Python - Application Areas

Python is a general-purpose programming language. It is suitable for the development of a wide range of software applications. Over the last few years Python has been the preferred language of choice for developers in the following application areas −

- Data Science
- Machine Learning
- Web Development
- Computer Vision and Image processing
- Embedded Systems and IoT
- Job Scheduling and Automation
- Desktop GUI Applications
- Console-based Applications
- CAD Applications
- Game Development

Let's look into these application areas in more detail:

Data Science

Python's recent meteoric rise in the popularity charts is largely due to its Data science libraries. Python has become an essential skill for data scientists. Today, real time web applications, mobile applications and other devices generate huge amount of data. Python's data science libraries help companies generate business insights from this data.

Libraries like NumPy, Pandas, and Matplotlib are extensively used to apply mathematical algorithms to the data and generate visualizations. Commercial and community Python distributions like Anaconda and ActiveState bundle all the essential libraries required for data science.

Machine Learning

Python libraries such as Scikit-learn and TensorFlow help in building models for prediction of trends like customer satisfaction, projected values of stocks etc. based upon the past data. Machine learning applications include (but not restricted to) medical diagnosis, statistical arbitrage, basket analysis, sales prediction etc.

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Web Development

Python's web frameworks facilitate rapid web application development. Django, Pyramid, Flask are very popular among the web developer community. etc. make it very easy to develop and deploy simple as well as complex web applications.

Latest versions of Python provide asynchronous programming support. Modern web frameworks leverage this feature to develop fast and high performance web apps and APIs.

Computer Vision and Image processing

OpenCV is a widely popular library for capturing and processing images. Image processing algorithms extract information from images, reconstruct image and video data. Computer Vision uses image processing for face detection and pattern recognition. OpenCV is a C++ library. Its Python port is extensively used because of its rapid development feature.

Some of the application areas of computer vision are robotics, industrial surveillance, automation, and biometrics etc.

Embedded Systems and IoT

Micropython (https://micropython.org/), a lightweight version especially for microcontrollers like Arduino. Many automation products, robotics, IoT, and kiosk applications are built around Arduino and programmed with Micropython. Raspberry Pi is also very popular alow cost single board computer used for these type of applications.

Job Scheduling and Automation

Python found one of its first applications in automating CRON (Command Run ON) jobs. Certain tasks like periodic data backups, can be written in Python scripts scheduled to be invoked automatically by operating system scheduler.

Many software products like Maya embed Python API for writing automation scripts (something similar to Excel micros).

Desktop GUI Applications

Python is a great option for building ergonomic, attractive, and user-friendly desktop GUI applications. Several graphics libraries, though built in C/C++, have been ported to Python. The popular Qt graphics toolkit is available as a PyQt package in Python. Similarly, WxWidgets has been ported to Python as WxPython. Python's built-in GUI package, TKinter is a Python interface to the Tk Graphics toolkit.

Here is a select list of Python GUI libraries:

- **Tkinter** − Tkinter is the Python interface to the Tk GUI toolkit shipped with Python's standard library.

- **wxPython** − This is the Python interface for the wxWidgets GUI toolkit. BitTorrent Client application has been built with wxPython functionality.

- **PyQt** – Qt is one of the most popular GUI toolkits. It has been ported to Python as a PyQt5 package. Notable desktop GUI apps that use PyQt include QGIS, Spyder IDE, Calibre Ebook Manager, etc.

- **PyGTK** − PyGTK is a set of wrappers written in Python and C for GTK + GUI library. The complete PyGTK tutorial is available here.

- **PySimpleGUI** − PySimpleGui is an open-source, cross-platform GUI library for Python. It aims to provide a uniform API for creating desktop GUIs based on Python's Tkinter, PySide, and WxPython toolkits.

- **Jython** − Jython is a Python port for Java, which gives Python scripts seamless access to the Java GUI libraries on the local machine.

Console-based Applications

Python is often employed to build CLI (command-line interface) applications. Such scripts can be used to run scheduled CRON jobs such as taking database backups etc. There are many Python libraries that parse the command line arguments. The argparse library comes bundled with Python's standard library. You can use Click (part of Flask framework) and Typer (included in FastAPI framework) to build console interfaces to the web-based applications built by the respective frameworks. Textual is a rapid development framework to build apps that run inside a terminal as well as browsers.

CAD Applications

CAD engineers can take advantage of Python's versatility to automate repetitive tasks such as drawing shapes and generating reports.

Autodesk Fusion 360 is a popular CAD software, which has a Python API that allows users to automate tasks and create custom tools. Similarly, SolidWorks has a built-in Python shell that allows users to run Python scripts inside the software.

CATIA is another very popular CAD software. Along with a VBScript, certain third-party Python libraries that can be used to control CATIA.

Game Development

Some popular gaming apps have been built with Python. Examples include BattleField2, The Sims 4, World of Tanks, Pirates of the Caribbean, and more. These apps are built with one of the following Python libraries.

Pygame is one of the most popular Python libraries used to build engaging computer games. Pygame is an open-source Python library for making multimedia applications like games built on top of the excellent SDL library. It is a cross-platform library, which means you can build a game that can run on any operating system platform.

Another library Kivy is also widely used to build desktop as well as mobile-based games. Kivy has a multi-touch interface. It is an open-source and cross-platform Python library for rapid development of game applications. Kivy runs on Linux, Windows, OS X, Android, iOS, and Raspberry Pi.

PyKyra library is based on both SDL (Software and Documentation Localisation) and the Kyra engine. It is one of the fastest game development frameworks. PyKyra supports MPEG , MP3, Ogg Vorbis, Wav, etc., multimedia formats.