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# 1) Tensorflow

TensorFlow is an end-to-end open-source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries, and community resources that lets researchers push the state-of-the-art in ML, and developers easily build and deploy ML-powered applications.

## Scope

It can be used for a variety of things just like all other ml based tools, but here are some things it is good at.

### Voice/Sound Recognition

Sound-based applications are one of the most well-known uses of TensorFlow. With the proper data feed, neural networks are capable of understanding audio signals. It includes Voice search, Voice recognition, flaw detection, and sentiment analysis.

Another common use case for Voice Recognition is language comprehension. Speech-to-text software can be used to extract sound snippets from larger audio recordings and convert them to text. CRM can also benefit from sound-based technologies. A use case scenario could be: TensorFlow algorithms act as customer service agents, routing customers to the information they need faster than the agents.

### Text-Based Applications

Further popular uses of TensorFlow are, text-based applications such as sentimental analysis (CRM, Social Media), Threat Detection (Social Media, Government), and Fraud Detection (Insurance, Finance)

Another use case is SmartReply. It automatically generates e-mail responses (wishing for the evolved version of this one doing our business on behalf of us).

**Image Recognition**

Object recognition algorithms based on TensorFlow classify and recognize arbitrary things in larger photos. This is commonly used in engineering applications to recognize shapes for modeling (3D space building from 2D photos) and by social media platforms for photo tagging (Facebook's Deep Face). The system may learn to recognize a tree it has never seen before by studying thousands of photographs of trees, for example.

**Time Series**

The TensorFlow Time Series algorithms are used to extract useful statistics from time-series data. They enable non-specific time period forecasting as well as the generation of alternate time series variants.

The recommendation is the most popular use case for Time Series. Other applications of TensorFlow Time Series algorithms include Risk Detection, Predictive Analysis, and Enterprise/Resource Planning in Finance, Accounting, Government, Security, and IoT.

**Video Detection**

Video data is also handled by TensorFlow neural networks. This is mostly utilized in Motion Detection and Real-Time Threat Detection in Gaming, Security, Airports, and UX/UI. Universities have recently begun to work on large-scale video classification datasets, such as YouTube-8M, in order to speed up research into large-scale video understanding, representation learning, noisy data modeling, transfer learning, and domain adaption methodologies for video.

## Merits and Demerits

Merits

1. Open-source platform
2. Data visualization
3. Keras friendly
4. Scalable

5. Compatible
6. Parallelism
7. Architectural support
8. Graphical support

Demerits

1. Frequent updates
2. Inconsistent
3. Architectural limitation
4. Dependency
5. Symbolic loops
6. GPU Support
7. Slow speed
8. Support for Windows

# 2) Sci Kit Learn

Sklearn, also known as scikit-learn in Python, is one of the most useful open-source tools for Machine Learning in Python. The scikit-learn library is a comprehensive collection of the most efficient statistical modeling and Machine Learning tools available. Regression, classification, dimensionality reduction, and clustering are just a few of the tools available.

## Scope

There is a vast variety of things under the scope of this tool, a few of these are

- **Feature extraction:** allows users to extract features from images, text, etc.
- **Clustering:** unlabeled data can be grouped using this.
- **Supervised learning algorithms:** It has a wide range of ML Algorithms pre-built and its toolbox offers a number of supervised learning algorithms, including – Linear regression, Decision Trees, Support Vector Machines, and Bayesian approaches are examples of generalized linear models.
- **Unsupervised learning algorithms:** Factoring, principal component analysis, unsupervised neural networks, and cluster analysis, belong in this category.
- **Cross-Validation and Ensembling Methods** are also provided by this tool.

## Merits and Demerits

Merits

- The library is distributed under the BSD license, making it free with minimum legal and licensing restrictions.
- Scikit-learn has been employed in the operations of many research groups and commercial enterprises, and they all agree that the module is simple to use. As a result, they don't have any issues when completing a variety of tasks.
- Scikit-learn is backed and updated by numerous authors, contributors, and a vast international online community.
- The scikit-learn website provides elaborate API documentation for users who want to integrate the algorithms with their platforms.

Demerits

- Inability to Reasonably do Automatic Machine Learning (AutoML)
- Inability to Reasonably do Deep Learning Pipelines
- Not ready for Production nor for Complex Pipelines
- It creates a convenient abstraction that could encourage more junior data scientists to go without an understanding of the fundamentals.

# 3) PyTorch

It is an open-source machine learning framework that accelerates the path from research prototyping to production deployment. It is a Python package that provides two high-level features:

- Tensor computation (like NumPy) with strong GPU acceleration
- Deep neural networks built on a tape-based autograd system

Unlike most other popular deep learning frameworks like TensorFlow, which use static computation graphs, PyTorch uses dynamic computation, which allows greater flexibility in building complex architectures.

## Scope

For research, PyTorch is a popular choice, and computer science programs like Stanford now uses it to teach deep learning.

As with most of the popular ML Frameworks, Pytorch as well is widely used in :

- Computer Vision
- Natural Language Processing
- Reinforcement Learning

PyTorch wraps the same C back end in a Python interface. But it's more than just a wrapper. Developers built it from the ground up to make models easy to write for Python programmers. The underlying, low-level C and C++ code is optimized for running Python code. Because of this tight integration, you get:

- Better memory and optimization
- More sensible error messages
- Finer-grained control of the model structure
- More transparent model behavior
- Better compatibility with NumPy

## Merits and Demerits

Merits

- It is easy to learn and simpler to code.
- Rich set of powerful APIs to extend the Pytorch Libraries.
- It has computational graph support at runtime.
- It is flexible, faster, and provides optimizations.
- It has support for GPU and CPU.
- Easy to debug using Pythons IDE and debugging tools.
- It supports cloud platforms.

Demerits

- It has been released in 2016, so it's new compared to others and has fewer users, and is not widely known.
- Absence of monitoring and visualization tools like a tensor board.
- The developer community is small compared to other frameworks.

## 4) Fast AI

Fast AI is a deep learning library that gives practitioners high-level components that can provide state-of-the-art results in conventional deep learning domains quickly and easily, as well as researchers with low-level components that can be mixed and matched to create novel techniques. It strives to achieve both goals without sacrificing usability, flexibility, or performance. This is made possible by a well-designed layered architecture that defines the common underlying patterns of numerous deep learning and data processing algorithms as disconnected abstractions.

### Scope

**Natural language processing (NLP):** Answering questions; speech recognition; summarizing documents; classifying documents; finding names, dates, etc. in documents; searching for articles mentioning a concept.

**Computer vision:** Satellite and drone imagery interpretation (e.g., for disaster resilience); face recognition; image captioning; reading traffic signs; locating pedestrians and vehicles in autonomous vehicles

**Medicine:** Finding anomalies in radiology images, including CT, MRI, and X-ray images; counting features in pathology slides; measuring features in ultrasounds; diagnosing diabetic retinopathy

**Image generation:** Colorizing images; increasing image resolution; removing noise from images; converting images to art in the style of famous artists
**Recommendation systems:** Web search; product recommendations; home page layout

**Other applications:** Financial and logistical forecasting, text to speech, and much more...

## Merits and Demerits

Merits

- Modern best practices are constantly implemented
- Datablock API is wonderful to load data
- Huge variety of applications ready to be used

Demerits

- The library is strongly opinionated on how things should behave, down to the level of changing how python works. This introduces huge friction when you want to do something new or different.
- It's hard to integrate with other libraries in the PyTorch ecosystem. More than once I've seen people reimplement code in fastai2 because it's easier.
- Error messages in fastai2 have really degraded from fastai1. Often they are a couple of pages long and hard to tell where the problem actually is.

# 5) ML Kit

ML Kit is a mobile SDK that brings Google's machine learning expertise to Android and iOS apps in a powerful yet easy-to-use package. Whether you're new or experienced in machine learning, you can implement the functionality you need in just a few lines of code.

## Scope

Video and image analysis APIs to label images and detect barcodes, text, faces, and objects.

Vision APIs

- Barcode scanning: Scan and process barcodes. Supports most standard 1D and 2D formats.
- Face detection: Detect faces and facial landmarks.

- Image labeling: Identify objects, locations, activities, animal species, products, and more. Use a general-purpose base model or tailor it to your use case with a custom TensorFlow Lite model.
- Object detection and tracking: Localize and track in real-time one or more objects in the live camera feed.
- Text recognition: Recognize and extract text from images.
- Digital Ink Recognition: Recognizes handwritten text and hand-drawn shapes on a digital surface, such as a touch screen. Recognizes 300+ languages, emojis, and basic shapes.
- Pose detection: Detect the position of the human body in real-time.
- Selfie segmentation: Separate the background from users within a scene and focus on what matters.

Natural Language APIs

- Language ID: Determine the language of a string of text with only a few words.
- On-device translation: Translate text between 58 languages, entirely on the device.
- Smart Reply: Generate reply suggestions in text conversations.
- Entity Extraction: Detect and locate entities (such as addresses, date/time, phone numbers, and more) and take action based on those entities. Works in 15 languages.

## Merits and Demerits

Merits

- Clear and easy-to-use
  ML Kit SDK allows developers to make everything faster and easier. Developers need to pass data to the required API and wait for the response from SDK.
- Custom Models
  It allows developers to download their model to the Firebase console and bundle it with their product.
- On Device and Cloud APIs
  Developers can choose on-device or cloud APIs, depending on their needs. User's data isn't stored in cloud APIs, and it is deleted once the processing is complete.
- Multi-Platform

ML Kit SDK is a multi-platform, that is APIs can be used for iOS and Android apps.

Demerits

- Large size
  Additional custom models may become very heavy for the app and make the app too large. Thus, a file's size will be much larger than the size of a typical app. And it won't be good either for developers or users.
- Beta version
  It is still in beta release mode, as we noted above. And it may have a negative impact on cloud-based APIs. Any beta version has some defects and bugs, and it is normal for a beta release. There is no news concerning the date of the final version release.

## 6) Google CoLaboratory

Collaboratory, or "Colab" for short, allows you to write and execute Python in your browser, with

- Zero configuration required
- Free access to GPUs
- Easy sharing

Whether you're a student, a data scientist, or an AI researcher, Colab can make your work easier.

### Scope

- Data science: You can import your own data into Colab notebooks from your Google Drive account, including from spreadsheets, as well as from Github and many other sources. You can harness the full power of popular Python libraries to analyze and visualize data with Colab.

- Machine Learning: Colab is used extensively in the machine learning

community with applications including:

- Developing and training neural networks
- Experimenting with TPUs
- Disseminating AI research
- Creating tutorials

## Merits and Demerits

Merits

- Google Colab comes with collaboration backed in the product. In fact, it is a Jupyter notebook that leverages Google Docs collaboration features.
- It also runs on Google servers and you don't need to install anything. Moreover, the notebooks are saved to your Google Drive account.
- Colab notebooks allow you to combine executable code and rich text in a single document, along with images, HTML, LaTeX, and more.
- You can easily share your Colab notebooks with co-workers or friends, allowing them to comment on your notebooks or even edit them.

Demerits

- It doesn't save your code automatically, so if the internet is gone, power is off, you closed the lid of your notebook, the code is gone. So hit save after every line, you write.
- It's hard to use it effectively if you have slow internet.
- Closed-Environment: Anyone can use Google Colab to write and run arbitrary python code in the browser. However, it is still a relatively closed environment, as machine learning practitioners can only run the python package already pre-added on the Colab.
- No Live-Editing: Writing a code and sharing the same with your partner or a team allows you to collaborate. However, the option for live editing is completely missing in Google Colab, which restricts two people to write, or editing codes at the same time

# 7) Keras

Keras is an API designed for human beings, not machines. Keras follows best

practices for reducing cognitive load: it offers consistent & simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear & actionable error messages. It also has extensive documentation and developer guides.

Keras is the most used deep learning framework among top-5 winning teams on Kaggle. Because Keras makes it easier to run new experiments, it empowers you to try more ideas than your competition, faster.

## Scope

Keras is better suited for developers who want a plug-and-play framework that lets them build, train, and evaluate their models quickly. Keras also offers more deployment options and easier model export. Keras is the best when working with small datasets, rapid prototyping, and multiple back-end support. It's the most popular framework thanks to its comparative simplicity. It runs on Linux, MacOS, and Windows.

- Keras is used for creating deep models which can be productized on smartphones.
- Keras is also used for distributed training of deep learning models.
- Keras is also extensively used in deep learning competitions to create and deploy working models, which are fast in a short amount of time.

Keras prioritizes developer experience. This ease of use does not come at the cost of reduced flexibility: because Keras integrates deeply with low-level TensorFlow functionality enables you to develop highly hackable workflows where any piece of functionality can be customized.

Keras models can be easily deployed across a greater range of platforms than any other deep learning API.

## Merits and Demerits

Merits

- User-Friendly and Fast Deployment
- Quality Documentation and Large Community Support

- Multiple Backend and Modularity
- Pretrained models
- Multiple GPU Support

Demerits

- Problems in low-level API: Sometimes you get low-level backend errors continuously and it becomes very irritating. It does not allow to modify much about its backend. Error logs are difficult to debug.
- Need improvement in some features: It is not so good to build some basic machine learning algorithms like clustering and PCM (principal component analysis). It does not have features of dynamic chart creation as well.
- Slower than its backend: Sometimes it is slow on GPU and takes a longer time in computation compared with its backends

# 8) Accord.Net

The Accord.NET Framework is a .NET machine learning framework combined with audio and image processing libraries completely written in C#. It is a complete framework for building production-grade computer vision, computer audition, signal processing, and statistics applications even for commercial use. A comprehensive set of sample applications provide a fast start to get up and running quickly, and extensive documentation and wiki help fill in the details.

## Scope

It is just like all of the other libraries can be used for a lot of models and things, below are a few of them. The best part of this is that it is available for C# and hence can be used for any C# based applications, rather than having to worry about integrating python-based libraries.

- Classification.
- Regression.

- Clustering.
- Distributions.
- Hypothesis Tests.
- Kernel Methods.
- Imaging.
- Audio and Signal.
- Vision.

## Merits and Demerits

Merits

- The Accord.NET Framework layout is excellent.
- It helps people follow up with interest promptly.
- The performance of the Accord.NET Framework is good as of now.
- Accord.NET Framework Support is excellent and useful.
- The best use case is for C# developers and hence it is better than others in this regard.

Demerits

- It is constrained to the environment of .NET and this makes it difficult to use it in any other place.
- Vendor lock-in
  It's an unfortunate fact that since the .NET bundle is under Microsoft, any changes or limitations that the company might impose will inevitably impact projects done under the framework. This means that developers will have less control
- Licensing cost
  Many aspects of the .NET family will cost money in terms of licensing fees and they can stack up. The more demanding the project, the more expensive it can get. For example, Visual Studio can cost a whopping $539.00 for one year.

# 9) MediaPipe

Mediapipe is an open-source framework to "build word-class machine learning solutions" by Google — currently in the alpha stage. It has been open-sourced for a year now but has likely been under development for far longer. A key "selling" point

(it's free) of Mediapipe is that the code is written in c++, but it can easily be deployed to any platform, from web assembly to Android to MacOS.

## Scope

MediaPipe offers open-source cross-platform, customizable ML solutions for live and streaming media.

- Face Detection
  Ultra-lightweight face detector with 6 landmarks and multi-face support
- Face Mesh
  468 face landmarks in 3D with multi-face support.
- Iris
- Hands
  21 Landmarks in 3D with multi-hand support, based on high-performance palm detection and hand landmark model
- Pose
  High-fidelity human body poses tracking, inferring up to 33 3D body landmarks from RGB frames.
- Selfie Segmentation
  Provides segmentation masks for prominent humans in the scene.
- Hair Segmentation
  Super realistic real-time hair recoloring
- Object Detection
  Detection and tracking of objects in the video in a single pipeline
- Holistic
  A combination of more than one of these available solutions.

## Merits and Demerits

Merits

- MediaPipe is Fast
  MediaPipe is able to achieve its speed thanks to the use of GPU acceleration and multi-threading. The multi-threading and GPU acceleration allow newer phones to run away with frames, often being at FPS too high to see with the human eye.
- Mediapipe is Modular and Reusable

Mediapipe's use of graphs, subgraphs, and calculators means that the work of one project can easily translate to the work of another. Combine that with side packets and you can really tweak the parameters of each calculator to fit different projects.

- Mediapipe Doesn't Care about your Deployment Platform
  Multi-platform support can be a great task for a small development team and that's talking about Windows, Mac, and Ubuntu support.

Demerits

- MediaPipe is Confusing
  The problem with MediaPipe is the lack of documentation. MediaPipe's "documentation" is a website that talks about its concepts at a high level and are an extremely simple code example. To really understand MediaPipe, a developer has to dive into the MediaPipe example source code. Having a c++ linter in that scenario is a requirement.
- MediaPipe is in Alpha
  This leads to the ultimate problem, that because MediaPipe is still in early development, many core features may still be subject to change. It is written on the GitHub page that "we may be still making breaking API changes and expect to get to stable APIs by v1.0."