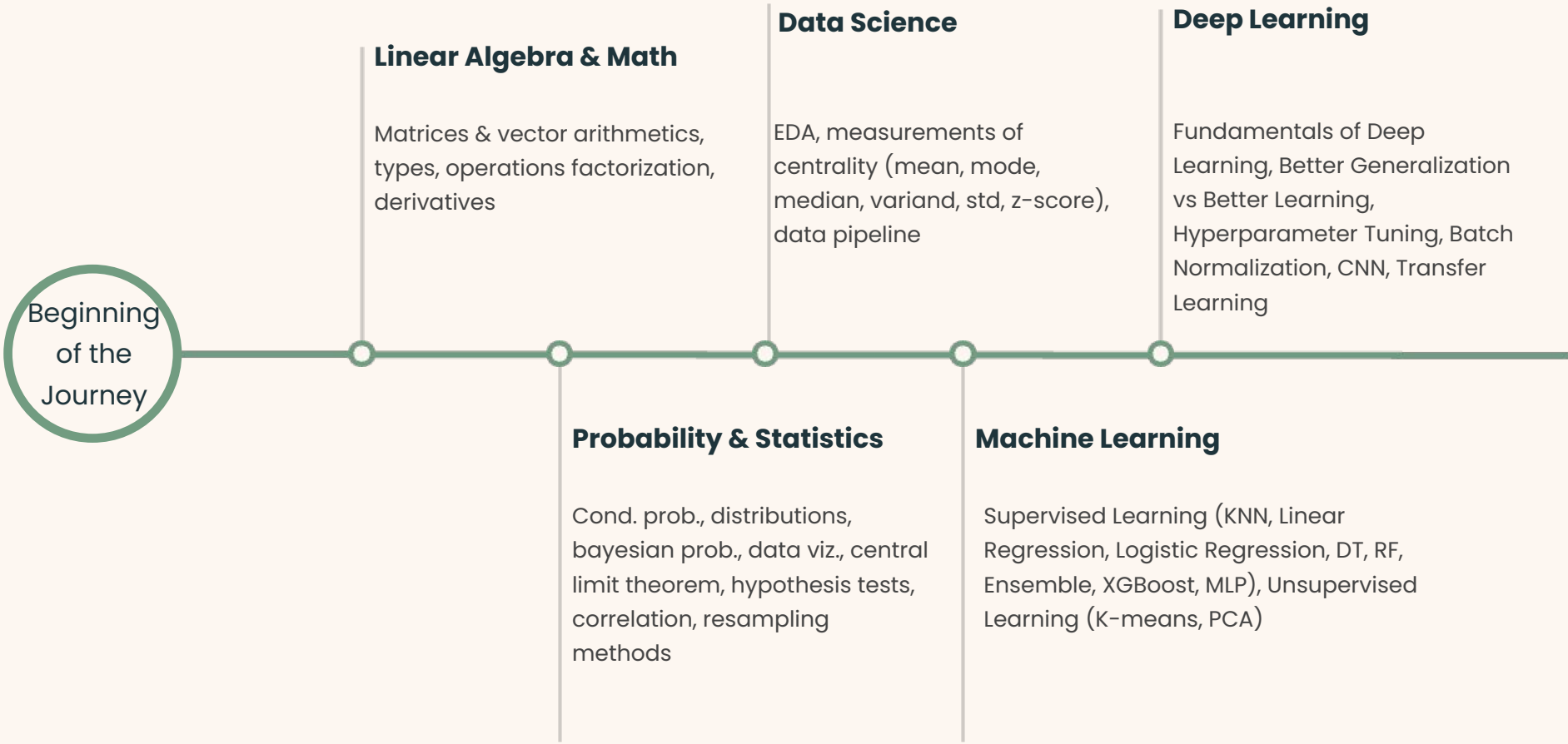
DCA0305
ivanovitch.silva@ufrn.br

Machine Learning Based Systems Design


Beginning of the Journey
Linear Algebra & Math
Matrices & vector arithmetics, types, operations factorization, derivatives
Probability & Statistics
Cond. prob., distributions, bayesian prob., data viz., central limit theorem, hypothesis tests, correlation, resampling methods
Data Science
EDA, measurements of centrality (mean, mode, median, variand, std, z-score), data pipeline
Machine Learning
Supervised Learning (KNN, Linear Regression, Logistic Regression, DT, RF, Ensemble, XGBoost, MLP), Unsupervised Learning (K-means, PCA)
Deep Learning
Fundamentals of Deep Learning, Better Generalization vs Better Learning, Hyperparameter Tuning, Batch Normalization, CNN, Transfer Learning

TinyML

Optimization, quantization, deploy into a microcontroller

New Models

Transformers, Difusion, GAN, LLM, GNN, Generative Flow Networks

But ....

If a model is not deployed, it does not generate value

Cont.

2016

Pandas

2017

Scikit-Learn

2018-2020

Keras, Pytorch, Covid-19

2021-2023

MLOps, GAN, LLM

How to project a typical machine learning workflow?

What is the issue with this solution?

clf = xG,BoostClassifier()

clf.fit(train_x,train_y)

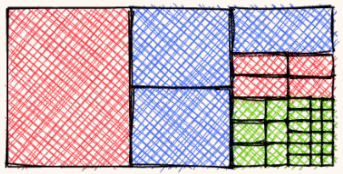
pred = clf.predict(test_x)

some_metrics(test_y, pred)

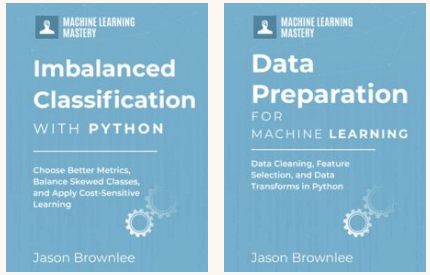
Database

publish a journal/conference paper, report

Stakeholders



Guarantee the same Feature Engineering artifacts are used in train/test and production env.



Feature Store

education sciences

MDPI

Article

Predictive Models for Imbalanced Data: A School Dropout Perspective

Thiago M. Barros [1,*,†], Plácido A. Souza Neto [1,†] and Ivanovitch Silva [2,†] and Luiz Affonso Guedes [2,†]

1 Federal Institute of Rio Grande do Norte (IFRN), 1559 Tirol Natal, Brazil; placido.neto@ifrn.edu.br
2 Federal University of Rio Grande do Norte (UFRN), 59078-970 Natal, Brazil; ivan@imd.ufrn.br (I.S.); affonso@dca.ufrn.br (L.A.G.)
* Correspondence: thiago.medeiros@ifrn.edu.br
† These authors contributed equally to this work.

Received: 24 July 2019; Accepted: 10 November 2019; Published: 15 November 2019

check for updates

Abstract: Predicting school dropout rates is an important issue for the smooth execution of an educational system. This problem is solved by classifying students into two classes using educational activities related statistical datasets. One of the classes must identify the students who have the tendency to persist. The other class must identify the students who have the tendency to dropout. This problem often encounters a phenomenon that masks out the obtain into this phenomenon and provides a reliable educational data mini predicts the dropout rates. In particular, the three data classifying techn neural networks and Balanced Bagging, are used. The performances of t and without the use of a downsample, SMOTE and ADASYN data bala other parameters geometric mean and UAR provides reliable results w rates using Balanced Bagging classifying techniques.

Keywords: dropout rates; accuracy paradox; imbalanced learning; d mlp; decision tree; Balanced Bagging; UAR; SMOTE; ADASYN

Evasão escolar de crianças e adolescente aumenta 171% na pandemia, diz estudo

Levantamento da organização Todos Pela Educação mostra que 244 mil crianças de 6 a 14 anos estavam fora da escola no segundo trimestre de 2021.

Por g1 — São Paulo
02/12/2021 13h28 · Atualizado há um ano

g1

Pandemia aumenta evasão escolar, diz relatório do Unicef

A quantidade de alunos, com idades entre 6 e 17 anos, que abandonaram as instituições de ensino foi de 1,38 milhão

Educadores alertam para aumento de evasão escolar durante a pandemia

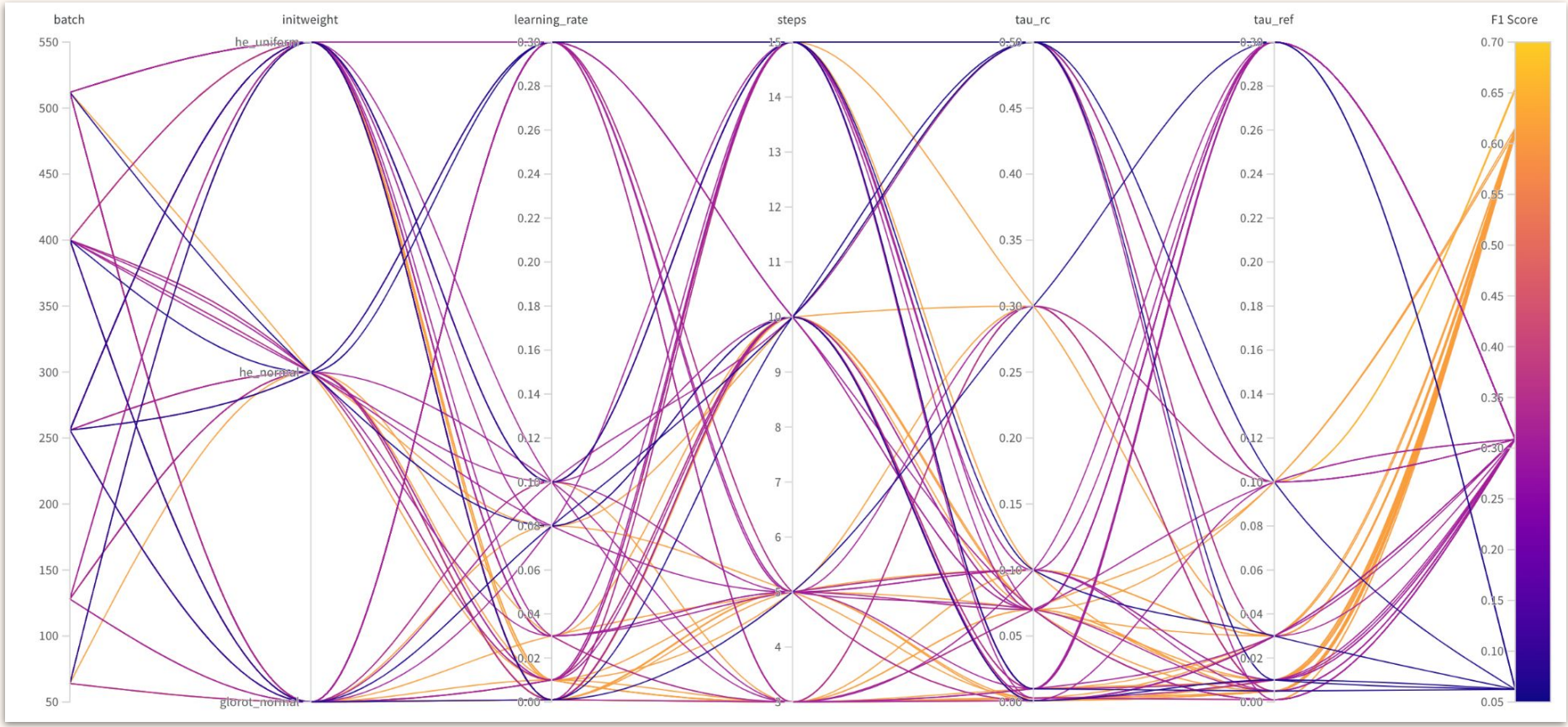
Para debatedores, desafio agora é atrair estudantes de volta à escola e recuperar o aprendizado

CÂMARA DOS DEPUTADOS

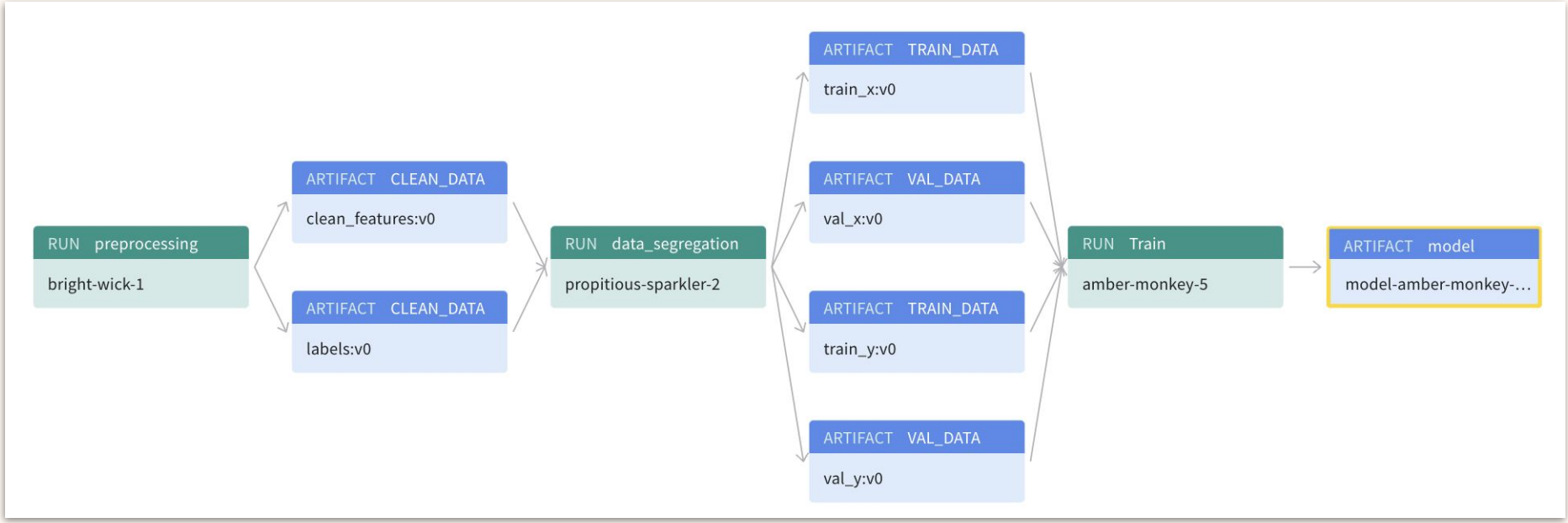
06/10/2021 - 20:04

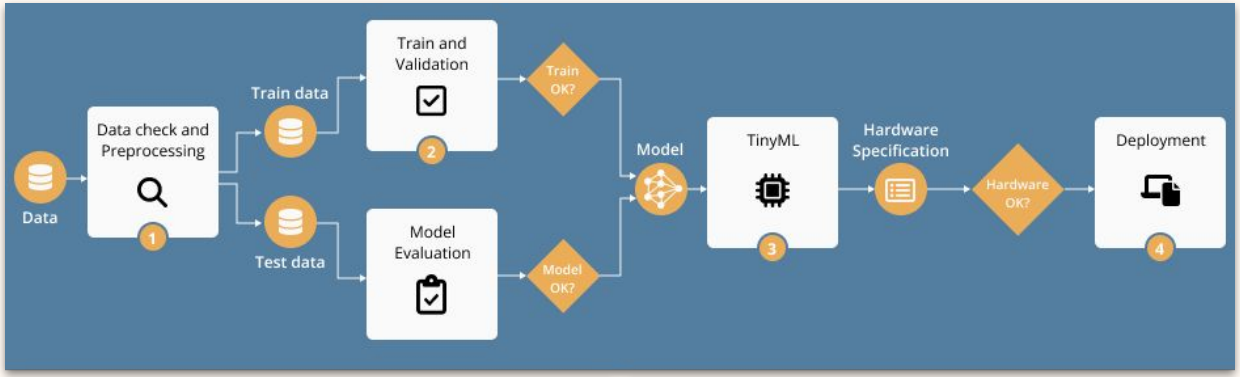
Concept/
Data Drift

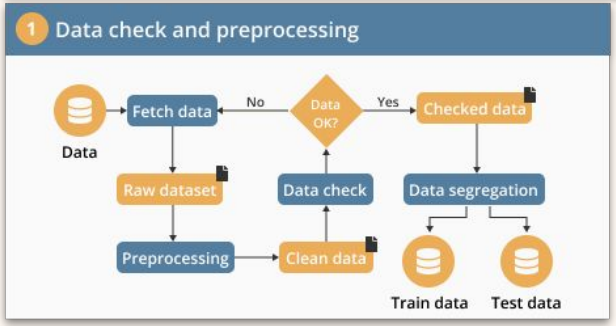
What settings were used in the last experiment?

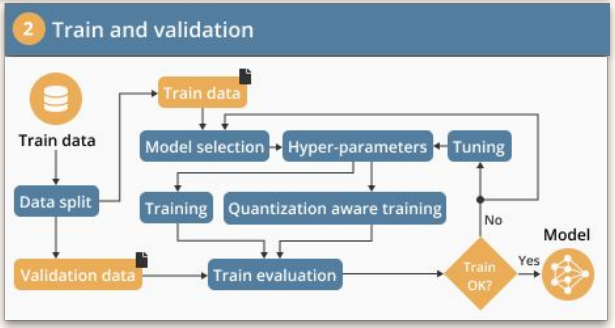


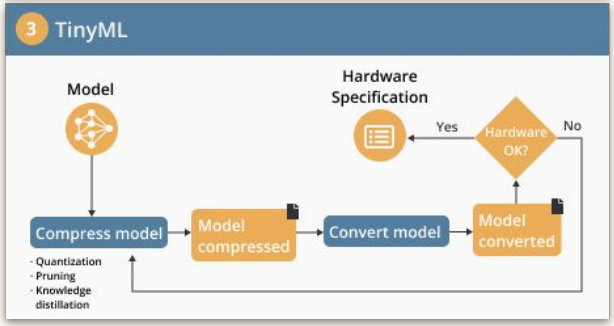
A more efficient machine learning workflow

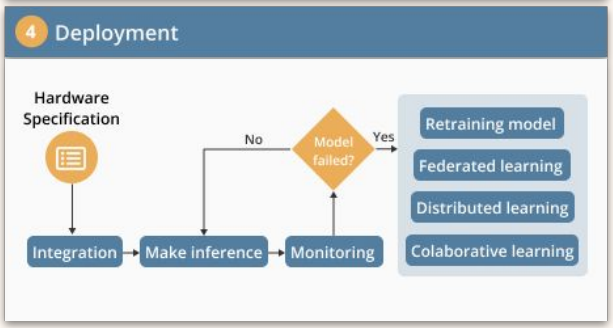


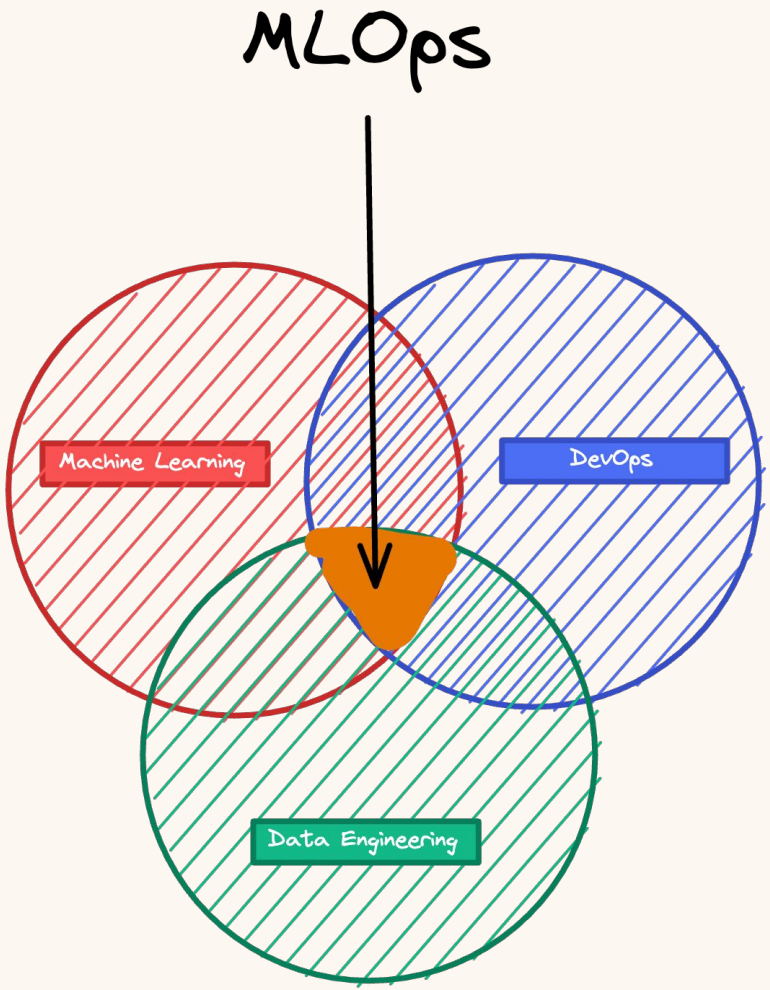

Data
Data check and Preprocessing
1
Train data
Test data
Train and Validation
2
Model Evaluation
Train OK?
Model OK?
Model
TinyML
3
Hardware Specification
Hardware OK?
Deployment
4


1 Data check and preprocessing
Data
Fetch data
No
Data OK?
Yes
Checked data
Raw dataset
Data check
Data segregation
Preprocessing
Clean data
Train data
Test data


2 Train and validation
Train data
Train data
Model selection
Hyper-parameters
Tuning
Data split
Training
Quantization aware training
No
Model
Validation data
Train evaluation
Train OK?
Yes

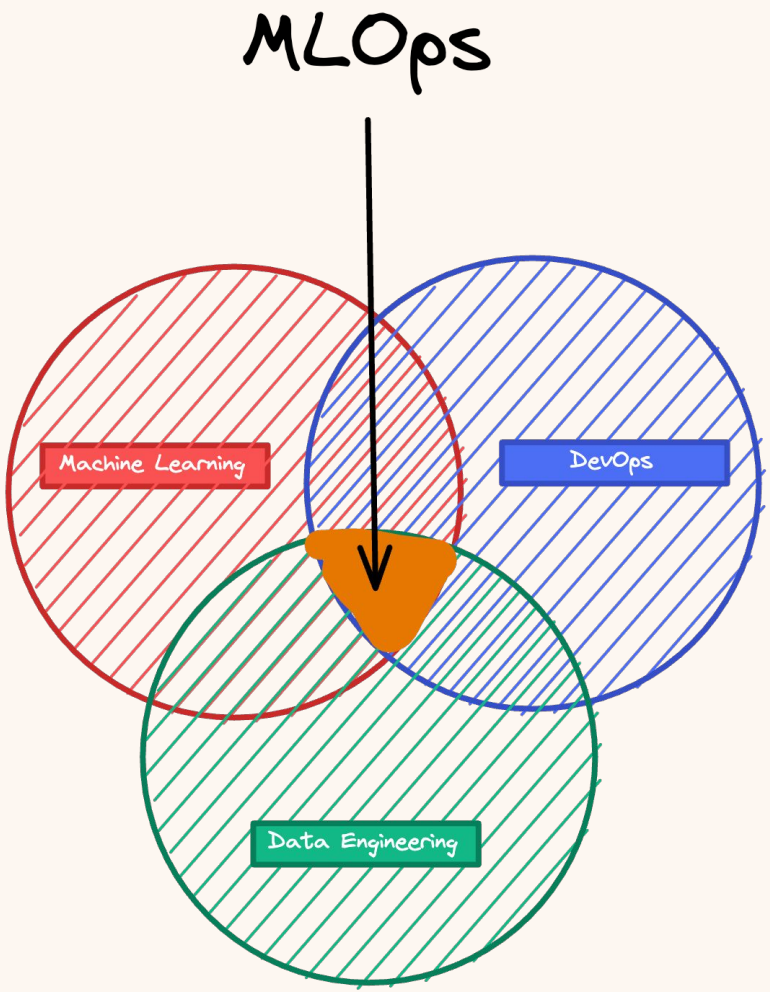

3 TinyML
Model
Hardware Specification
Yes
Hardware OK?
No
Compress model
Model compressed
Convert model
Model converted
· Quantization
· Pruning
· Knowledge distillation


4 Deployment
Hardware Specification
No
Model failed?
Yes
Retraining model
Federated learning
Distributed learning
Colaborative learning
Integration
Make inference
Monitoring



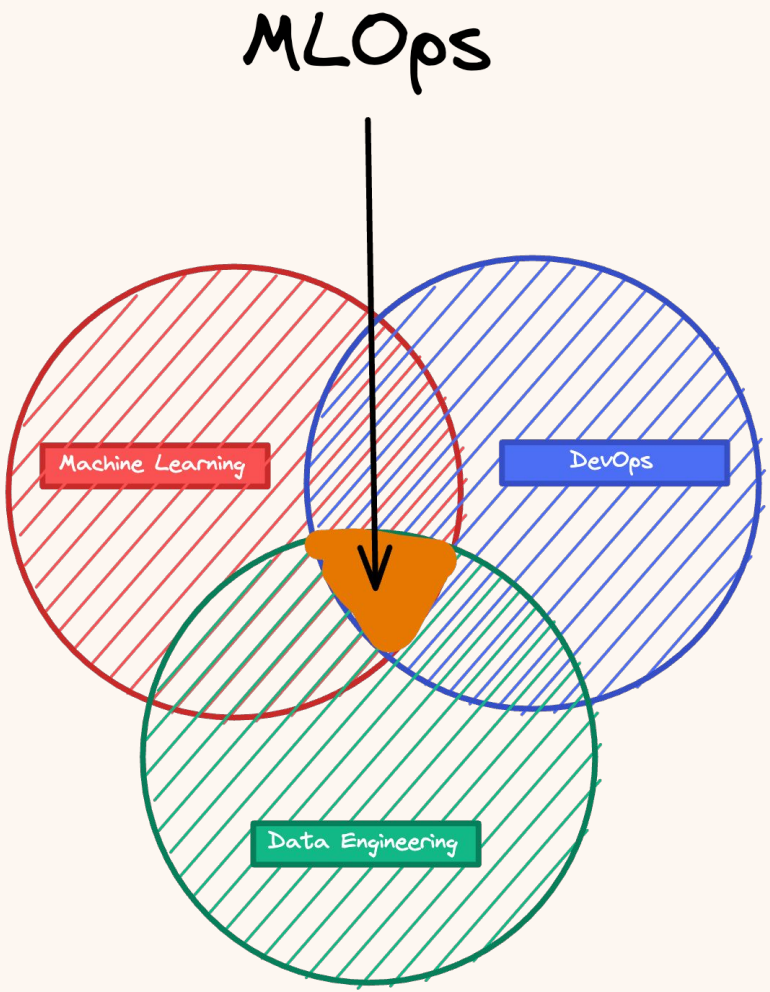
Python Essentials for MLOps

CLI Fundamentals	Clean Code Principles	Production Ready Code	Programming
Elements of the Command Line	Refactoring Documentation	Catching Errors Logging	Functions Classes Decorators
Infrastructure Github Codespace vscode, colab, terminal	Python Code Quality Authority (PCQA)	Testing	Interact with APIs and SDKs to build command-line tools



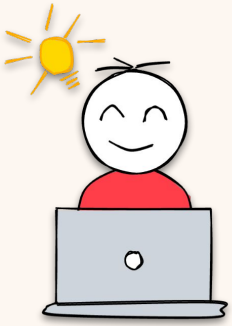
Essential guide for NLP

Foundations	Data Preparation	Applicatons	ML Introduction
From Linguistics to NLP	Tokenization Bag of Words	Text Classification	Foundations of Attention
Standard Models	Word Embeddings	Image Captioning Machine Translation	From RNN to Transformer



Building a Reproducible Model Workflow

Principles and Practices of MLOps	Full-Pipeline	MLOps Tools	Other Tools
Operations Pipelines	ETL, Data Segregation, Data Checks, Train, Validation and Experiment Tracking	Introduction to MLflow and HugginFace	FastAPI, DVC, Gradio, Streamlit
End to End MLOps and AIOps	Data and Artifact Version, Release for reproducibility, Deploy	Deploying and Applied HuggingFace	Weights & Bias



Work in Progress
WiP

Third+ time the course is offered

The subject is new, we don't have all the answers

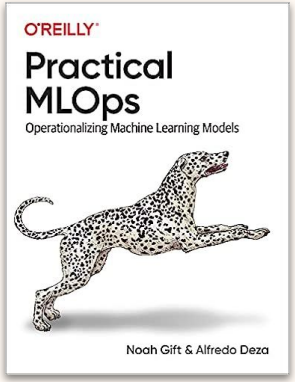
We are all learning together!!!

We appreciate you:

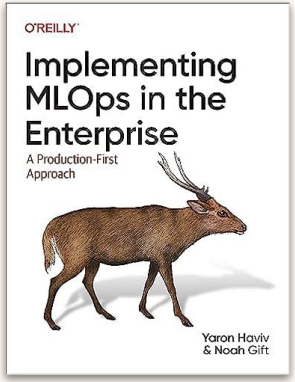
a) enthusiams for trying out new things

b) patience bearing with things that don't quite work

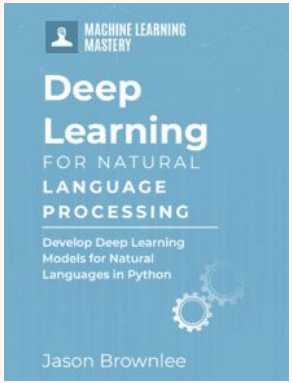
c) feedback to improve the course



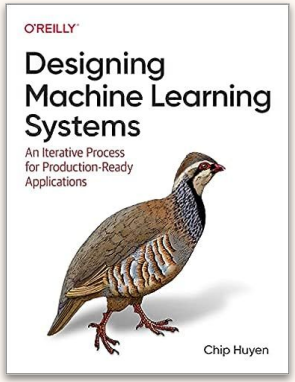
Sept. 2021



Oct. 2023



March 2021



May 2022

Clone me!!!!

https://github.com/ivanovitchm/mlops