Module 2

Setting up Deep Learning Environment

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Road map!

- Module 1- Introduction to Deep Learning
- Module 2- Setting up Deep Learning Environment
- Module 3- Machine Learning review (ML fundamentals + models)
- Module 4- Deep Neural Networks (NN and DNN)
- Module 5- Deep Computer Vision (CNN, FCN)
- Module 6- Deep Sequence Modeling (RNN, LSTM)
- Module 7- Transformers (Attention is all you need!)
- Module 8- Deep Generative Modeling (AE, VAE, GAN)
- Module 9- Deep Reinforcement Learning (DQN, PG)

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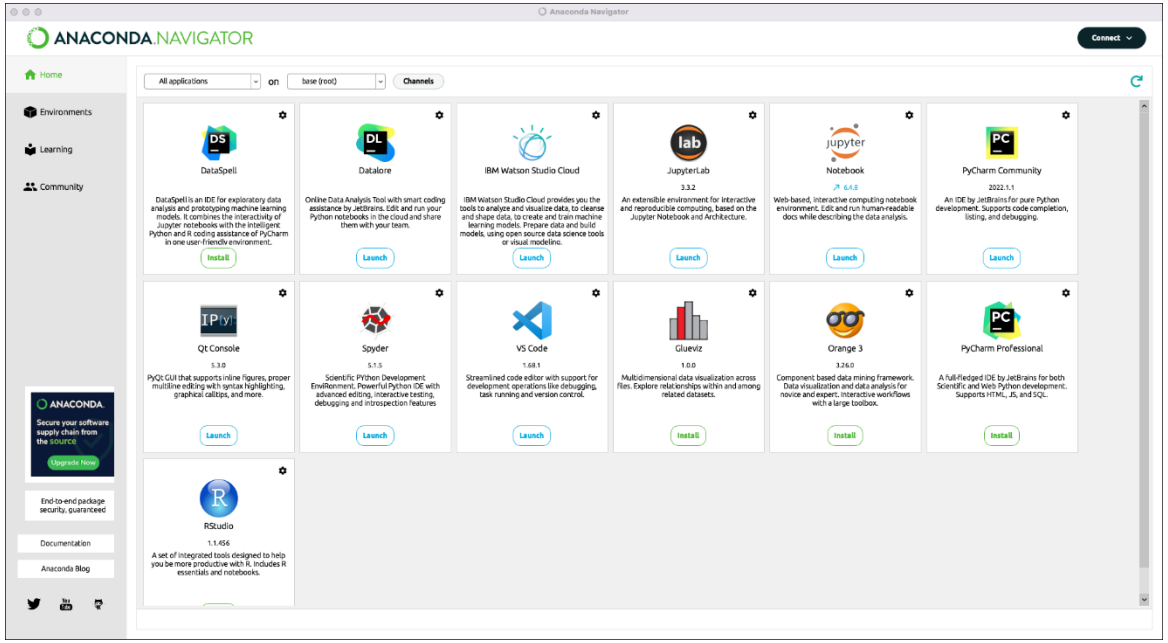
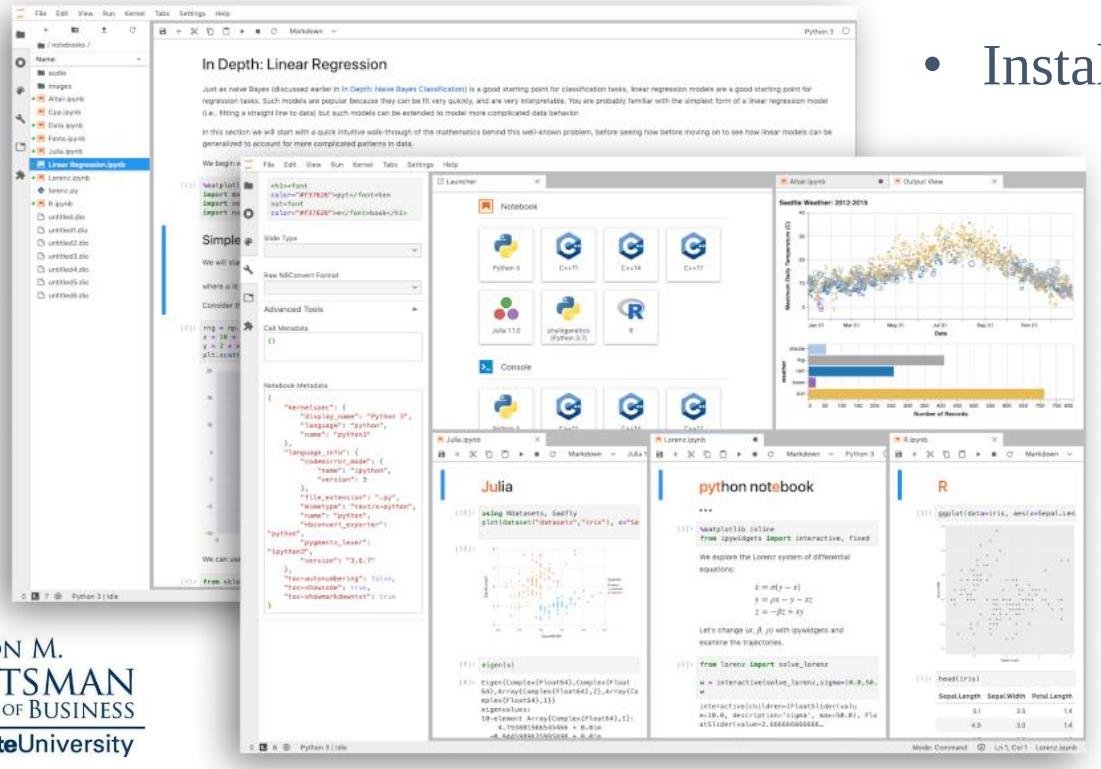
Install through

- Anaconda is a distribution of the Python and R programming languages for scientific computing, that aims to simplify package management with conda environments.
- Anaconda offers the easiest way to perform data science and machine learning on a single machine.
- Install Anaconda @ https://www.anaconda.com/products/distribution



JupyterLab

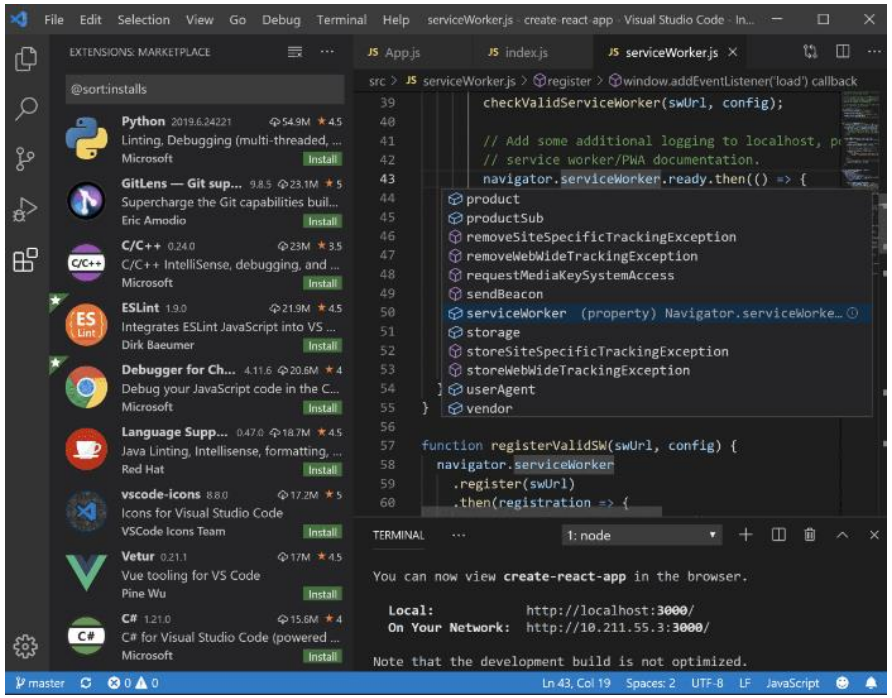
- JupyterLab is the latest web-based interactive development environment for notebooks, code, and data
- Jupyter's name is a reference to the three core programming languages supported by Jupyter, which are Julia, Python and R



- Install JupyterLab @ http://jupyter.org/install

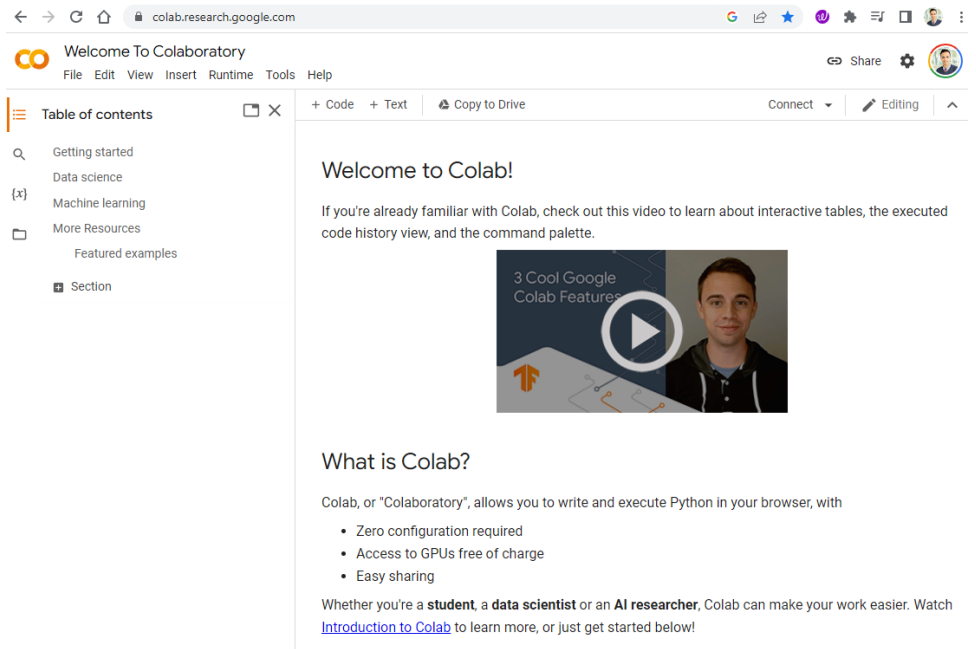
VS Code

- VS Code is one of the most popular source code editors
- Features include support for debugging, syntax highlighting, intelligent code completion, code refactoring, and embedded Git.
- Install VS code @ https://code.visualstudio.com/



Google colab

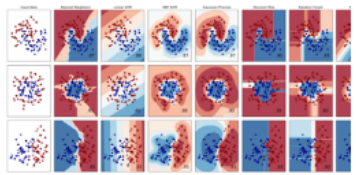
- Colab is a free hosted Jupyter notebook-style environment that runs entirely in the cloud and requires no setup to use. It also provides access to machine learning libraries and computing resources including GPU.
- Colab allows anybody to write and execute arbitrary python code through the browser, and is especially well suited to machine learning, data analysis and education. https://colab.research.google.com/



Classification

Identifying which category an object belongs to.

Applications: Spam detection, image recognition.
Algorithms: SVM, nearest neighbors, random forest, and more...

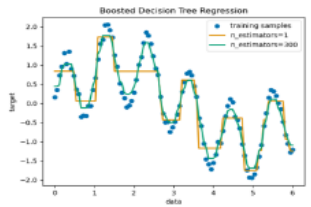


Examples

Regression

Predicting a continuous-valued attribute associated with an object.

Applications: Drug response, Stock prices.
Algorithms: SVR, nearest neighbors, random forest, and more...

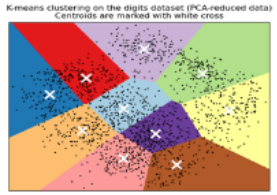


Examples

Clustering

Automatic grouping of similar objects into sets.

Applications: Customer segmentation, Grouping experiment outcomes
Algorithms: k-Means, spectral clustering, mean-shift, and more...

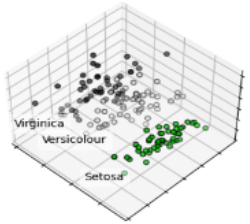


Examples

Dimensionality reduction

Reducing the number of random variables to consider.

Applications: Visualization, Increased efficiency
Algorithms: PCA, feature selection, non-negative matrix factorization, and more...

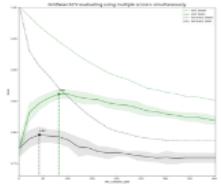


Examples

Model selection

Comparing, validating and choosing parameters and models.

Applications: Improved accuracy via parameter tuning
Algorithms: grid search, cross validation, metrics, and more...

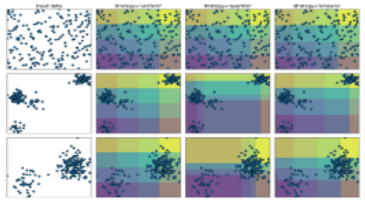


Examples

Preprocessing

Feature extraction and normalization.

Applications: Transforming input data such as text for use with machine learning algorithms.
Algorithms: preprocessing, feature extraction, and more...



Examples

- Scikit-learn is an open-sourced Python library and includes a variety of unsupervised and supervised learning techniques.
- It is based on technologies and libraries like Matplotlib, Pandas and NumPy and helps simplify the coding task.
- Install Scikit-learn @ https://scikit-learn.org/stable/install.html

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PYCARET

- PyCaret is an open-source, low-code machine learning library in Python that automates machine learning workflows.
- PyCaret is essentially a Python wrapper around several machine learning libraries and frameworks
- Install PyCaret @ https://pycaret.gitbook.io/docs/get-started/installation

```python
# load dataset
import pandas as pd
train = pd.read_csv('train.csv')
test  = pd.read_csv('test.csv')

# init setup
from pycaret.classification import *
s = setup(train, target= 'target')

# model training and selection
best = compare_models()

# analyze best model
evaluate_model(best)


# predict on new data
predictions = predict_model(best, data =test )

# save best pipeline
save_model(best, 'my_best_pipeline')
```

ID	Name
'lr'	Logistic Regression
'knn'	K Nearest Neighbour
'nb'	Naives Bayes
'dt'	Decision Tree Classifier
'svm'	SVM - Linear Kernel
'rbfsvm'	SVM - Radial Kernel
'gpc'	Gaussian Process Classifier
'mlp'	Multi Level Perceptron
'ridge'	Ridge Classifier
'rf'	Random Forest Classifier
'qda'	Quadratic Discriminant Analysis
'ada'	Ada Boost Classifier
'gbc'	Gradient Boosting Classifier
'lda'	Linear Discriminant Analysis
'et'	Extra Trees Classifier
'xgboost'	Extreme Gradient Boosting
'lightgbm'	Light Gradient Boosting
'catboost'	CatBoost Classifier

Keras

- Keras is a high-level, open-source neural network library written in Python. It was developed to make it easier for researchers and developers to build and experiment with deep learning models.
- The Keras API became the official high-level API for TensorFlow 2.0 in 2019. https://keras.io/

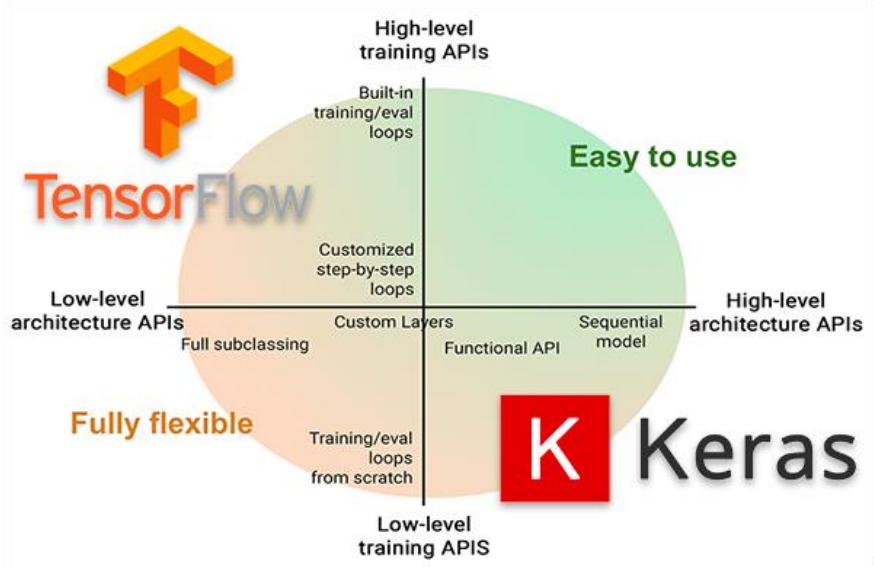
```
model = keras.Sequential(
    [
        keras.Input(shape=input_shape),
        layers.Conv2D(32, kernel_size=(3, 3), activation="relu"),
        layers.MaxPooling2D(pool_size=(2, 2)),
        layers.Conv2D(64, kernel_size=(3, 3), activation="relu"),
        layers.MaxPooling2D(pool_size=(2, 2)),
        layers.Flatten(),
        layers.Dropout(0.5),
        layers.Dense(num_classes, activation="softmax"),
    ]
)

model.summary()
```

TensorFlow

- TensorFlow is a Google-maintained open-source end-to-end platform for prototyping and assessing machine learning models, primarily neural networks.
- TensorFlow also offers TensorBoard, a visualization tool for comparing and tracking our learned models.
- It can scale from a single CPU, to a GPU or cluster of GPUs all the way up to a multi-node TPU infrastructure.
- Build-in Google Colab. For local installation visit https://www.tensorflow.org/install

Keras Vs TensorFlow

- Level of abstraction: Keras is a higher-level library that provides a more intuitive interface for building and training models, while TensorFlow is a lower-level library that provides more flexibility but requires the user to specify more details of the model.
- Keras is a standalone library, while TensorFlow includes both a low-level library for numerical computations and a high-level library for building and training machine learning models.
- Keras is a user-friendly interface to TensorFlow



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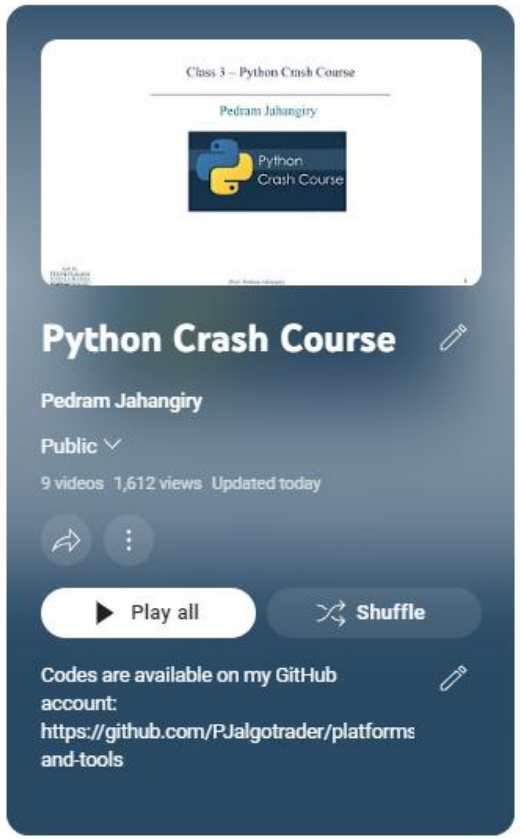
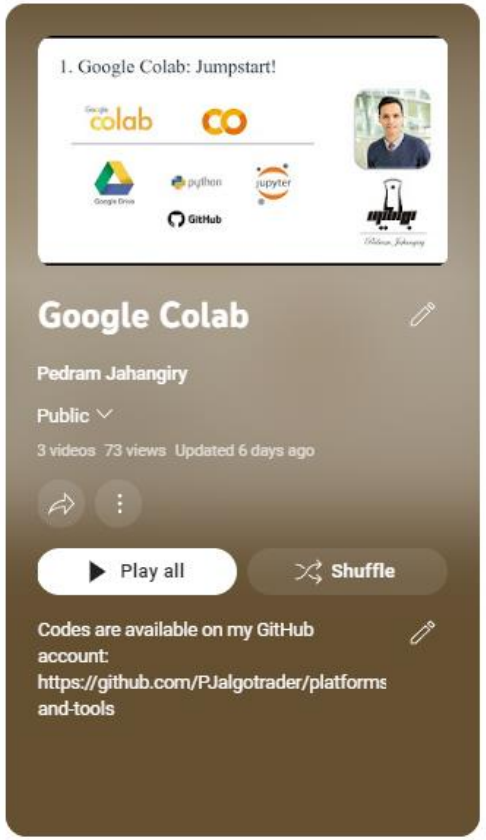
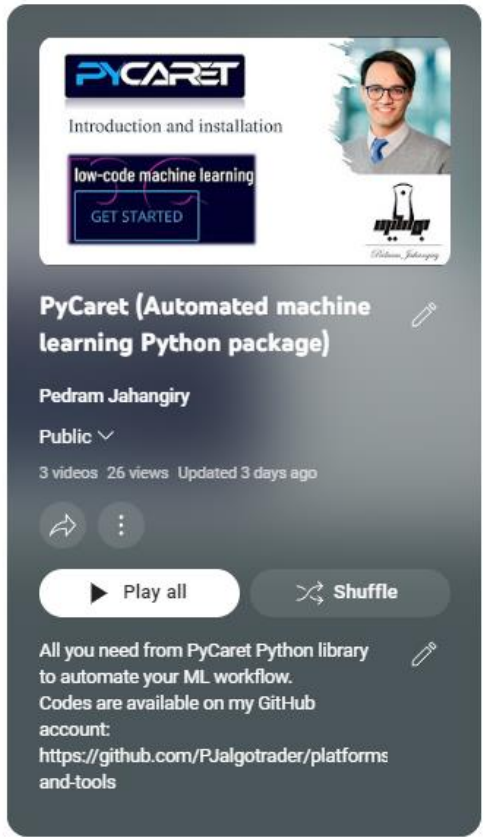
Available YouTube playlists







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Platforms and Packages

Listed below are some Python packages and platforms that will be used in the deep learning and deep forecasting courses.

Google colab

General Python libraries

Machine Learning libraries

Deep Learning libraries

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Setting up Deep Learning Environment

Google colab

	Personal Workstation	Cloud Platforms	Google Colaboratory
Pros	• Full control over hardware and software • Work offline • Fixed cost	• Powerful computing resources • Scalability • Ease of use • Cost-effective: Pay-as-you-go • Collaboration	• Powerful computing resources (GPU, TPU) • Ease of use • Collaboration • No need to set up a local environment
Cons	• Scalability • Maintenance (both hardware and software)	• Expensive for large-scale experiments • Dependency on the provider • Limited control • Internet connection • Security	• Time limit • Hardware limitation • Data storage • Limited control • Internet connection • Security

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The modern machine learning landscape

- From 2016 to 2020, the entire machine learning and data science industry has been dominated by these two approaches:
  1. Deep learning
  2. Gradient boosted trees

- Most practitioners of deep learning use Keras, often in combination with its parent framework TensorFlow.
- This means you'll need to be familiar with Scikit-learn, XGBoost, and Keras

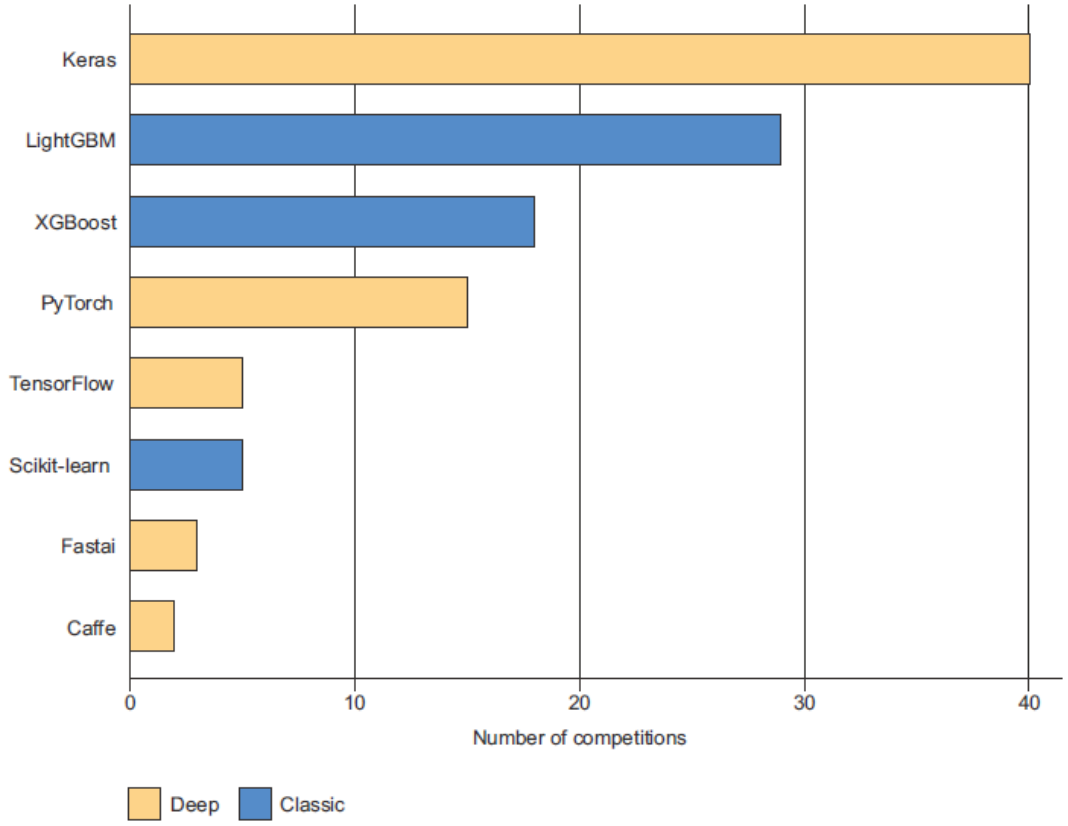

Figure 1.12 Machine learning tools used by top teams on Kaggle

The modern machine learning landscape

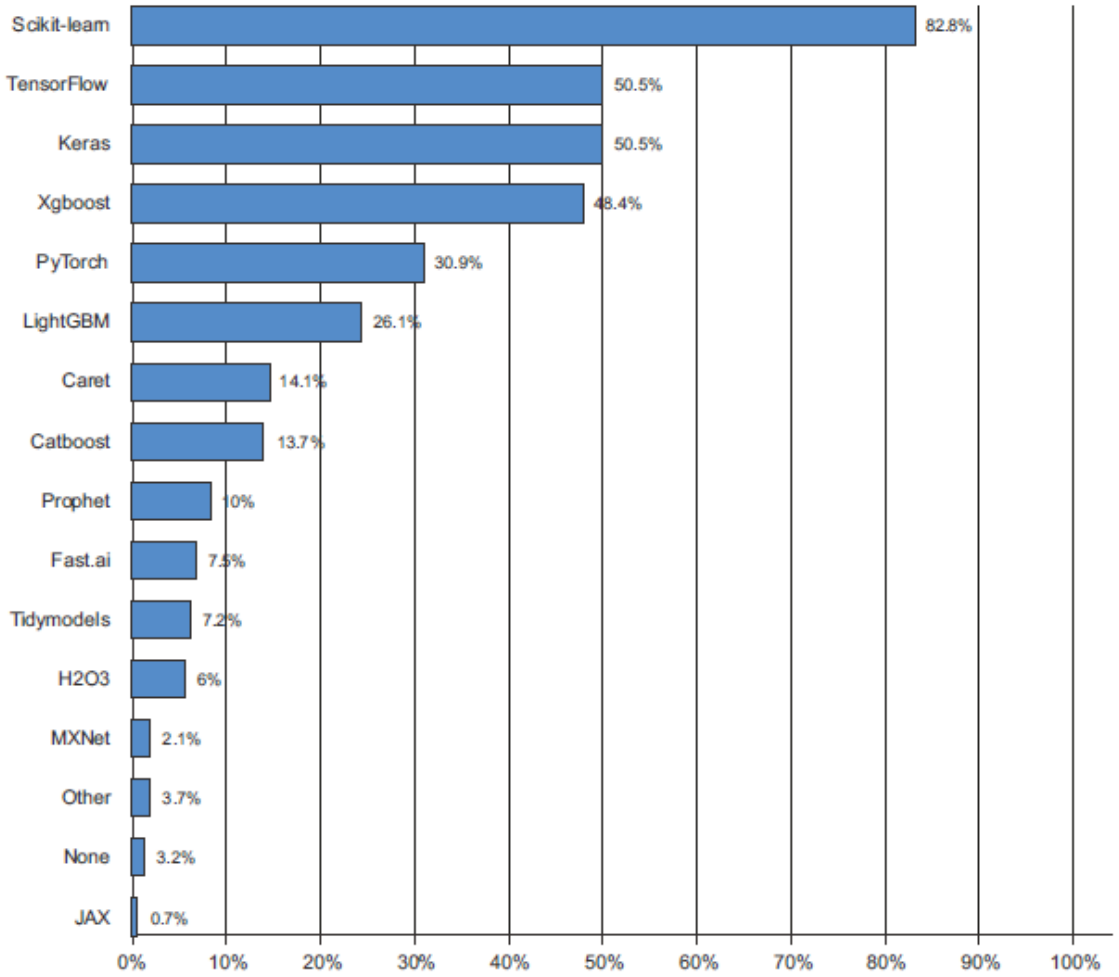

Figure 1.13 Tool usage across the machine learning and data science industry (Source: www.kaggle.com/kaggle-survey-2020)

- Kaggle also runs a yearly survey among machine learning and data science professionals worldwide.
- This survey is one of our most reliable sources about the state of the industry!!!
- This figure shows the percentage of usage of different machine learning software frameworks.

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