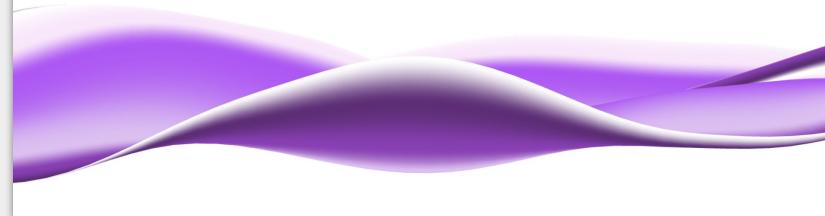
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Generative Agents: Interactive Simulacra of Human Behavior 5 min <a href="#">View Source</a> <a href="#">View Transcript</a> <a href="#">Play</a>	Large Language Models Encode Clinical Knowledge 3 min <a href="#">View Source</a> <a href="#">View Transcript</a> <a href="#">Play</a>	Position: Levels of AGI for Operationalizing Progress on the Path ... 4 min <a href="#">View Source</a> <a href="#">View Transcript</a> <a href="#">Play</a>
Generative Ghosts: Anticipating Benefits and Risks of AI... 4 min <a href="#">View Source</a> <a href="#">View Transcript</a> <a href="#">Play</a>	Code as Policies: Language Model Programs for Embodi... 4 min <a href="#">View Source</a> <a href="#">View Transcript</a> <a href="#">Play</a>	AI and the Opportunity for Shared Prosperity: Lessons From the... 3 min <a href="#">View Source</a> <a href="#">View Transcript</a> <a href="#">Play</a>

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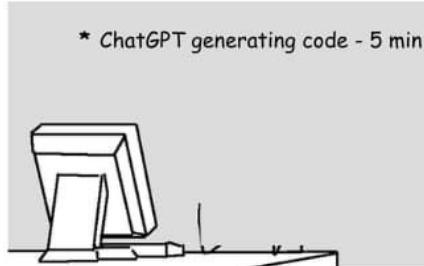
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## After Chat GPT



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CEO at Data Scientific, Google's first Chief Decision Scientist, De...

4d •

Computers don't make decisions. Humans make decisions, and those decisions are amplified by AI.

"AI will not replace you. A person using AI will."



Introducing Devin, the first AI software engineer

Scott Wu, CEO / Cognition AI  
Human Software Engineer

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March 12th, 2024 | Written by Scott Wu

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## New AI assistant threatens software engineering jobs

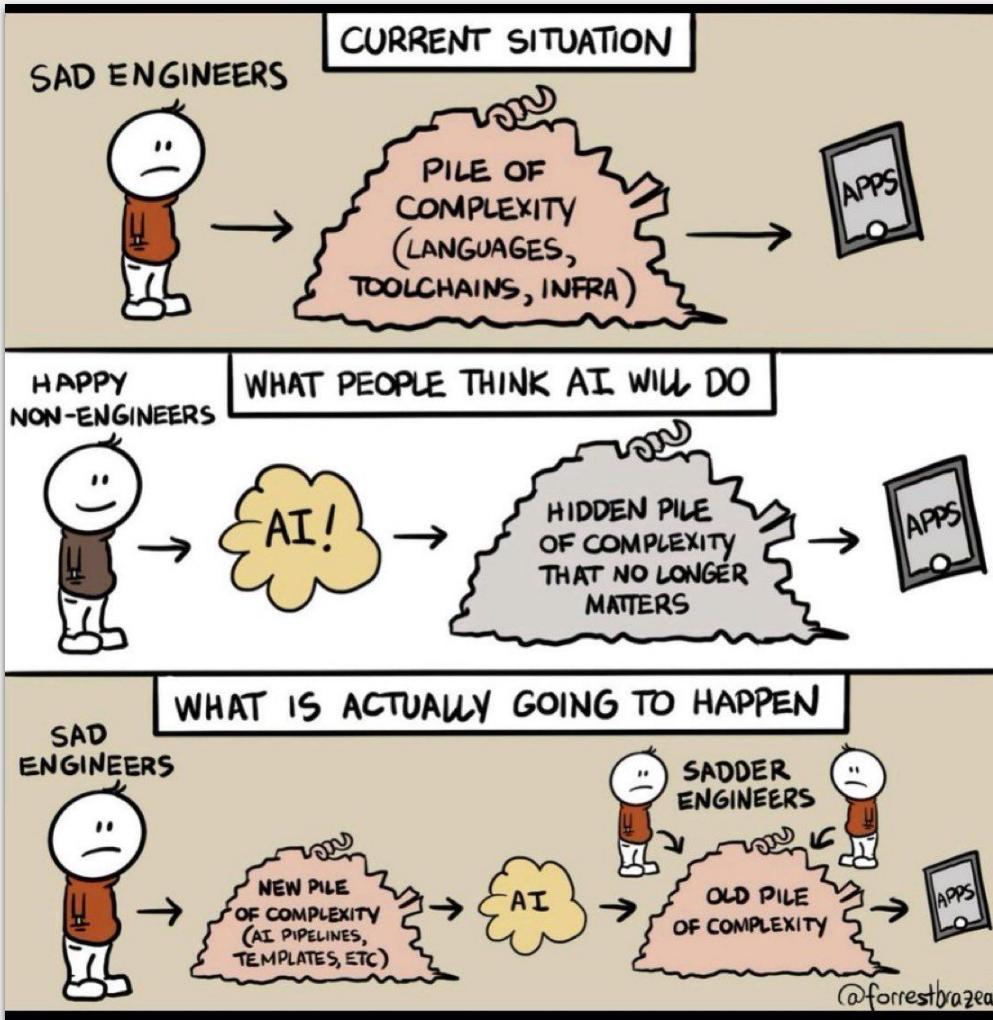
Devin has the ability to actively collaborate with users during software development. This includes providing real-time progress updates, accepting feedback, and working together to make design choices.



By [Sandeep Budki](#)

InfoWorld | MAR 13, 2024 6:29 AM PDT

<https://www.cognition-labs.com/blog>



Even with the advent of no-code tools, why do I still have to focus into fundamental stuff?



## The three-dimensional porous mesh structure of Cu-based metal-organic-framework - aramid cellulose separator enhances the electrochemical performance of lithium metal anode batteries

Manshu Zhang<sup>a,1</sup>, Liming Wu<sup>a,1</sup>, Tao Yang<sup>b</sup>, Bing Zhu<sup>a</sup>, Yangai Liu<sup>a,\*</sup>

<sup>a</sup> Beijing Key Laboratory of Materials Utilization of Nonmetallic Minerals and Solid Wastes, National Laboratory of Mineral Materials, School of Materials Science and Technology, China University of Geosciences, Beijing 100083, China

<sup>b</sup> College of Materials & Environmental Engineering, Hangzhou Dianzi University, Hangzhou 310036, China

### ARTICLE INFO

#### Keywords:

Lithium metal battery  
Lithium dendrites  
CuMOF-ANFs separator

### ABSTRACT

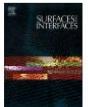
Lithium metal, due to its advantages of high theoretical capacity, low density and low electrochemical reaction potential, is used as a negative electrode material for batteries and brings great potential for the next generation of energy storage systems. However, the production of lithium metal dendrites makes the battery life low and poor safety, so lithium dendrites have been the biggest problem of lithium metal batteries. This study shows that the larger specific surface area and more pore structure of Cu-based metal-organic-framework - aramid cellulose (CuMOF-ANFs) composite separator can help to inhibit the formation of lithium dendrites. After 110 cycles at 1 mA/cm<sup>2</sup>, the discharge capacity retention rate of the Li-Cu battery using the CuMOF-ANFs separator is about 96 %. Li-Li batteries can continue to maintain low hysteresis for 2000 h at the same current density. The results show that CuMOF-ANFs composite membrane can inhibit the generation of lithium dendrites and improve the cycle stability and cycle life of the battery. The three-dimensional (3D) porous mesh structure of CuMOF-ANFs separator provides a new perspective for the practical application of lithium metal battery.

### 1. Introduction

Certainly, here is a possible introduction for your topic:Lithium metal batteries are promising candidates for high-energy-density rechargeable batteries due to their low electrode potentials and high theoretical capacities [1,2]. However, during the cycle, dendrites forming on the lithium metal anode can cause a short circuit, which can affect the safety and life of the battery [3–9]. Therefore, researchers are indeed focusing on various aspects such as negative electrode structure [10], electrolyte additives [11,12], SEI film construction [13,14], and collector modification [15] to inhibit the formation of lithium dendrites. However, using a separator with high mechanical strength and chemical stability is another promising approach to prevent dendrites from infiltrating the cathode. By incorporating a separator with high me-

chemical stability of the separator is equally important as it ensures that the separator remains intact and does not react or degrade in the presence of the electrolyte or other battery components. A chemically stable separator helps to prevent the formation of reactive species that can further promote dendrite growth. Researchers are actively exploring different materials and designs for separators to enhance their mechanical strength and chemical stability. These efforts aim to create separators that can effectively block dendrite formation, thereby improving the safety and performance of lithium-ion batteries. While there are several research directions to address the issue of dendrite formation, using a separator with high mechanical strength and chemical stability is an important approach to prevent dendrites from infiltrating the cathode. By incorporating a separator with high mechanical strength, it can act as a physical barrier to impede the growth of dendrites. This barrier can withstand the mechanical stress exerted by the dendrites during battery operation, preventing them from reaching the cathode and causing short circuits or other safety issues. Moreover,

Several types of separators currently used in research include



## The three-dimensional porous mesh structure of Cu-based metal-organic-framework - aramid cellulose separator enhances the electrochemical performance of lithium metal anode batteries

Manshu Zhang<sup>a,1</sup>, Liming Wu<sup>a,1</sup>, Tao Yang<sup>b</sup>, Bing Zhu<sup>a</sup>, Yangai Liu<sup>a,\*</sup>

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Several types of separators currently used in research include nanoporous polymer separators [16], ceramic composite separators [17], nanofiber separators [18–20], and metal-organic skeleton (MOF) separators [21–24]. While these separators have shown some ability to inhibit the growth of lithium dendrites, they still have some drawbacks,

\* Corresponding author.

E-mail address: [liuyang@cugb.edu.cn](mailto:liuyang@cugb.edu.cn) (Y. Liu).

<sup>1</sup> These authors contributed equally.

## Chamada CNPq/MCTI/FNDCT Nº 22/2024 – Programa Conhecimento Brasil – Apoio a Projetos em Rede com Pesquisadores Brasileiros no Exterior

O Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq, com financiamento do Fundo Nacional de Desenvolvimento Científico e Tecnológico (FNDCT) e seguindo as diretrizes emanadas do Ministério da Ciência, Tecnologia e Inovação – MCTI torna pública a presente Chamada e convidam os interessados a apresentarem propostas nos termos aqui estabelecidos.

### 1 – Objeto

Apoiar projetos de pesquisa que visem contribuir para o desenvolvimento científico e tecnológico e a inovação do País, nas diversas áreas, com pesquisadores brasileiros radicados no exterior.

#### 1.1 – São objetivos e diretrizes desta chamada:

a) Apoiar a execução de projetos em Instituições de Ensino Superior e Pesquisa em Ciência e Tecnologia – ICT, localizadas no Brasil, em parceria com pesquisadores brasileiros radicados em instituições de ensino, pesquisa e desenvolvimento no exterior.

b) Estimular o intercâmbio de conhecimento entre pesquisadores brasileiros radicados no exterior e pesquisadores brasileiros radicados no exterior, através de ferramentas e processos que envolvam Inteligência Artificial.

c)

**6.7** – Será aceita uma única proposta por proponente. Os projetos terão vigência inicial de até 24 meses.

**6.8** – Na hipótese de envio de mais de uma proposta pelo mesmo proponente, respeitando-se o prazo limite estipulado para submissão das propostas, será considerada para análise somente a última proposta recebida.

**6.9** – Constatado o envio de propostas idênticas, apresentadas por diferentes proponentes, todas as propostas nesta condição serão indeferidas.

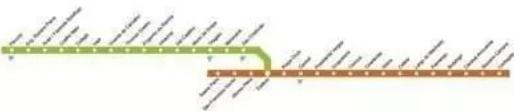
**6.10** – Recomenda-se ao proponente que informe se na elaboração e redação da proposta foi utilizado instrumento de Inteligência Artificial. Esta informação tem caráter consultivo, não tendo impacto no julgamento da proposta.

Rio de Janeiro, 1993



Xangai, 1993  
(sem metrô)

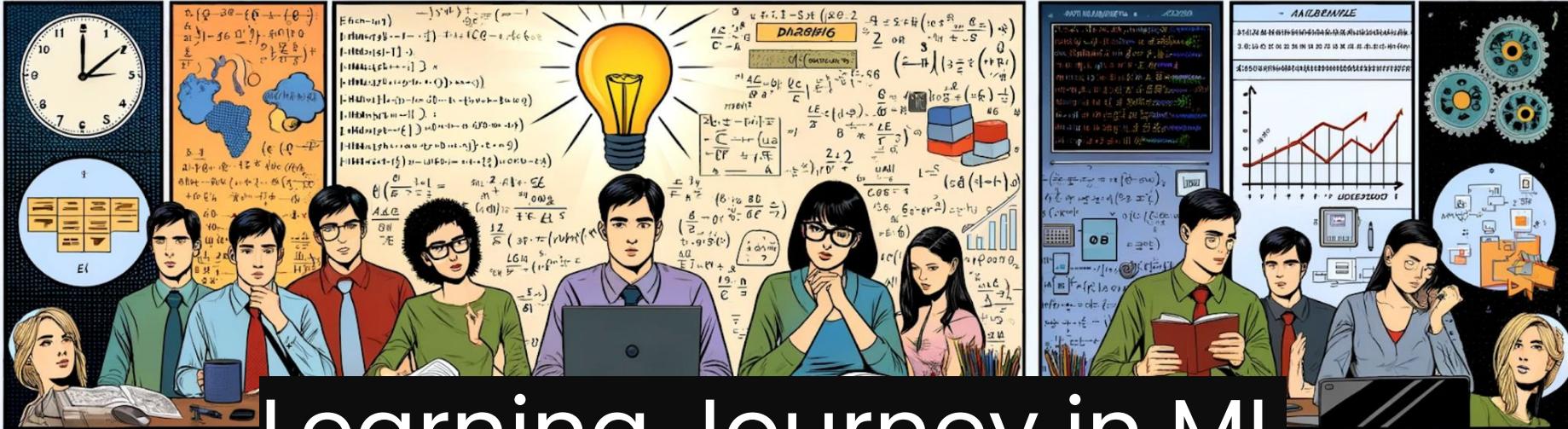
Rio de Janeiro, 2013



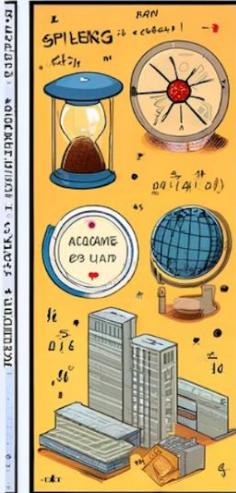
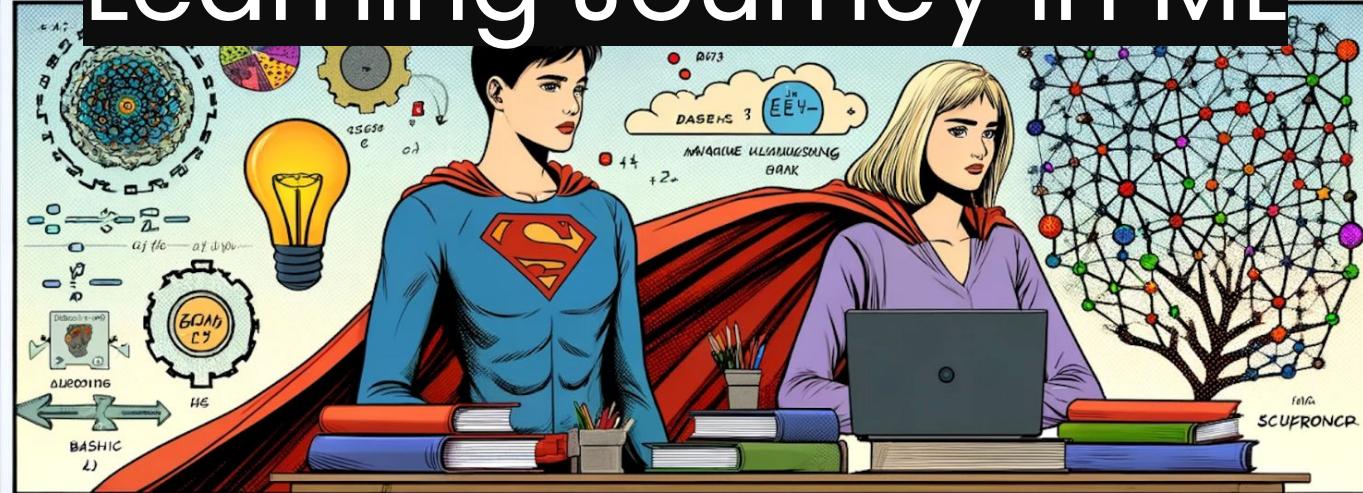
Xangai, 2013



How does this metaphor fit into our learning journey, really?



# Learning Journey in ML



Fundamental  
Concepts in  
ML

Data Preparation:  
cleaning, feature  
selection, data  
transforms

Fundamental  
Concepts in  
Statistics

Linear  
Regression

Gradient  
Descent

Logistic  
Regression

Naive  
Bayes

Assessing  
Model  
Performance

Preventing  
Overfitting with  
Regularization

Unbalancing  
Data  
Methods

Support  
Vector  
Machines

Decision  
Tree

Random  
Forest

Boosting

Ensemble

Neural  
Networks

Dimensionality  
Reduction

Clustering

## A classical ML course

\*Undergrad

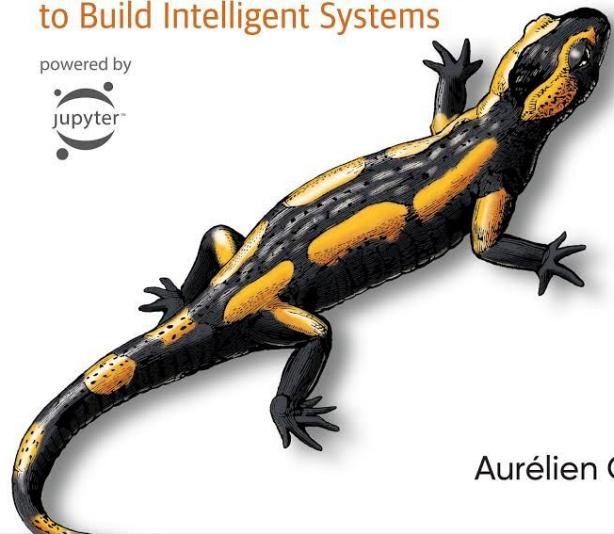
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## Data Preparation for Machine Learning

Data Cleaning, Feature Selection,  
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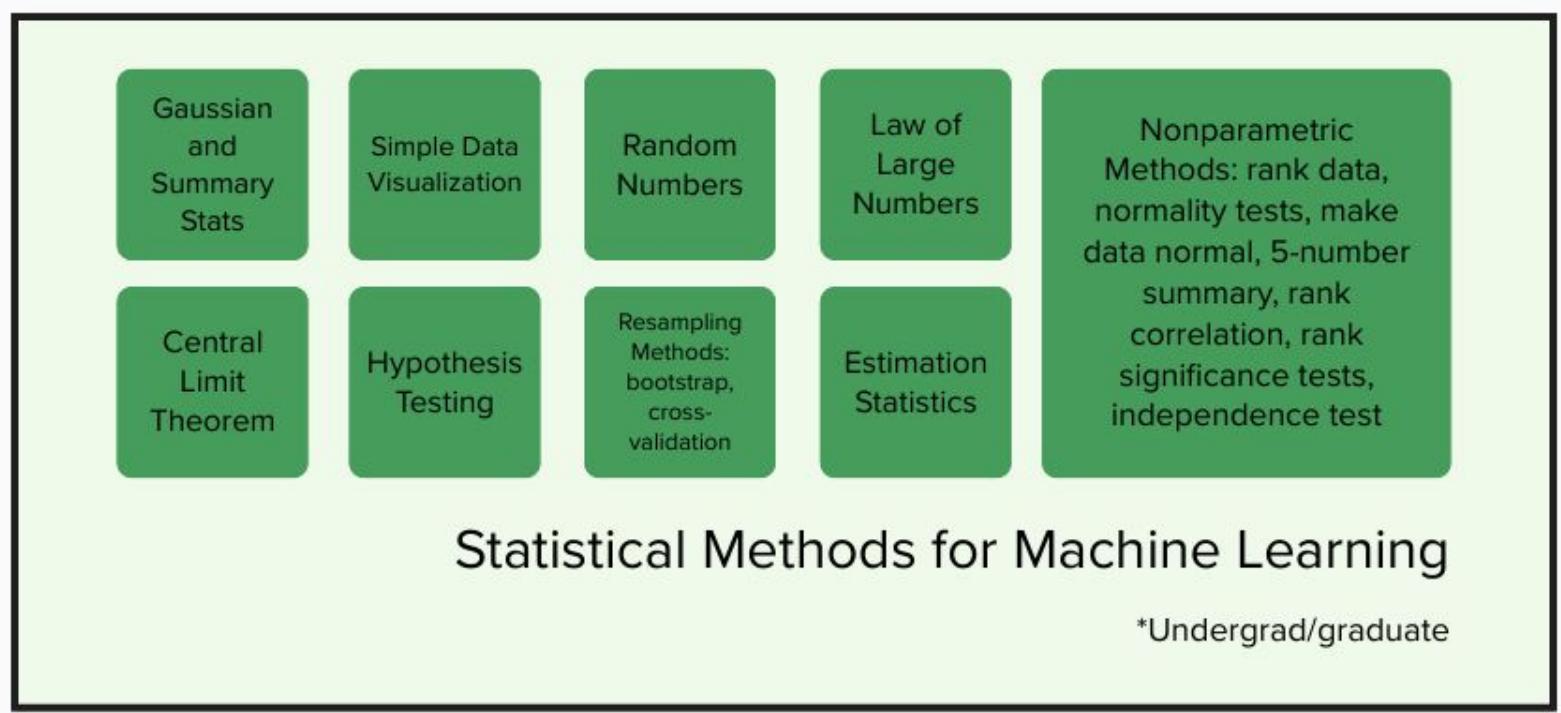
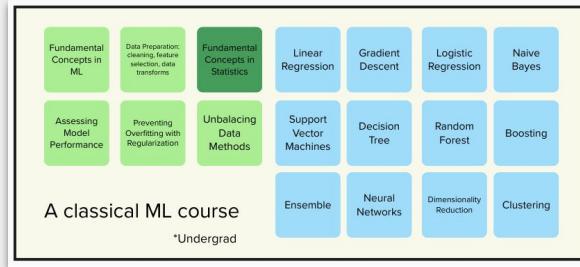
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## The StatQuest Illustrated Guide to Machine Learning!!!



By Josh Starmer, Ph.D.



# Statistical Methods for Machine Learning

Discover how to Transform Data  
into Knowledge with Python

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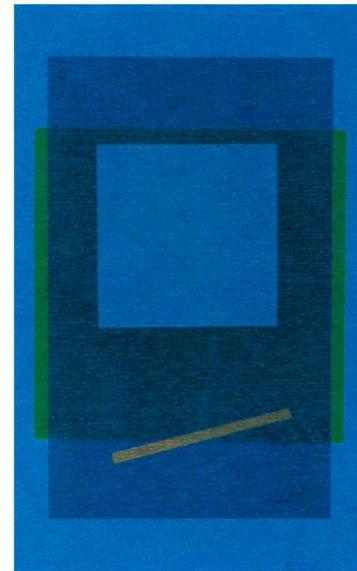
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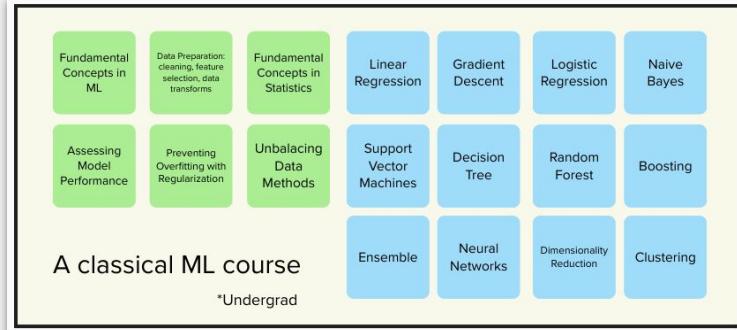


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E ESTATÍSTICA

Marcos Nascimento Magalhães  
Antonio Carlos Pedroso de Lima



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EXPERT INSIGHT

# TinyML Cookbook

Combine machine learning with microcontrollers  
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Second Edition

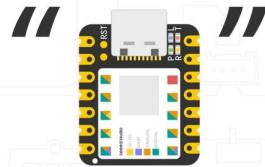
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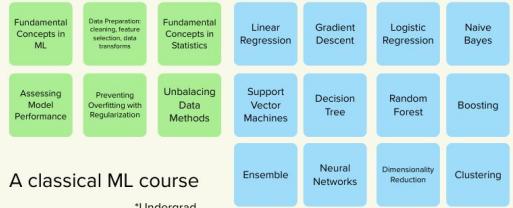
Lei Feng, Marcelo Rovai

seeed studio



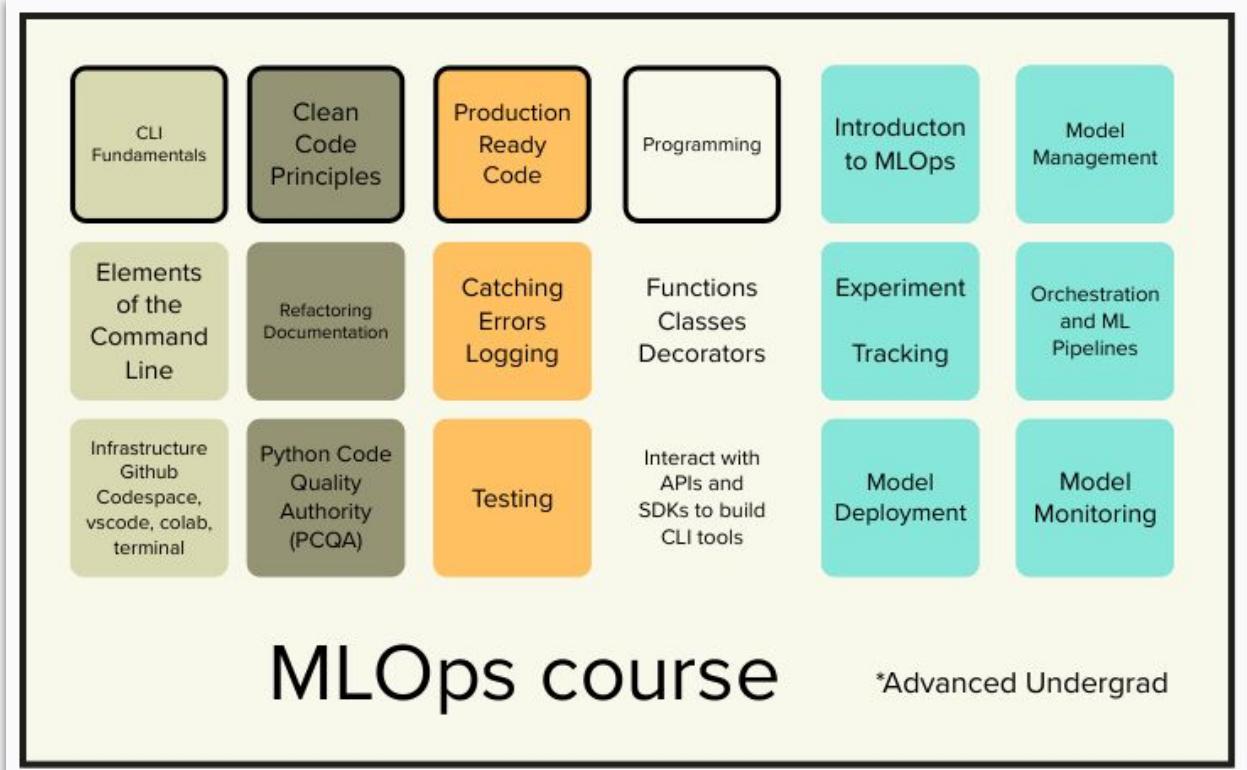
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Chip Huyen



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# Implementing MLOps in the Enterprise

A Production-First  
Approach



Yaron Haviv  
& Noah Gift

<https://noahgift.com/courses/latest/>

# Go, Python, Rust, and production AI applications



March 11, 2024

In this article, I'll talk about Go, Python, and Rust, and each language's role in building AI-powered applications.

<https://ajmani.net/2024/03/11/go-python-rust-and-production-ai-applications>

**Sameer Ajmani**  
he/him · Brooklyn, NY, USA  
Engineering Director at Google



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Hongfan notes (#260)

5 months ago

02-experiment-tracking

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03-orchestration

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04-deployment

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07-project

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cohorts

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Learn practical aspects of productionizing ML services — from training and experimenting to model deployment and monitoring.

### Topics:

- ◆ Introduction to MLOps
- ◆ Experiment tracking and model management
- ◆ Orchestration and ML Pipelines
- ◆ Model Deployment
- ◆ Model Monitoring
- ◆ Best Practices
- ◆ Processes

Learn more about the course in this article:

<https://datatalks.club/blog/mlops-zoomcamp.html>

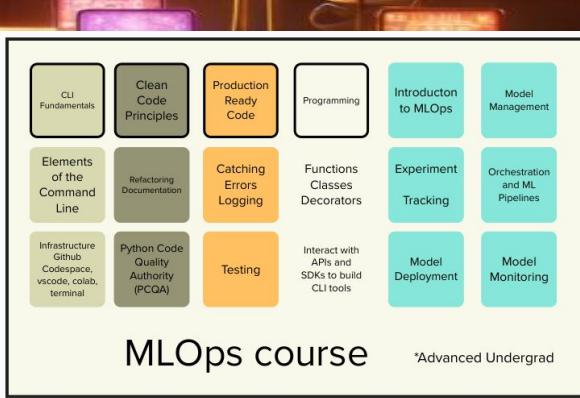
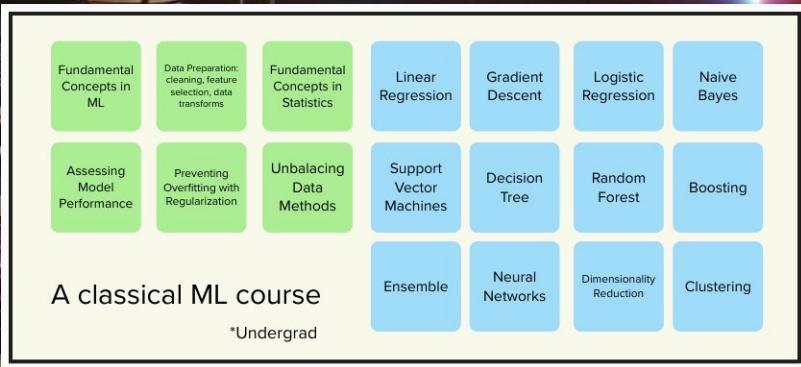
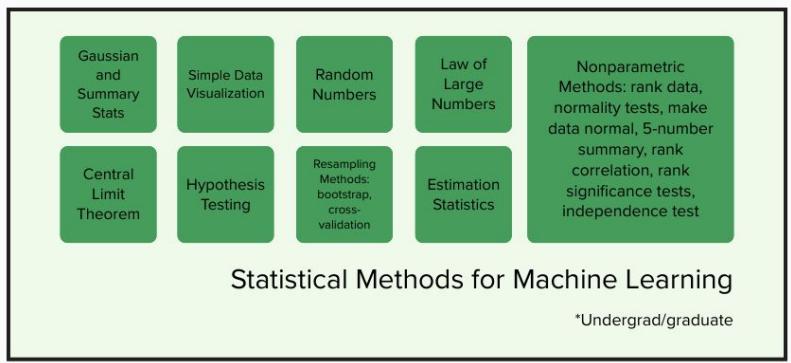
Check course curriculum and materials:

<https://github.com/DataTalksClub/mlops-zoomcamp>

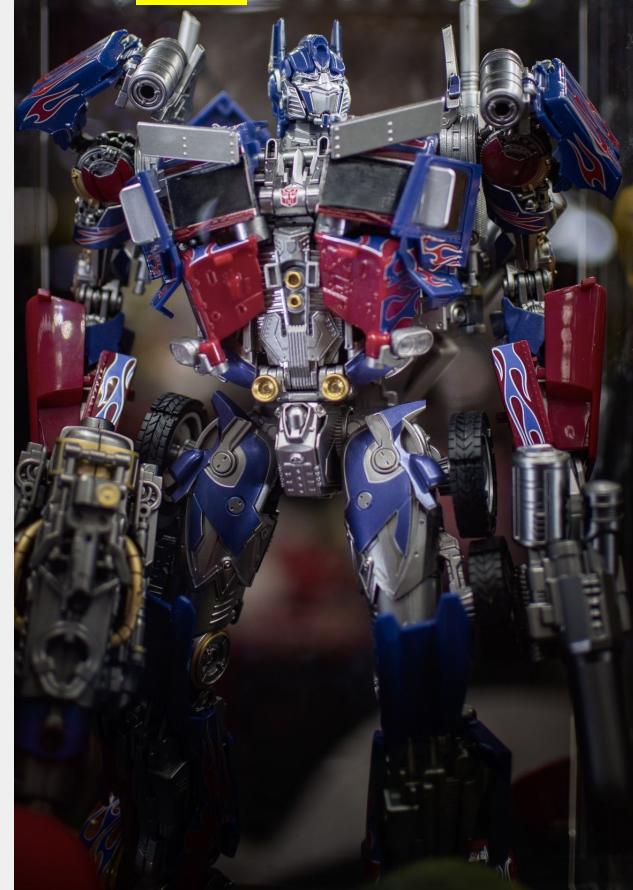
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No releases published



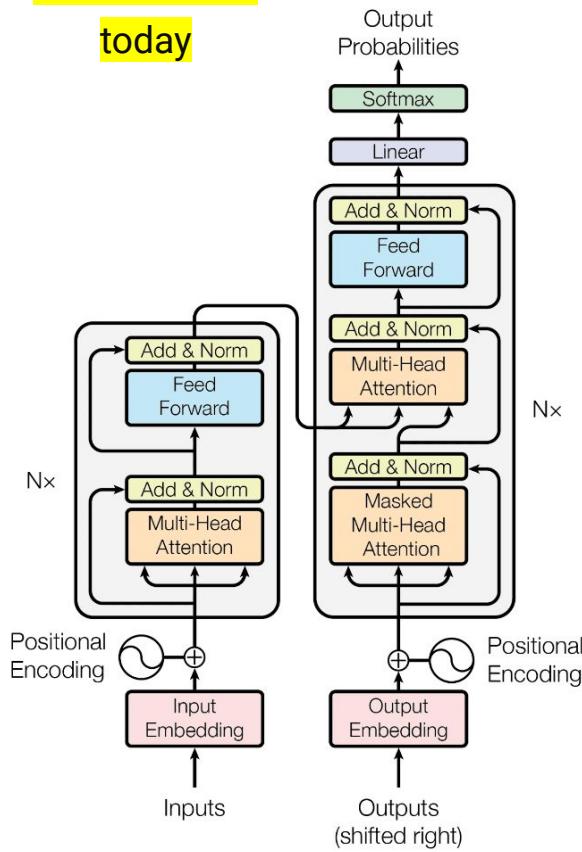
Transformers at  
school



Transformer at  
college



Transformers  
today



## LLMops Specialization (Specialization: 6 Courses)

Publisher: Coursera + Duke

Release Date: 2/1/2024

-  Operationalizing LLMs on Azure

## Rust Programming Specialization (Specialization: 5 Courses)

Publisher: Coursera + Duke

Release Date: 1/1/2024

-  Rust Programming Specialization
-  Rust for DevOps
-  Rust LLMops
-  Rust Fundamentals
-  Data Engineering with Rust
-  Python and Rust with Linux Command Line Tools

Reduce and measure hallucinations

Optimize context length and context construction

Incorporate other data modalities

Make LLMs faster and cheaper (LLMops)

Design a new model architecture

Develop GPU alternatives

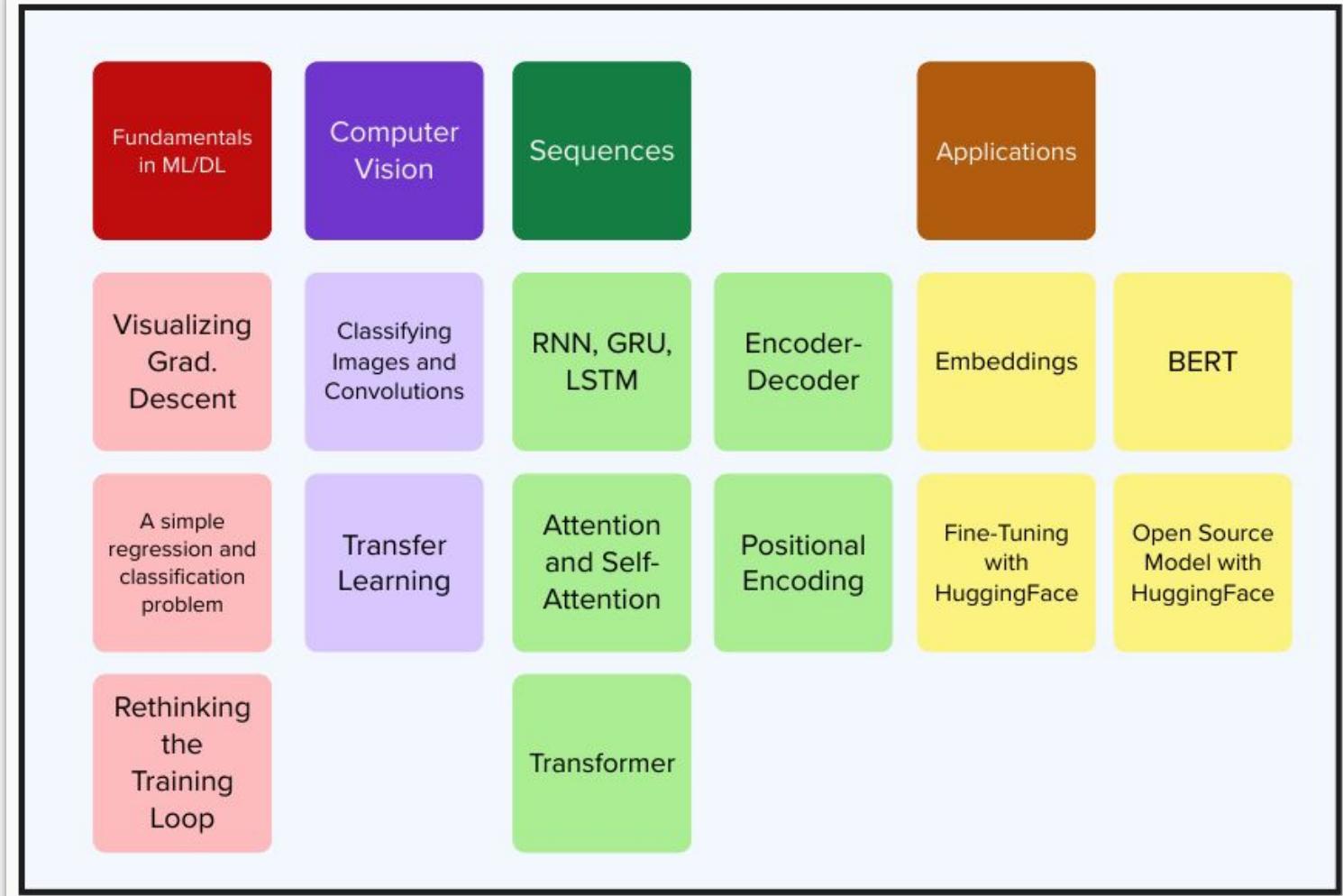
Make agents usable

Improve learning from human preference

Retrieval all you need and knowledge model

Build LLMs for non-English languages

# Course Syllabus



Daniel Voigt Godoy

# Deep Learning with PyTorch Step-by-Step

A Beginner's Guide



MACHINE LEARNING  
MASTERY

# Deep Learning with PyTorch

Learn Basic Deep Learning  
with Minimal Code in  
PyTorch 2.0

Adrian Tam



MACHINE LEARNING  
MASTERY

# Building Transformer Models WITH ATTENTION

Implementing a Neural  
Machine Translator from  
Scratch in Keras



Stefania Cristina  
Mehreen Saeed

O'REILLY®

# Designing Machine Learning Systems

An Iterative Process  
for Production-Ready  
Applications



Chip Huyen

# What will the grades be like?

[95,100] - A

[85,95) - B

[70,85) - C

[-,70) - D, E

# Clone me!!!!

<https://github.com/ivanovitchm/PPGEEC2318>