PPGEEC2318

Machine Learning

Course Outline

Ivanovitch Silva
ivanovitch.silva@ufrn.br

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

Natal, RN, dezembro de 2022.

UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE
CENTRO DE TECNOLOGIA
PROGRAMA DE PÓS-GRADUAÇÃO EM ENGENHARIA ELÉTRICA E DE COMPUTAÇÃO
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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
PPGEEC2318	Aprendizado de Máquina	04	EC
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

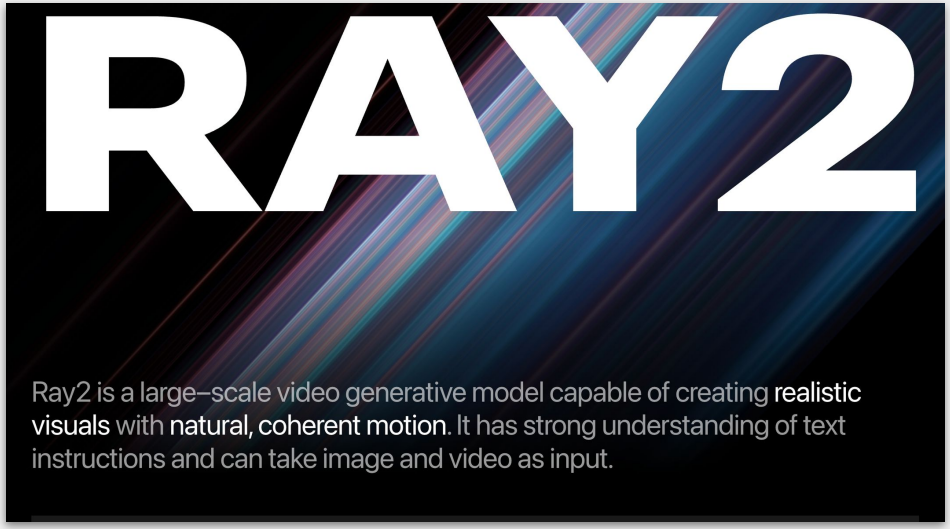
AI-Generated
(fake image & video)

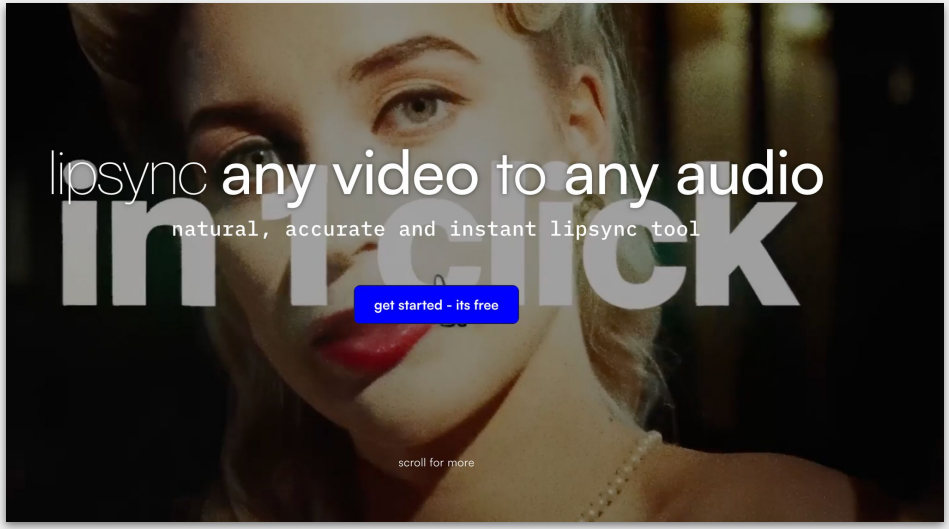
What challenges do you envision in this reality?

Text, Video to Video

AI-Generated
(fake image & video)


You don't have to worry,
sweetheart.


RAY2
Ray2 is a large–scale video generative model capable of creating realistic visuals with natural, coherent motion. It has strong understanding of text instructions and can take image and video as input.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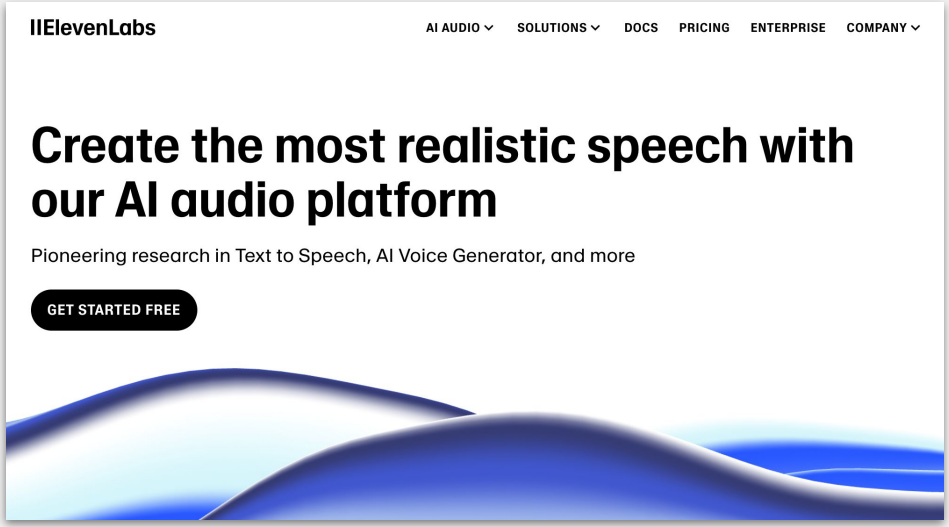
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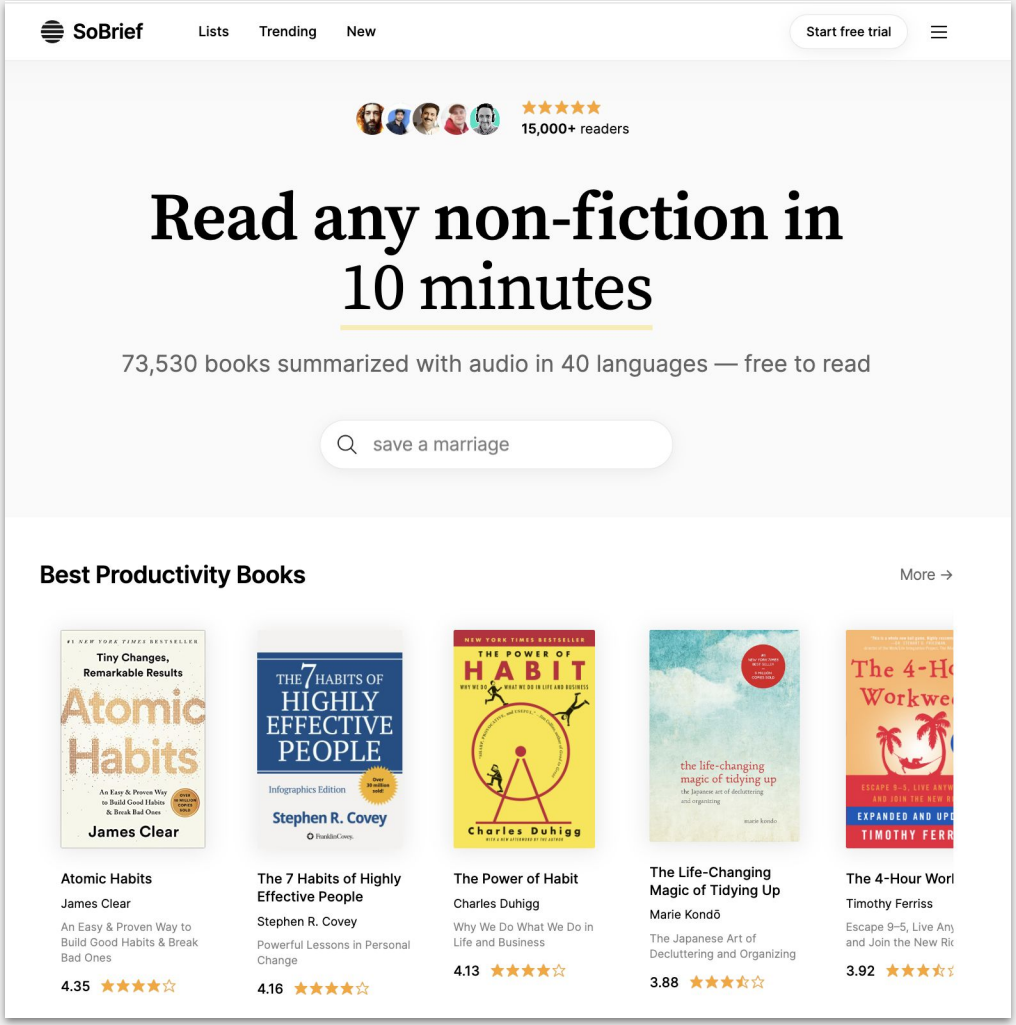

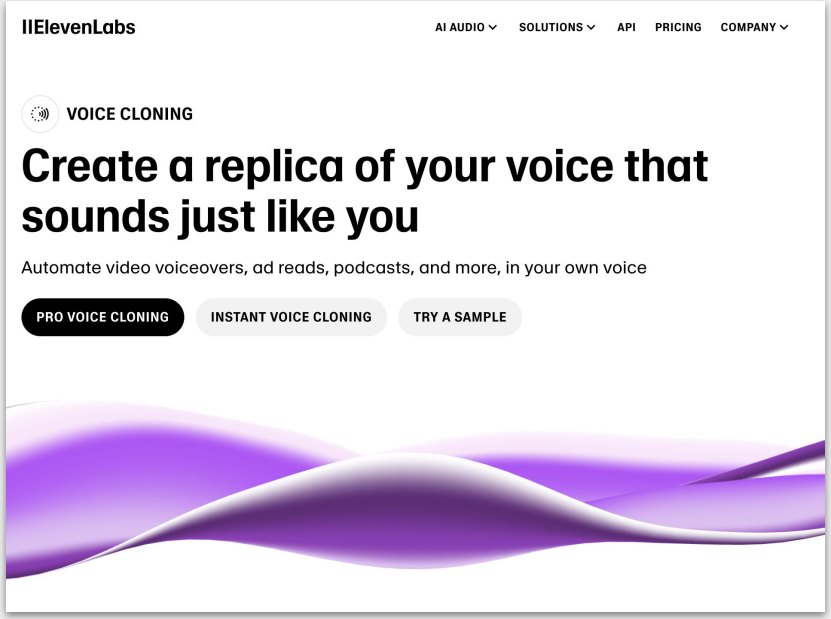

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AudioLM: a Language Modeling Approach to Audio Generation
6m


Switch Transformers: Scaling to Trillion Parameter Models...
7m


Let's Verify Step by Step
6m


Position: Levels of AGI for Operationalizing Progress on the Pat...
4m


Scaling LLM Test-Time Compute Optimally can be More Effectiv...
7m


Generative Ghosts: Anticipating Benefits and Risks of AI...
4m


Description and Discussion on DCASE 2023 Challenge Task...
7m


Generative Agents: Interactive Simulacra of Human Behavior
5m


Code as Policies: Language Model Programs for...
4m


Attention Is All You Need
4m


The Illusion of Artificial Inclusion
7m


Sample of LLM Research from Google
8m


Imagic: Text-Based Real Image Editing With Diffusion Models
6m


Large Language Models Encode Clinical Knowledge
3m


RecurrentGemma: Moving Past Transformers for...
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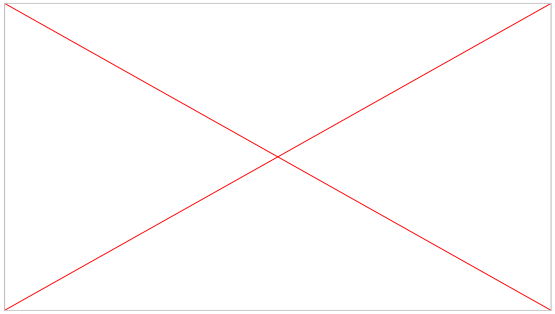

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Apresentação

A Engenharia de Computação tem como objetivo a aplicação da ciência da computação e o uso da tecnologia da computação na solução de problemas de engenharia. Destina-se à formação de profissionais capazes de atuar principalmente em áreas em que existe uma forte integração entre software e hardware, como automação industrial, sistemas paralelos e distribuídos, arquitetura de computadores, sistemas embarcados, robótica, comunicação de dados e processamento digital de sinais.

Em comparação com outros profissionais de Computação e Informática, o Engenheiro de Computação é mais direcionado a sistemas onde os computadores não são os únicos agentes que influenciam o meio. O tipo de informação principal dos demais profissionais de Computação e Informática são os dados, grandezas geradas, processadas e utilizadas por computadores. O Engenheiro de Computação trata também os sinais, informações geradas externamente e/ou produzidas para atuar sobre o meio externo.

Para tanto, a formação em Engenharia de Computação deve propiciar aos seus alunos:
uma boa formação básica nos fundamentos científicos relevantes das Ciências Exatas e Naturais (principalmente Física e Matemática) e nos conhecimentos tradicionais associados à formação básica em Engenharia e Computação;
uma formação profissionalizante geral que envolve os conteúdos fundamentais da Computação e alguns aspectos da Eletrônica e Eletricidade; e
uma formação profissionalizante específica nos aspectos ligados à arquitetura dos sistemas computacionais em relação aos seus componentes físicos, lógicos e às aplicações da Computação em vários problemas de Engenharia.

Com esta formação, o perfil profissional do Engenheiro de Computação é o de um profissional com formação em engenharia de computação, apto a especificar, conceber, desenvolver, adaptar, produzir, industrializar, instalar e manter sistemas computacionais, bem como perfazer a integração dos recursos físicos e lógicos necessários ao atendimento das necessidades computacionais de organizações em geral.

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Prof. Agostinho de Medeiros Brito Júnior

Vice-Coordenação atual:
Prof. Adelardo Adelino Dantas de Medeiros

Secretaria:
Raphael Galhardo
Sala 221 do CTEC
Contatos:
engcomp@ct.ufrn.br (preferencial) / (84) 99193-6237

Calendário

Fique por dentro dos eventos relacionados ao nosso Calendário Acadêmico.

10/02/2025 - 17/02/2025
· *Matrícula para o período 2025.1.*

17/03/2025
· *Início do período letivo 2025.1.*

Clique aqui e saiba mais!

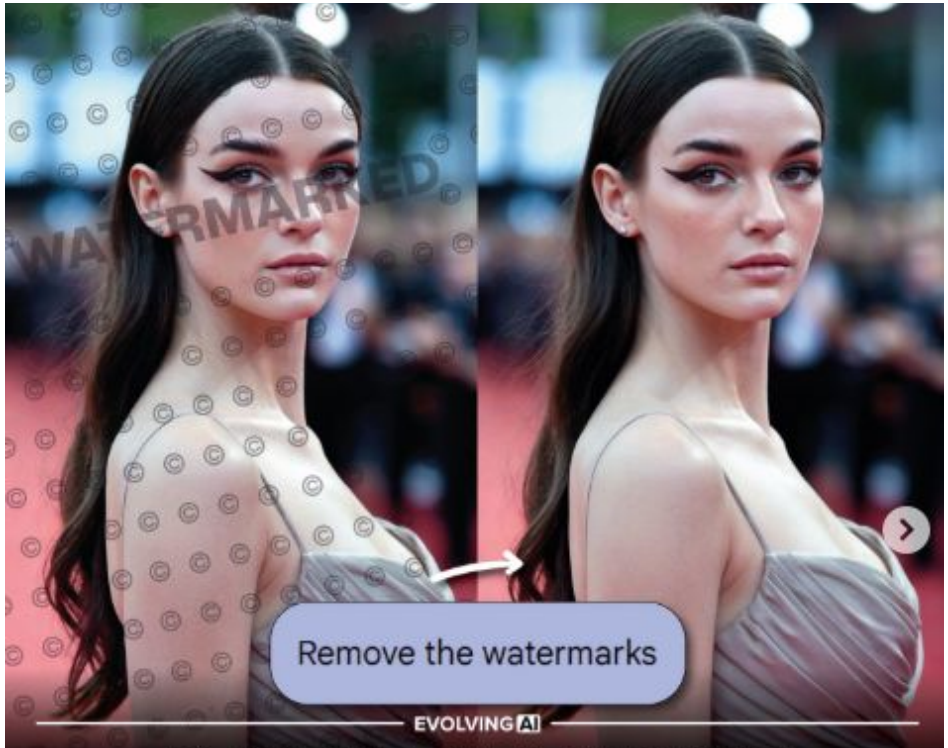
Notícias

Veja abaixo as noticias referentes ao nosso Curso.

» *ACOLHIDA AOS INGRESSANTES 2023.2*

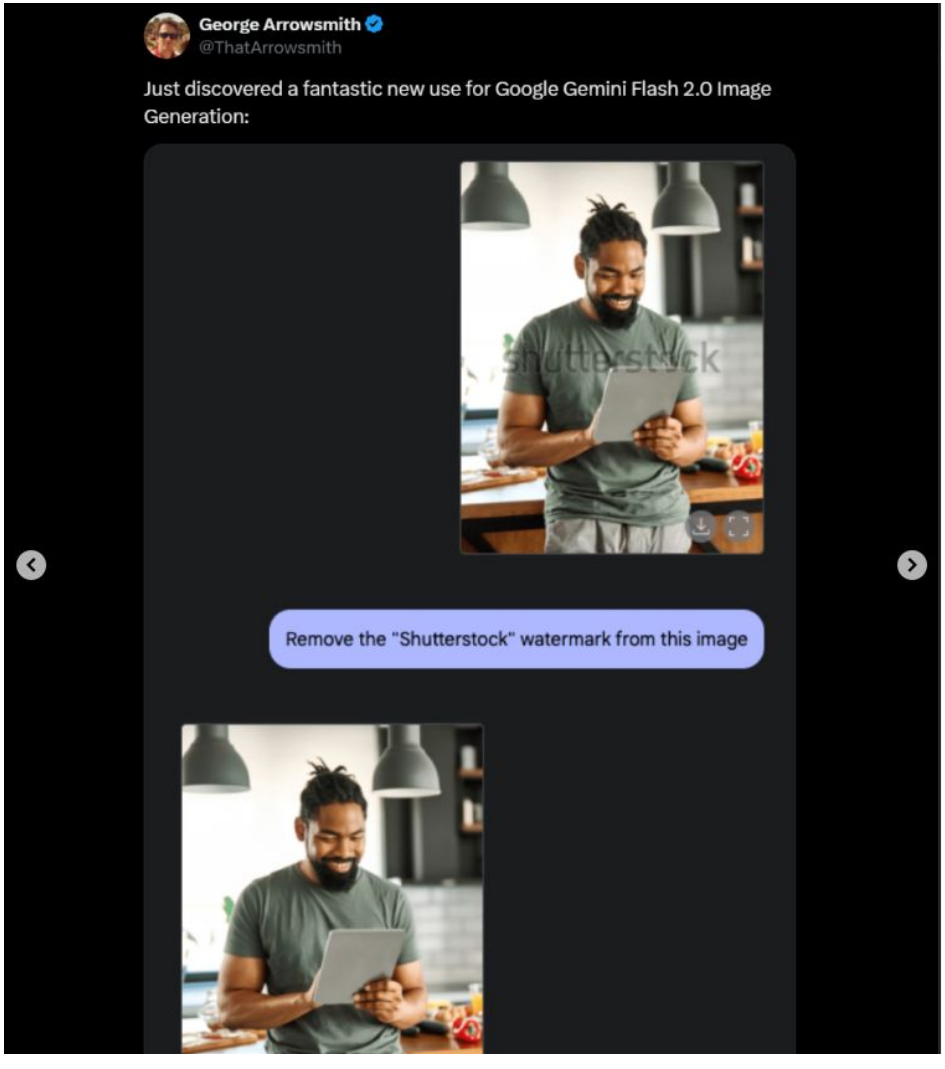
» *DIVULGAÇÃO DO RESULTADO DA CONSULTA ELEITORAL PARA COORDENADOR E VICE-COORDENADOR DE ENGENHARIA ...*

» *HOMOLOGAÇÃO DE CHAPAS INSCRITAS PARA ELEIÇÃO DE COORDENADOR E VICE-COORDENADOR - BIÊNIO 23/25*



EVOLVING AI

PEOPLE ARE USING GOOGLE'S NEW AI MODEL TO REMOVE WATERMARKS FROM IMAGES



Contents lists available at ScienceDirect

Surfaces and Interfaces

journal homepage: www.sciencedirect.com/journal/surfaces-and-interfaces

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 [a,1], Liming Wu [a,1], Tao Yang [b], Bing Zhu [a], Yangai Liu [a,*]

[a] 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, Beijing100083, China
[b] 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^2, 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 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, 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 and ensure safe operation of lithium metal batteries.

Several types of separators currently used in research include

Surfaces and Interfaces 46 (2024) 104081

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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 (Y. Liu).
[1] These authors contributed equally.

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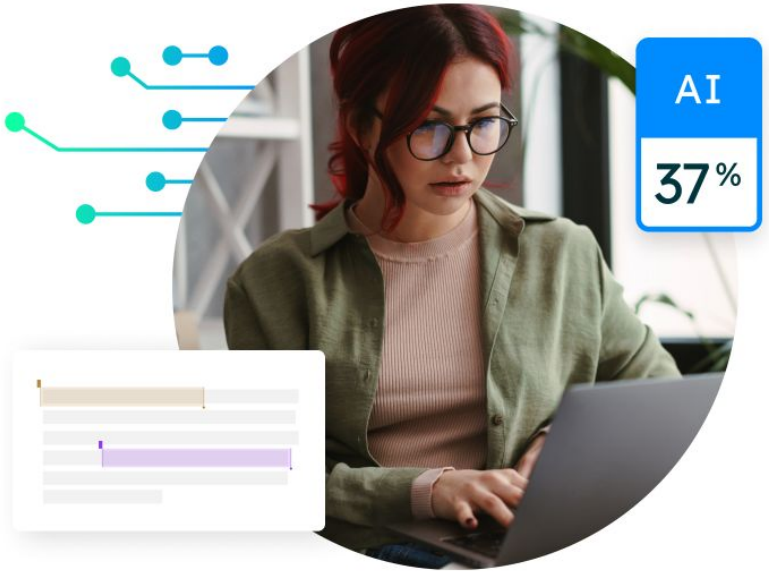


CNPq
Conselho Nacional de Desenvolvimento Científico e Tecnológico

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 s
científico e tecnológico e a inovação do País, nas divers
com pesquisadores brasileiros radicados no exterior.

1.1 – São objetivos e diretrizes desta chamada:

a) Apoiar a execução de projetos em Instituições de Ens
de Ciência e Tecnologia – ICT, localizadas no Brasil, em
radicados em instituições de ensino, pesquisa e desenv

b) Estimular o intercâmbio de conhecimento entre pes
com pesquisadores brasileiros radicados no exterio
ferramentas e processos que envolvam Inteligência Artificial.

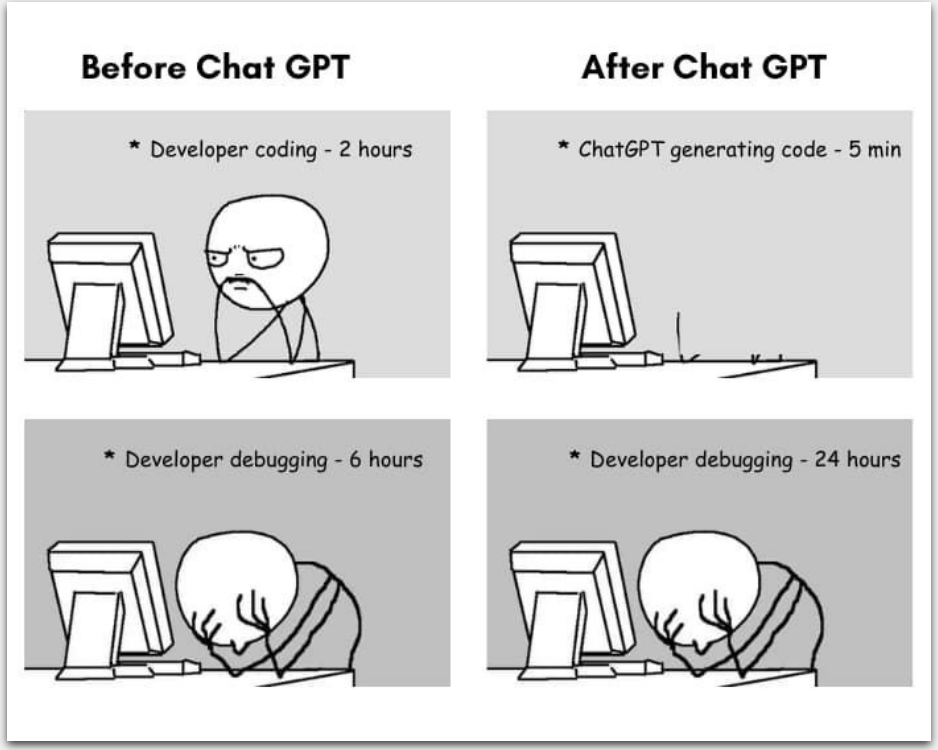
c)

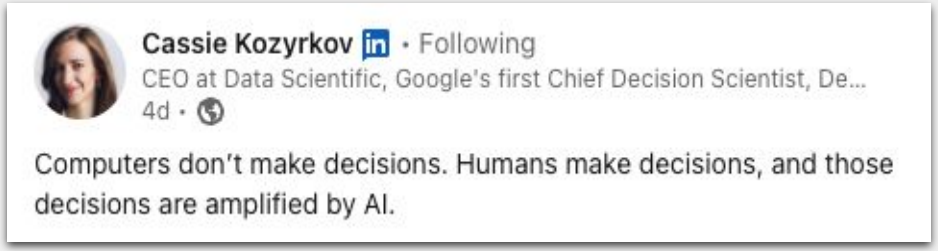
6.7 – Será aceita uma única proposta por proponente. Os projetos terão vigência inicial de até 24 meses.

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.





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

Radar / AI & ML

The End of Programming as We Know It

By Tim O'Reilly

February 4, 2025

There's a lot of chatter in the media that software developers will soon lose their jobs to AI. I don't buy it.

It is not the end of programming. *It is the end of programming as we know it today*. That is not new. The first programmers connected physical circuits to perform each calculation. They were succeeded by programmers writing machine instructions as binary code to be input one bit at a time by flipping switches on the front of a computer. Assembly language programming then put an end to that. It lets a programmer use a human-like language to tell the

Data programming (source: Pixabay)

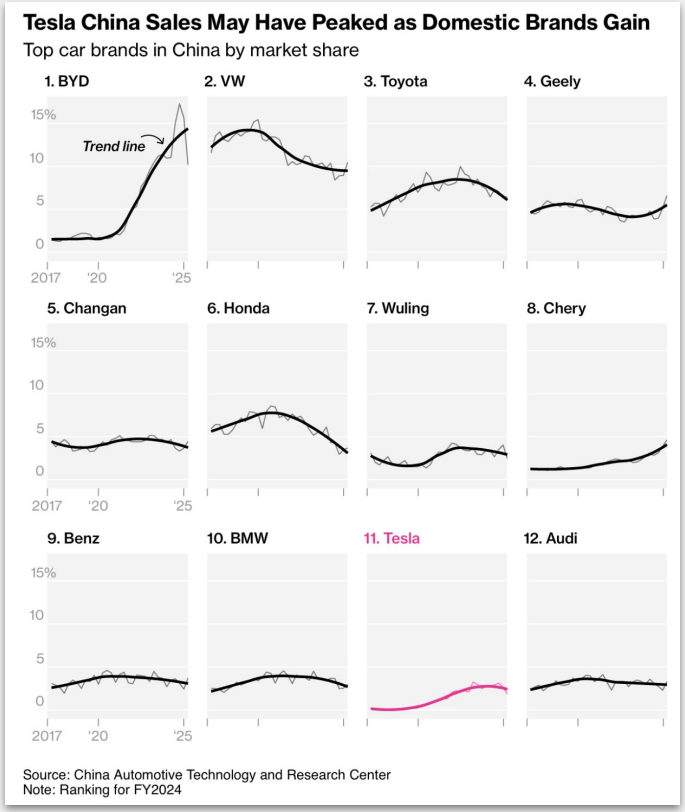
Traditional Coding → Prompting

Developers shifting from detailed coding to higher-level tasks

Human Language → Code

CHOP - Chat Oriented Programming
Brindging technical gaps without specialized knowledge

https://flowingdata.com



Skill Democratizaton

Non-programmers empowered to build software solutions

Efficiency and Productivity

Faster prototyping, reduced debugging, automated repetitive coding tasks

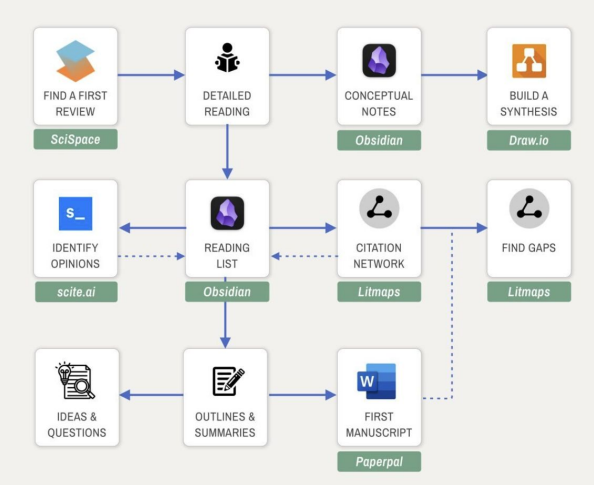
The Trust Challenge

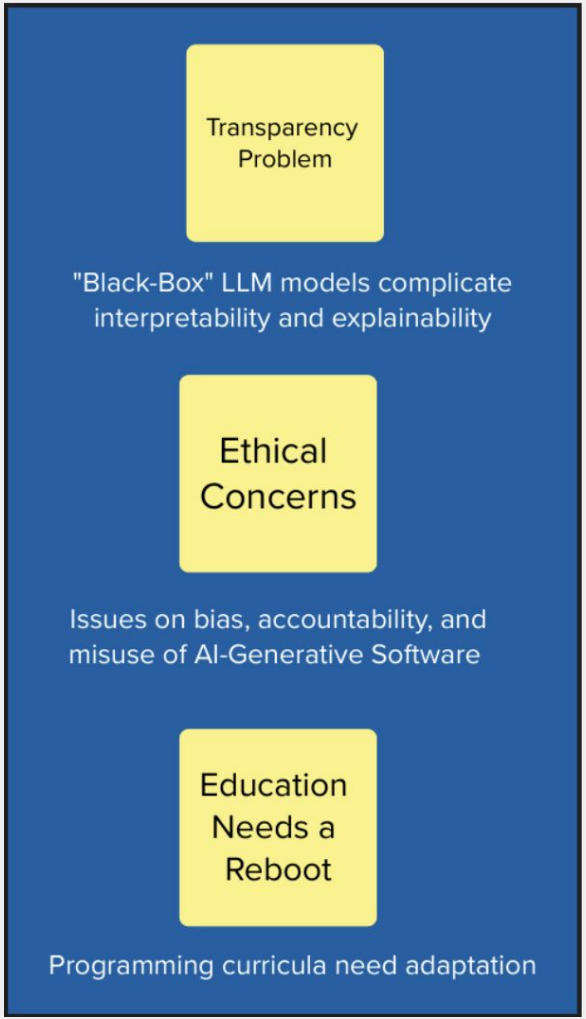
Harder to trust autogenerated code validation and testing become crucial

Jobs in Flux

Programming jobs shifting toward prompting, reviews, and oversight roles

https://effortlessacademic.com/lit-review





Editorial: From Explainable Artificial Intelligence (xAI) to Understandable Artificial Intelligence (uAI)

I. Introduction

In this editorial, we argue that the artificial intelligence (AI) community needs to escape the trap of explainable artificial intelligence (xAI) by growing more research on understandable artificial intelligence (uAI). We provocatively term xAI a trap because it has caused some AI researchers to see it as the "end" rather than a "means." We will discuss why uAI is a better way forward and present a framework for uAI to define research directions that go beyond xAI. Let us first share where this concept emerged before introducing it.

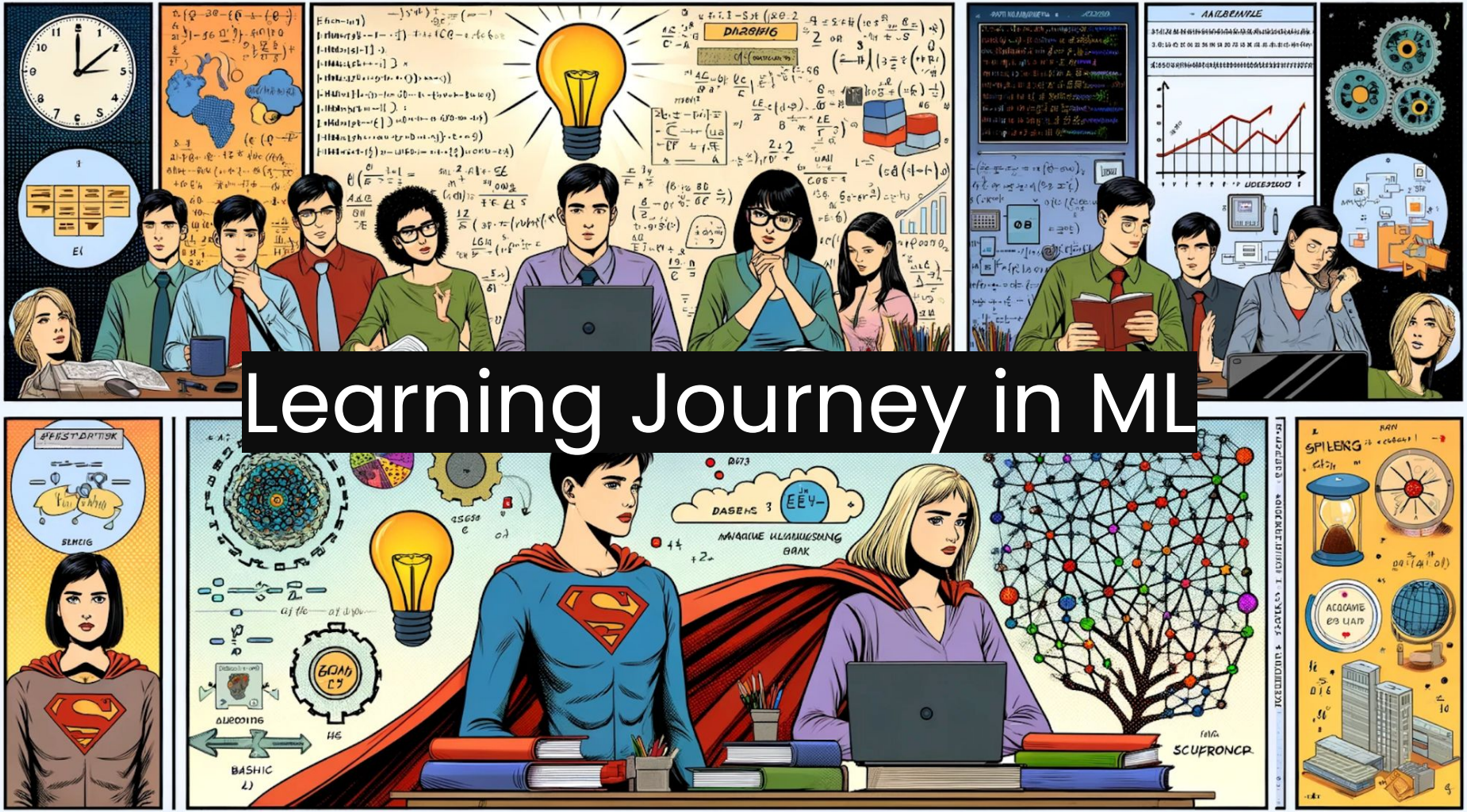
On 1 July 2024, Prof. Abbass presented an online Invited Talk at the IEEE World Congress on Computational Intelligence (IEEE WCCI 2024) on "Explaining explainable artificial intelligence." This was followed by a two-hour panel to discuss xAI on 3 July. The panelists were the authors of this editorial, chaired by Prof. Garibaldi. The first half of the panel was a debate between Prof. Gegov and Prof. Abbass on xAI, where Prof. Gegov was given the affirmative role for arguing that xAI is a necessary condition for trust, safety, responsibility, and accountability. In contrast, Prof. Abbass was given the "negative role," in which he argued instead that xAI is not enough and the community needs to expand the scope of research to the broader concept of uAI. An engaging Q&A with the audience and other panelists followed the debate. The second half of the panel included presentations from Prof. Sousa on an industry perspective on xAI, Prof. Crockett on human-centred xAI and legislation, and Prof. Kaymak on algorithmic explanation. In the remainder of this editorial, we will present a refined account of the points made during the invited talk and the panel.

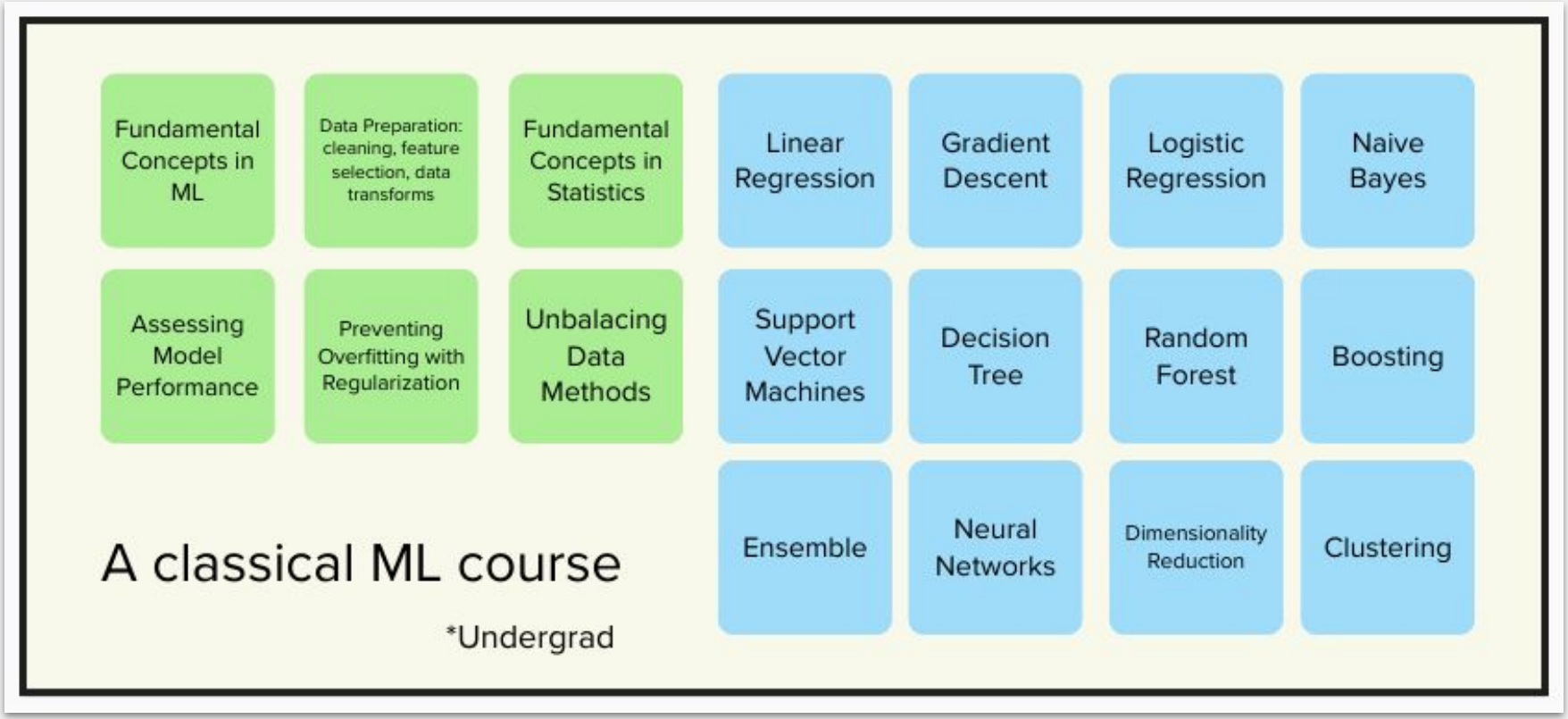
systems and genetic programming and, indeed, at the heart of the whole field of fuzzy systems.

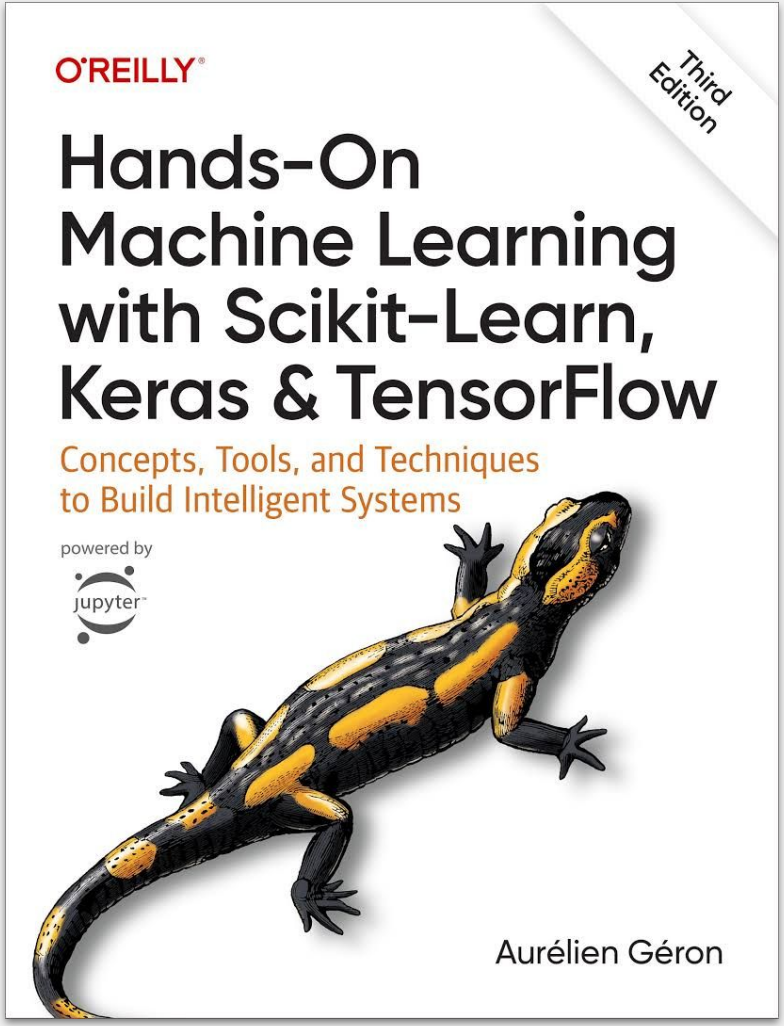
The rise of deep learning almost caused a shift in the perception of AI from being a field in academic labs to a commodity ready for end-users to create wealth. This revolution caused a spike in the need for users to understand AI, including AI models, develop confidence in their output, and trust in adopting them, especially in safety critical problems. DARPA sensed the signal as early as 2016 and established a program in xAI.

Gunning and Aha [1] summarize DARPA's journey. They emphasized the significance of xAI in their statement that "explaining AI will be essential if users are to understand, appropriately trust, and effectively manage these artificially intelligent partners" [1, p. 44]. They continued to state how DARPA defines xAI "as AI systems that can explain their rationale to a human user, characterize their strengths and weaknesses, and convey an understanding of how they will behave in the future" [1, p. 44]. Gunning and Aha categorized DARPA's program using three questions: "1) how to produce more explainable models; 2) how to design explanation interfaces; and 3) how to understand the psychological requirements for effective explanations" [1, p. 45]. They then discussed the three strategies for developing explainable models: 1) deep explanation; 2) interpretable models and primarily causal models; and 3) model induction. It is worth noting that the most frequent word in Gunning and Aha's paper was "understand" (and its derivations). The emphasis in this paragraph is ours and will be revisited in our discussion as follows.

DARPA's promotion of xAI contributed to an exponential growth in the number of papers on the topic. We categorize


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
Unbalacing 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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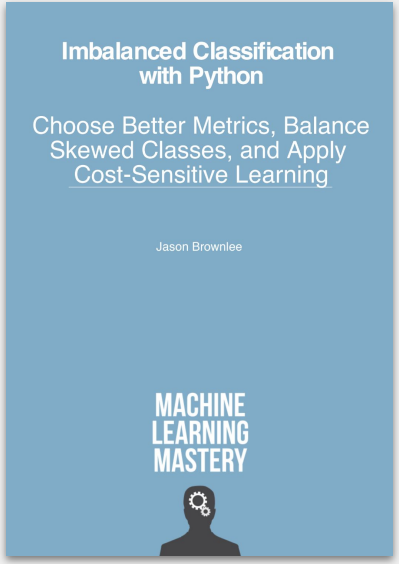
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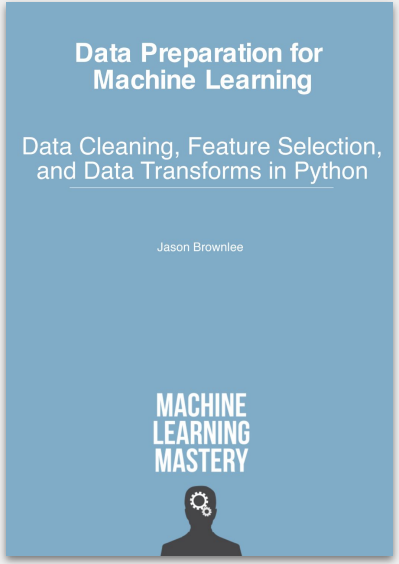
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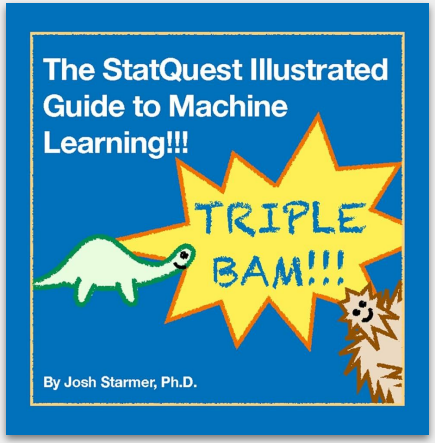
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TillMeineke and alexeygrigorev Update README.md (#649) 9c89731 · 2 weeks ago 943 Commits

.github	Update FUNDING.yml	4 years ago
01-intro	Update README.md (#527)	6 months ago
02-regression	Update README.md with Kemal's notes (#529)	5 months ago
03-classification	Update README.md (#563)	5 months ago
04-evaluation	Update README.md with Kemal's notes (#576)	5 months ago
05-deployment	Fix scikit-learn package name in notes (#577)	
06-trees	Update README.md with Kemal's notes (#598)	
08-deep-learning	fixed typo in 07-checkpointing.md (#643)	
09-serverless	More notes for 02-aws-lambda.md (#628)	
10-kubernetes	Typos 08-eks.md (#641)	
11-kserve	moved one level up	
article	Update README.md	
cohorts	Update projects.md (#644)	last month

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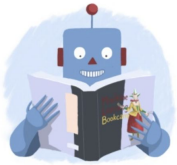

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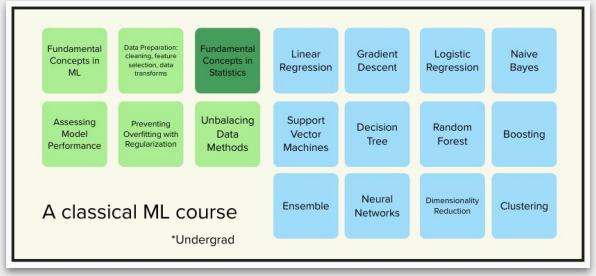
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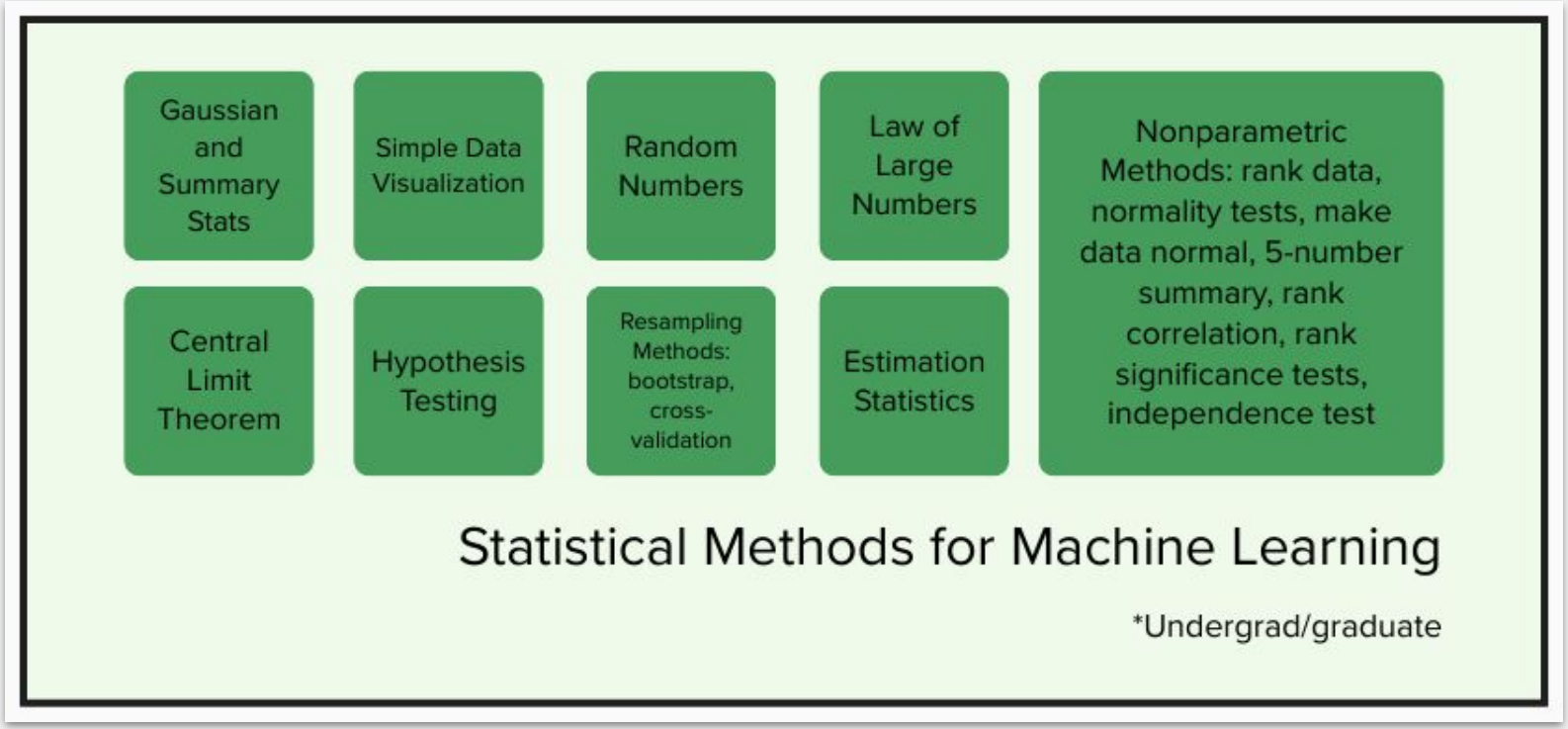
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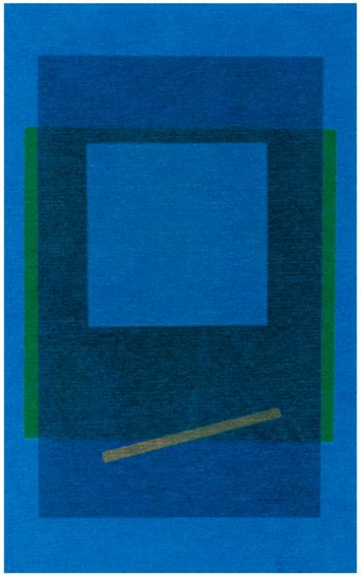

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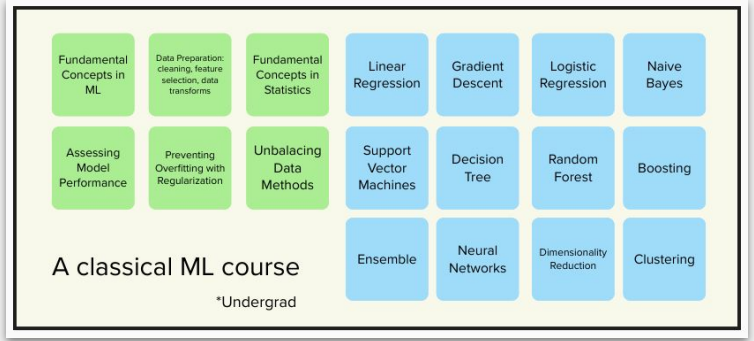
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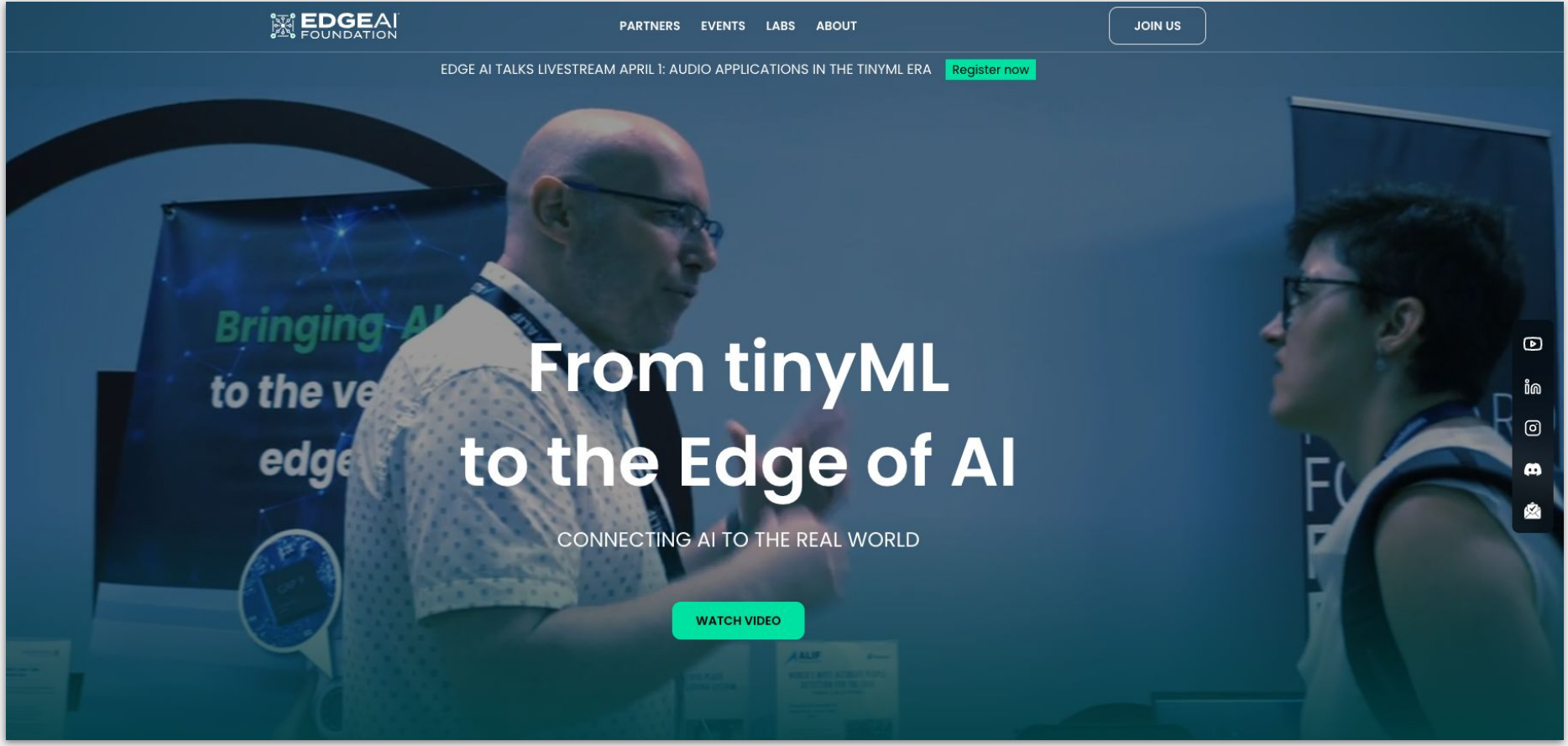

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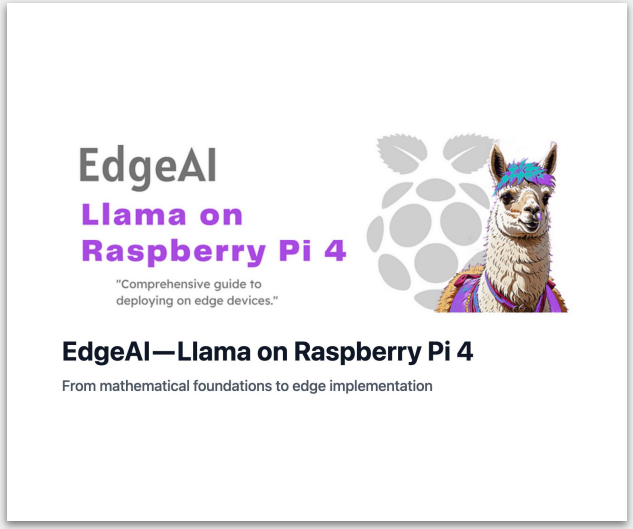

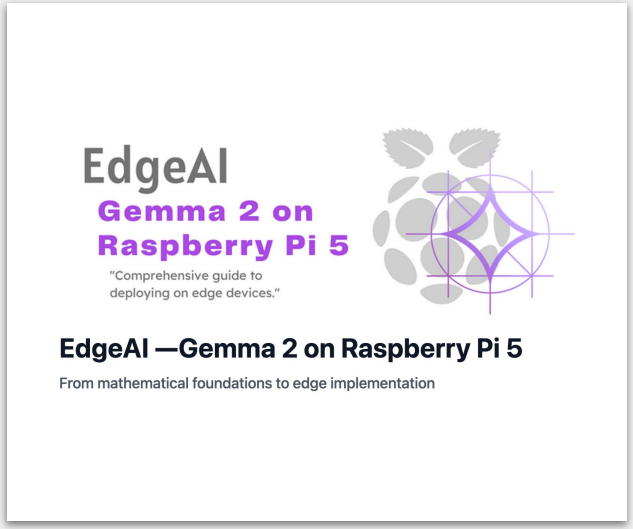

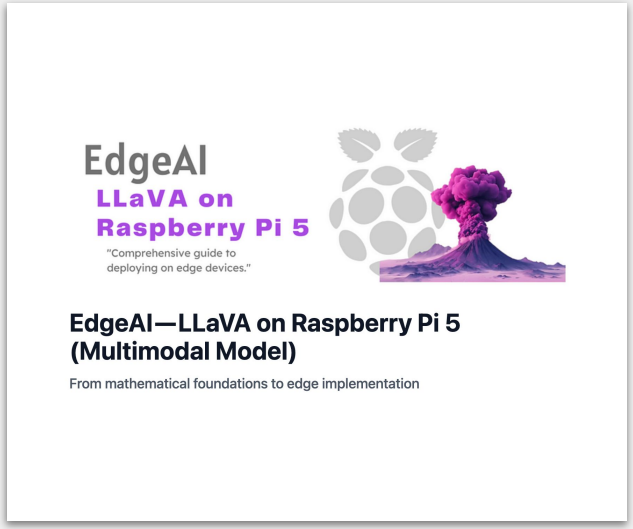

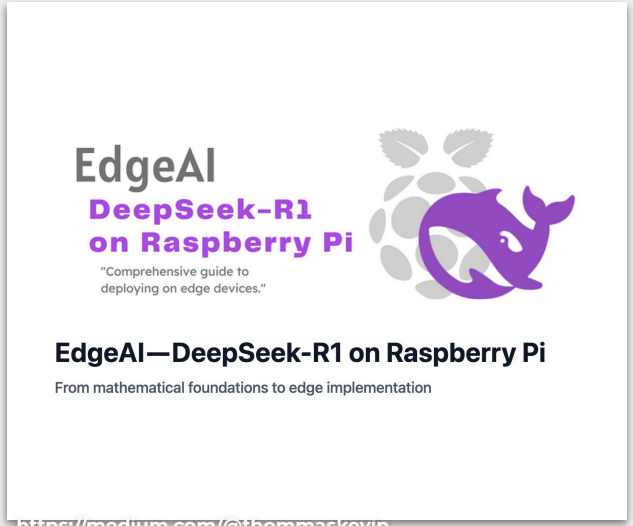

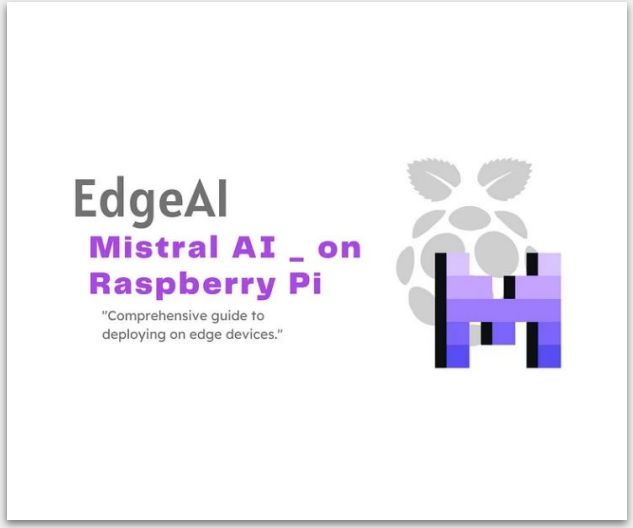

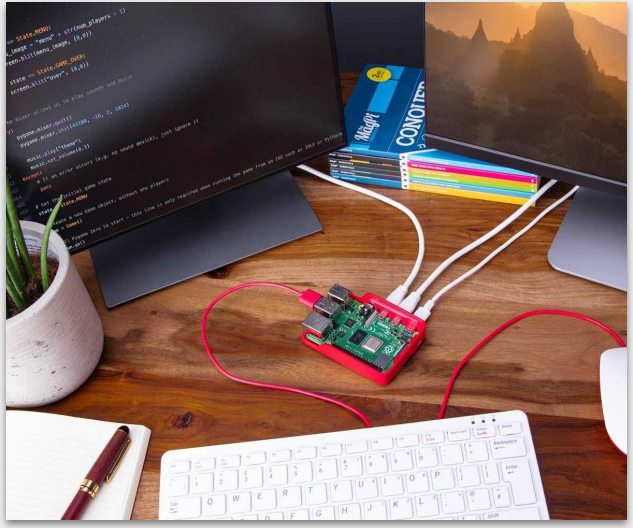

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Staff Software Engineer

T.J. Alumbaugh
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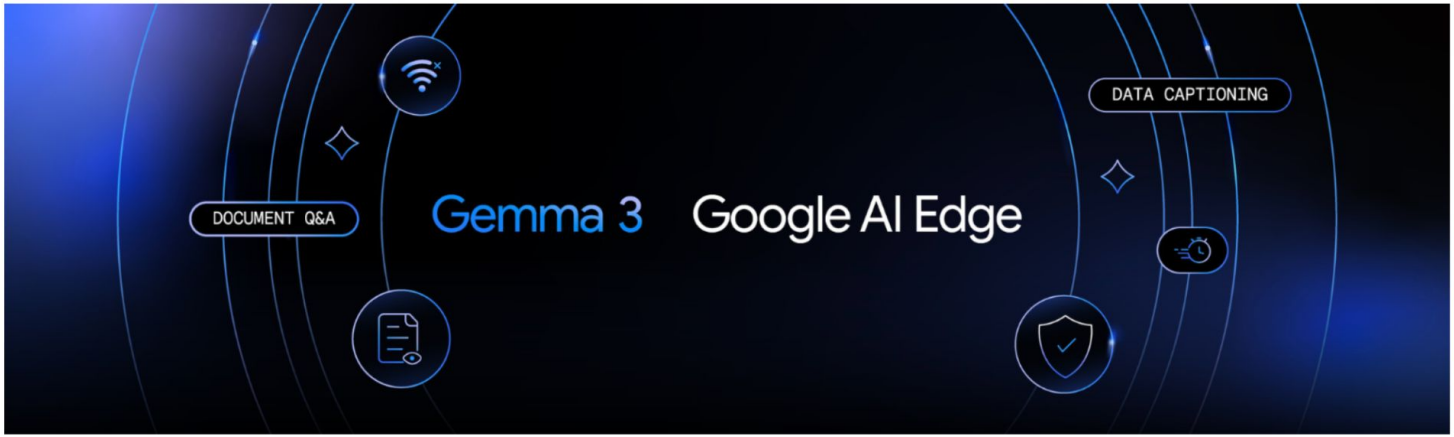

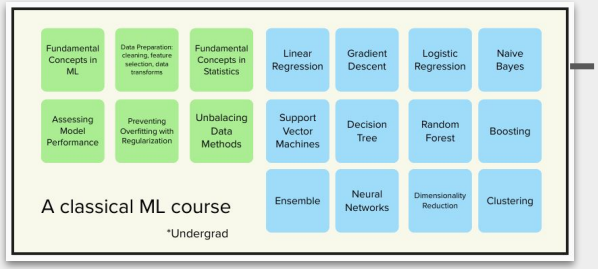

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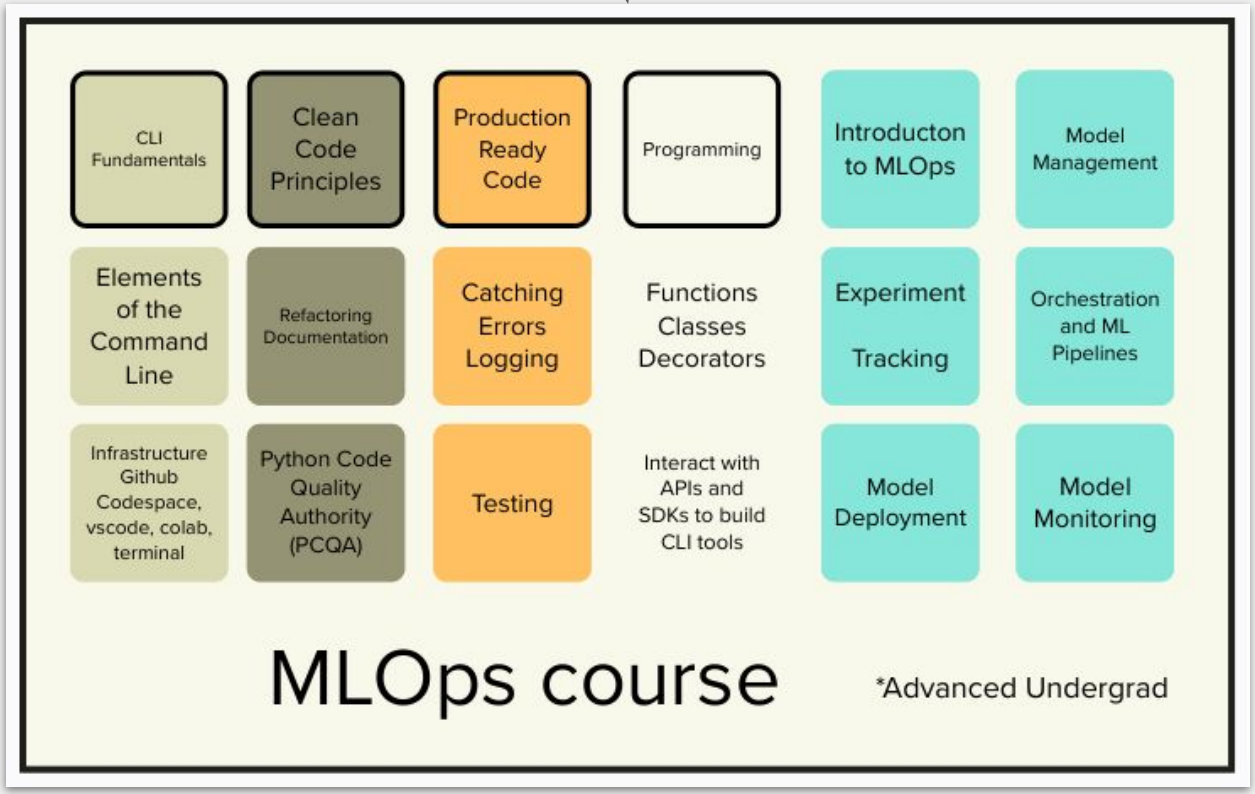

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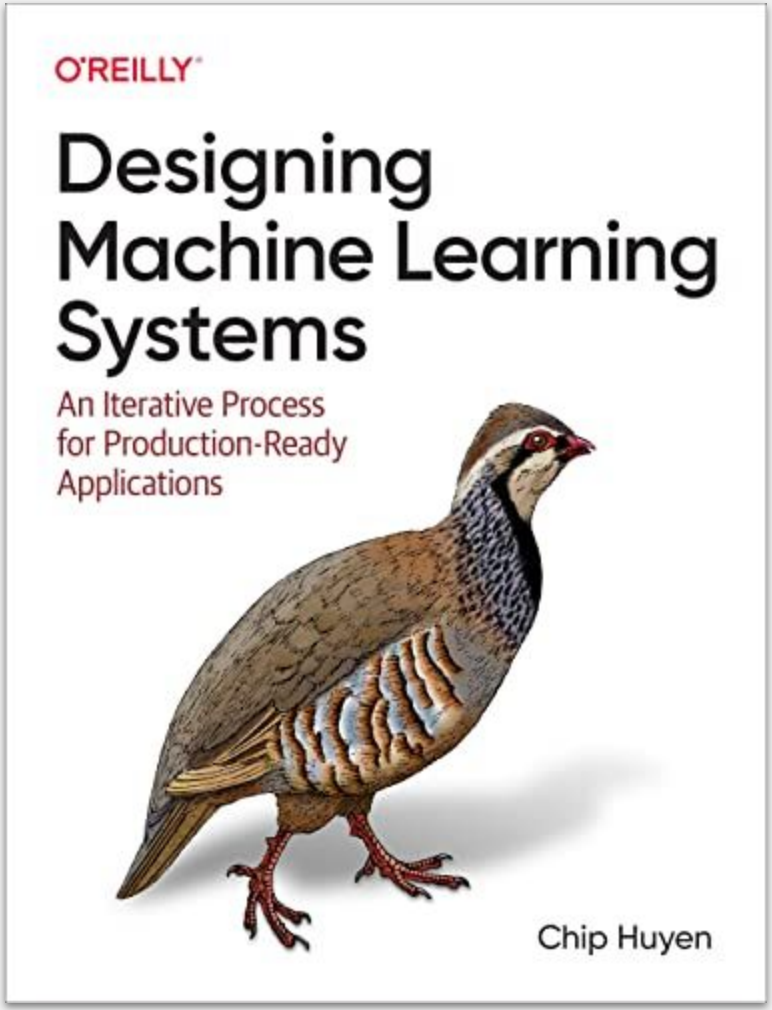

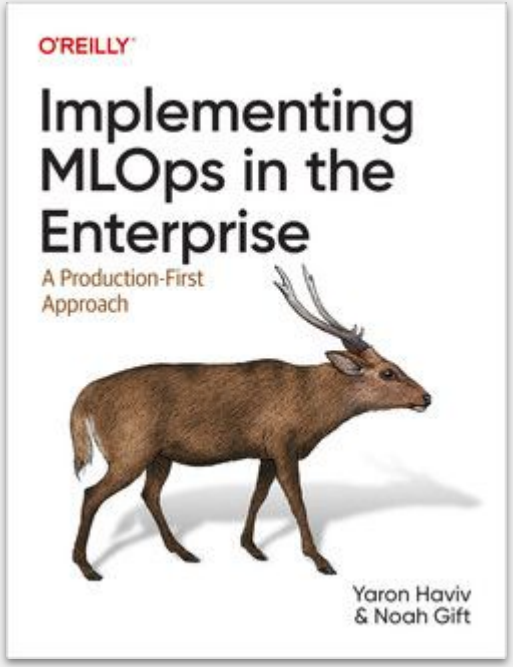

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alexeygrigorev Update README.md — 5a80204 · last week — 509 Commits

.github/workflows	Feature/week6b ci/cd (#156)
01-intro	Use `root_mean_squared_error` instead
02-experiment-tracking	Update notes (#312)
03-orchestration	Update README.md (#314)
04-deployment	docs: add note about video 4.4 being o
05-monitoring	Updated grafana image to fix issue rais
06-best-practices	Fix homework link to year 2024 (#324)
07-project	Update README.md
cohorts	Update project.md
generate	deployment link & script update
images	learning in public
.gitignore	merge prefect materials
README.md	Update README.md

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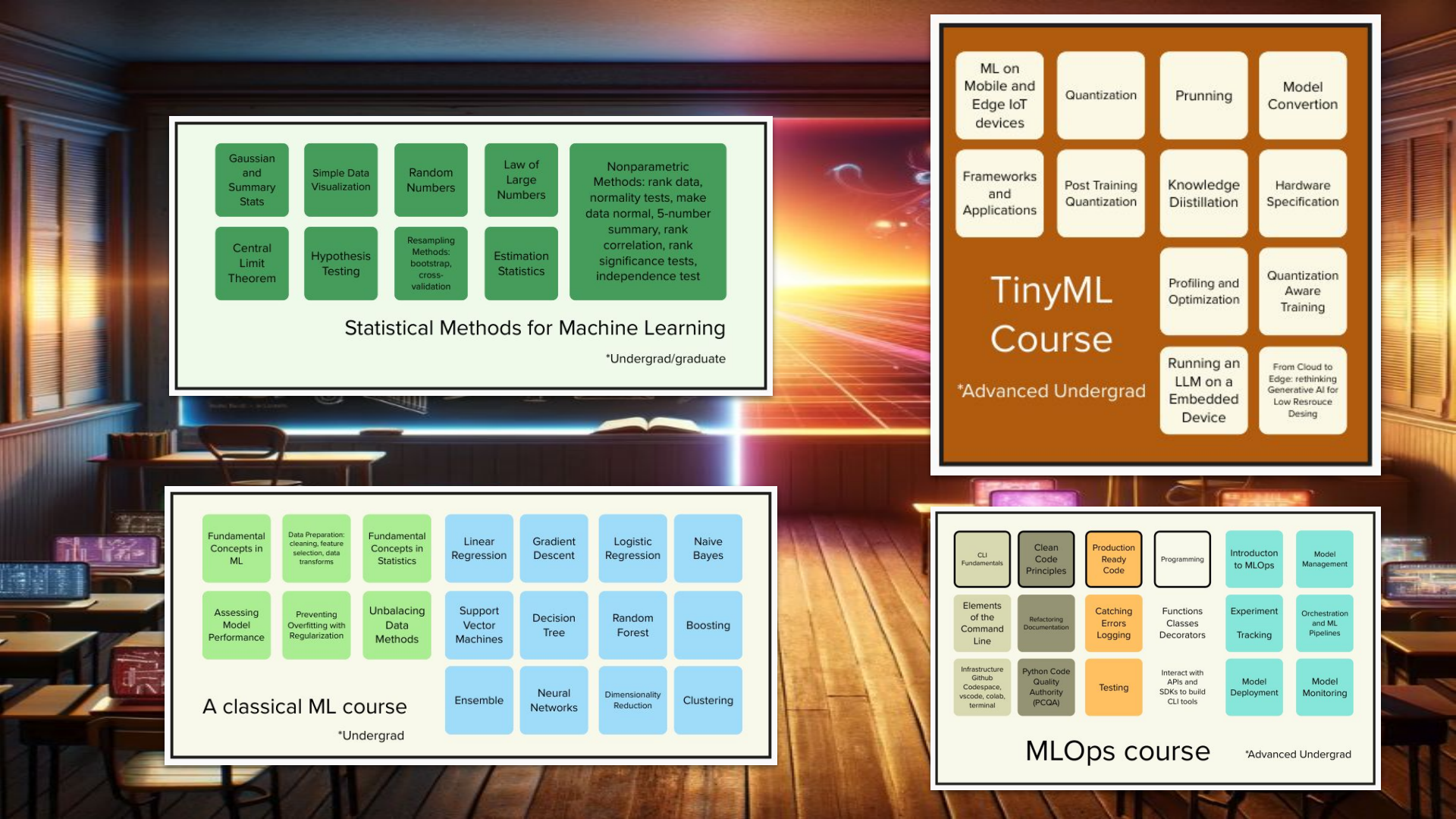
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Gradient Descent
Logistic Regression
Naive Bayes
Assessing Model Performance
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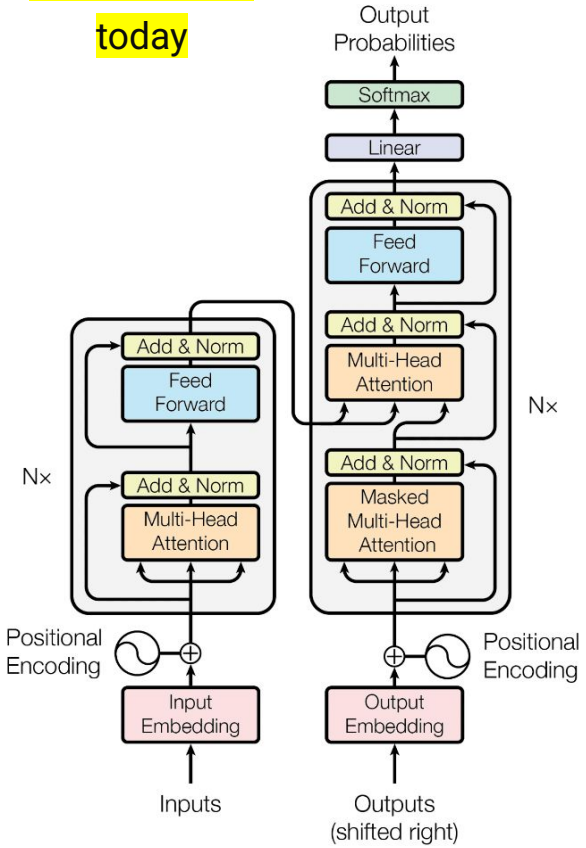

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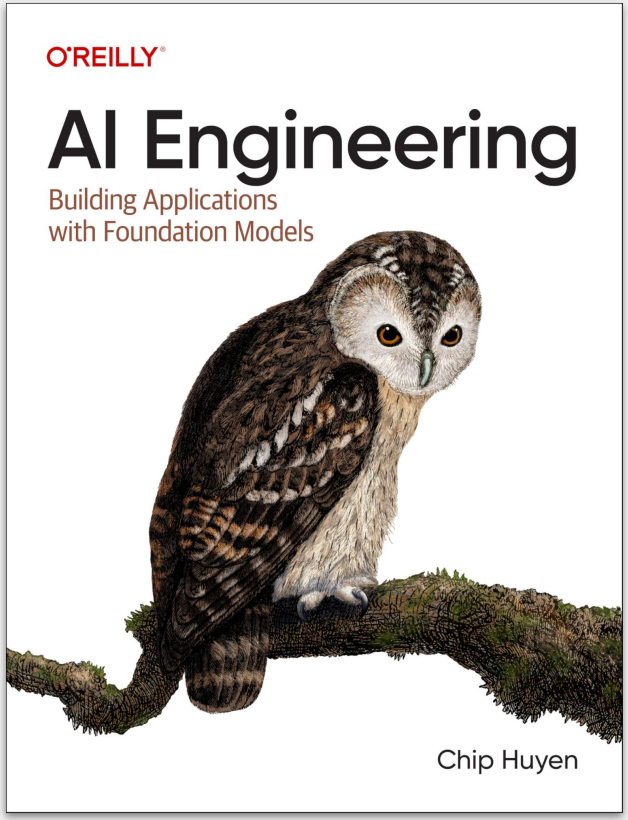

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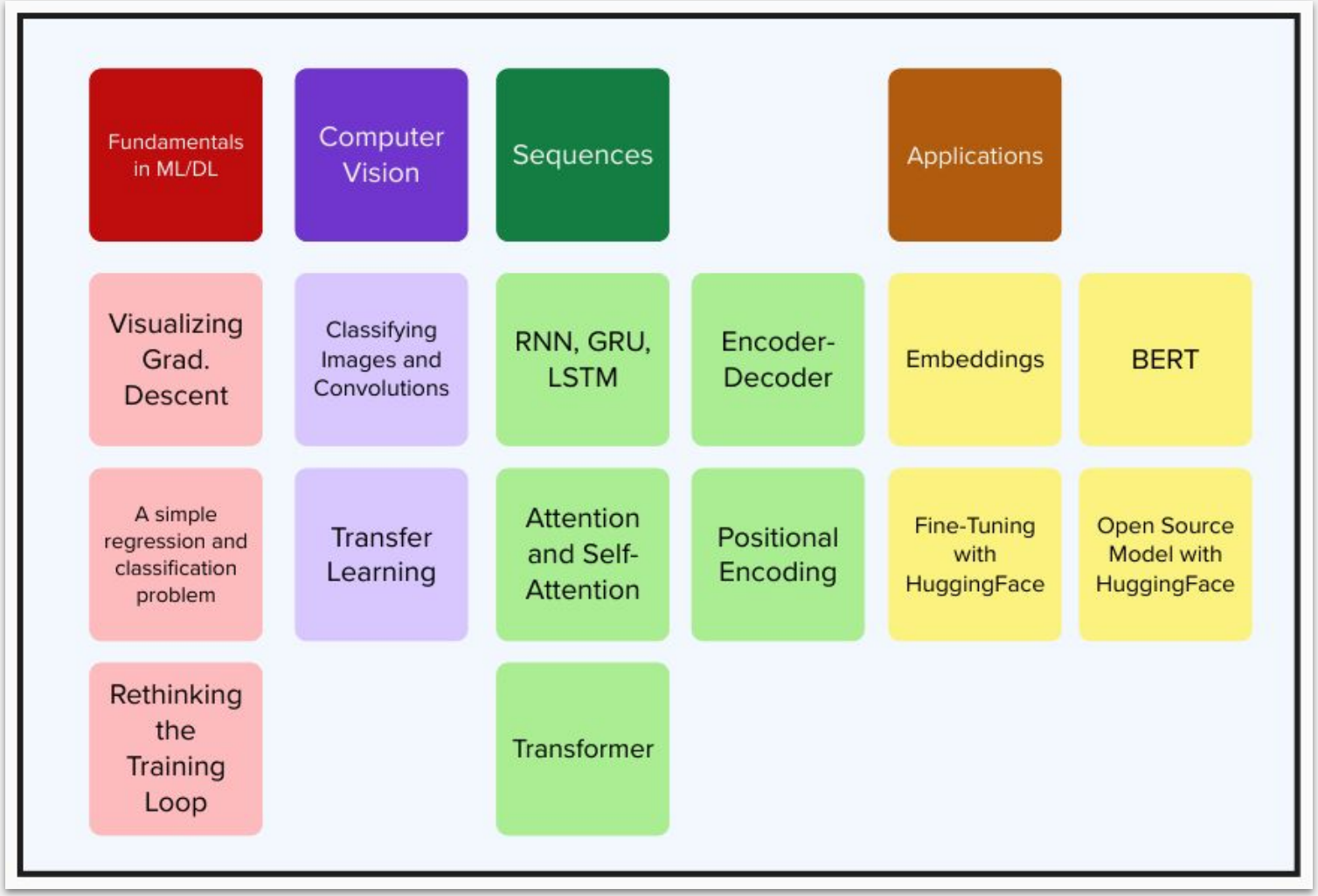

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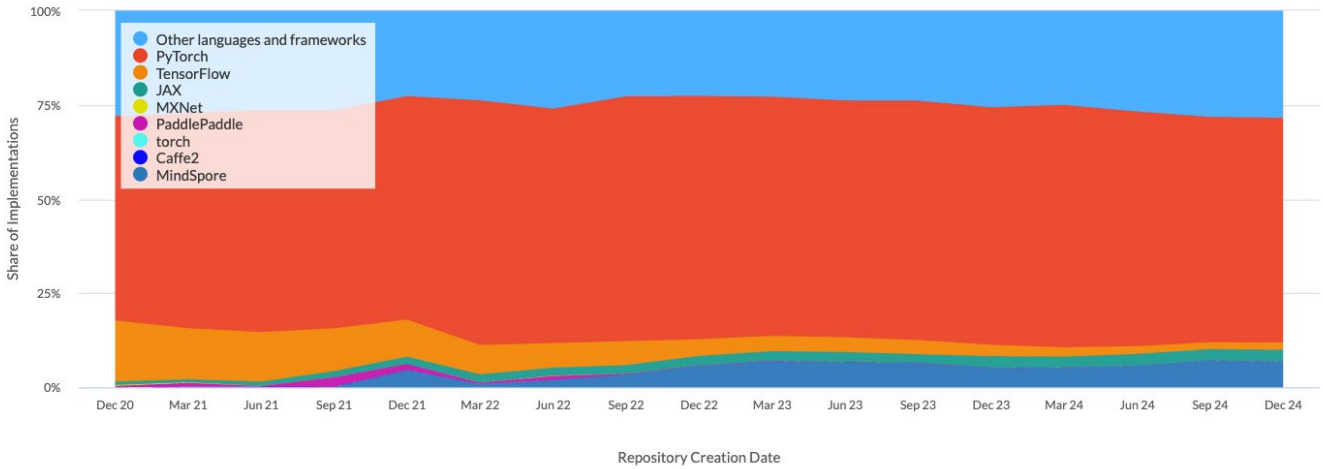

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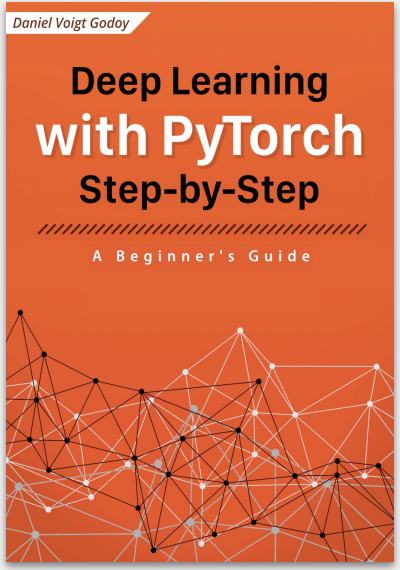
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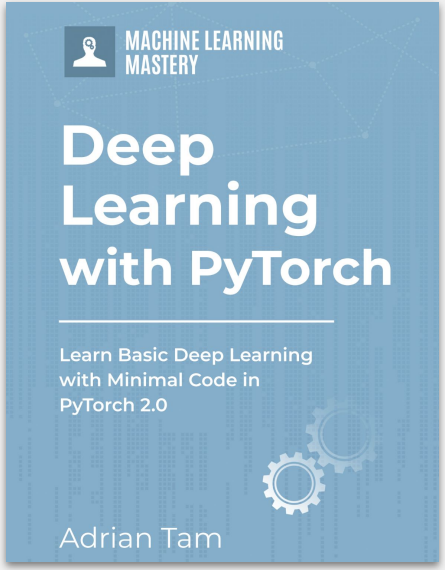
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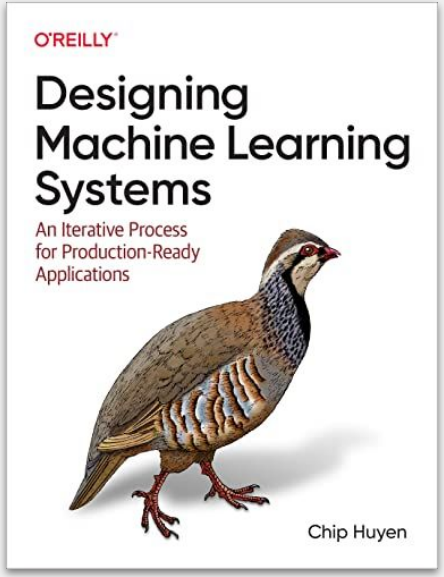
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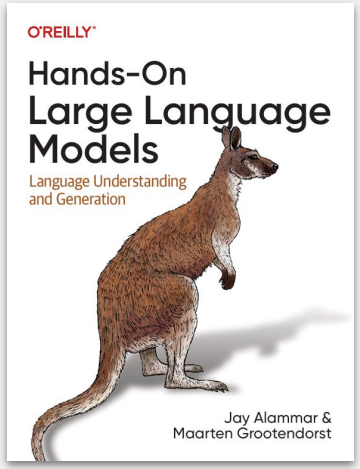
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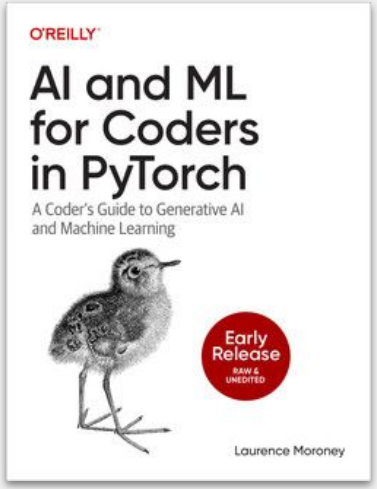
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Laurence Moroney

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