Introduction

Python Programming

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Most of the slides are available on Senseable AI Lab homepage: https://sailab.space/courses/

Contents

- 1. Getting started with Python
- 2. Python development environment settings

1. Getting started with python

- Program
 - a sequence of instructions that specifies how to perform a computation
 - computation
 - something mathematical
 - e.g., solving equations or finding the roots of a polynomial
 - can also be a symbolic computation
 - e.g., searching and replacing text in a document or something graphical
 - processing an image or playing a video

- Programming
 - to command the computer to do what a human thinks
 - all the work to create a program and also referred to as "development"

- Programming language
 - a tool to create software (e.g. Excel, League of Legend, etc.) that operates on a computer,

using a language the computer can understand

- Programmer
 - a person who uses programming language to create software or apps (applications)

Programming language

- Over hundreds of types of programming languages
 - widely used languages: C, C++, Java, HTML, PHP, Python, etc.



IEEE Spectrum: The Top Programming Languages 2023

Basic instruction of languages

- The details looks different in different languages, but a few basic instructions appear in just about every language:
 - input: Get data from the keyboard, a file, the network, or some other device
 - output: Display data on the screen, save it in a file, send it over the network, etc.
 - math: Perform basic mathematical operations like addition and multiplication
 - conditional execution: Check for certain conditions and run the appropriate code
 - repetition: Perform some actions repeatedly, usually with some variations



- A popular programming language
 - By Guido van Rossum, released in 1991
 - Supported by C++

- It is used for
 - web development (server-side)
 - software development
 - mathematics
 - system scripting, etc.

Guido van Rossum



2014 31 January 1956 (age 67)^[1] Born The Hague,^[2] Netherlands Nationality Dutch Alma mater University of Amsterdam Occupation(s) Computer programmer, author Employer Microsoft Known for Creating the Python programming language Kim Knapp (m. 2000) Spouse 1[3] Children Award for the Advancement Awards of Free Software (2001) gvanrossum.github.io ₽ Website



What can Python do?

- Can be used on a server to create web applications
- Can be used alongside software to create workflows
- Can connect to database systems; also reading and modifying files
- Can be used to handle big data and perform complex mathematics
- Can based used for rapid prototyping or for production-ready software development

Why Python?

- Works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc.)
- A simple syntax similar with the English language
- Syntax that allow developers to write programs with fewer lines that some other languages
 - Designed for readability
- Runs on an interpreter system
 - Interpreter: code can be executed as soon as it is written; prototyping can be very quick
- Be treated in a procedural way, an object-oriented way or a functional way

- Compiler language
 - Batch translates source code into executable machine code, after which the translated file is executed (Executable files: .exe, .class, etc.)
 - Compile: The process of translating source code into machine code (by compiler)
 - C, C++, Java, etc.
- Interpreter language
 - Reads and executes source code line by line; does not create a separate executable file
 - By interpreter
 - Python, JavaScript, Perl, etc.
 - Execution speed: Compiler language are faster than script languages

Note: compiler language vs. interpreter language

• Interpreter in Python



Why Python?

- Focused on "data analysis" and "artificial intelligence"
 - Provide a variety of data analytic tools and visualization packages





► ■ date=21-03



Good to know

- The most recent major version of Python is Python 3 (in detail, Python 3.XX version)
 - We shall be using in this lecture
 - Python 2.X versions; is still quite popular but not being updated with anything other than security updates

2. Python development env. settings

Development environment setting order

- 1. Virtual environment (Anaconda) setting up
- 2. IDE installation; Python installation and setting
- 3. Connecting to Anaconda virtual environment in VSCode
- 4. Installing packages in Anaconda
- 5. Introduction on various Python programming environment

- What is virtual environment?
 - Used to logically separate different versions/compatibilities of packages among multiple users (or multiple projects), allowing for the construction of projects in different environments within each virtual environment

• Example of Anaconda virtual environment





Virtual environment setting up

- 1. Download Anaconda
 - <u>https://www.anaconda.com/</u>



Virtual environment setting up

- 2. Install Anaconda
 - **** PLEASE CHECK "DESTINATION FOLDER" ****



Virtual environment setting up

- 2 . Install Anaconda
 - **** PLESE CAREFUL OPTIONS ****



Add Anaconda3 to my PATH environment variable 체크 시 git, powershell, cmd와 같은 명령 프롬프트 창에서 anaconda 사용 가능 체크하지 않으면 Windows 시작 메뉴에서만 실행 가능

- 3. Complete
 - Run "Anaconda Navigator" to check if Anaconda is installed successfully
 - Jupyter Notebook is also available for Python programming

O Anaconda3 2023.03-1 (64-b	it) Setup —		O Anaconda Navigator <u>File</u> <u>H</u> elp				-	. o x
 Anaconda3 2023.03-1 (64-b Kondag 	 it) Setup – Completing Anaconda3 2023 (64-bit) Setup Thank you for installing Anaconda Distribution. Here are some helpful tips and resources to get We recommend you bookmark these links so you back to them later. Welcome to Anaconda 	0 × 0.03-1 you started.	Anaconda Navigator Ele Help ANACONI ANACONI Comments Learning Community	All applications on All applications on All applications on DataSpell DataSpell DataSpell is an IDE for exploratory data analysis and procetyping machine learning models. It combines the interactivity of Jupyter notebooks with the intelligent Python and R coding assistance of Pycharm in one user-Friendly environment.	base (root) Channels Ch	JupyterLab JupyterLab 24 3.44 An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.	Upgrade Now Upgrade Now Upgrade Now Upgrade Now Notebook P 6412 Web-based, interactive compu notebook environment. Edit and human-readable docs while describ data analysis.	ting frun sing the
OANACC	Welcome to Anaconda Getting Started with Anaconda Distribution		Anaconda Toelbox Suparcharged Ioodi IntroBooks Click the Toelbox It let on Toelbox It let on Toelbox Toeumentation Documentation Anaconda Blog	Jupper notebooks with the intelligent Python and Roding assistance of PyCharm in one user-friendly environment. Install Powershell Prompt 0.01 Run a Powershell terminal with your current environment From Navigator activated Launch	Lsunch	Lsunch Constraints and a second seco	data analysis. Launch VS Code 1851 Streamlined code editor with supp development operations like deb. task running and version contr Launch	↓ ort for juging. ol.
	< Back Finish	Cancel					Cloud infrastructure	×

IDE installation

• IDE

• Integrated Development Editor



IDE installation

- 1. Download VSCode
 - <u>https://code.visualstudio.com/download</u>

Download Visual Studio Code

Free and built on open source. Integrated Git, debugging and extensions.



Python installation and setting

- 2. Install and run VSCode
- 3. Extension setting in VSCode (Python installation)
 - Various extensions for your development life



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Install

Instal

Python installation and setting

• "Open Folder" → "Add Folder to Workspace…" (Space for handling your source code)



Connecting to Anaconda in VSCode

- Open "Command Prompt": "Terminal" tab → New terminal
 - Provides the various terminal options
 - PowerShell (PS), Git bash, Command Prompt



Connecting to Anaconda in VSCode

- How to create your virtual env. on command prompt
 - conda create –n [ENV_NAME] [OPTS]
 - Set your virtual env. name with options
 - Ex) conda create -- n bj2 python=3.8
 - Proceed ([y]/n)? → ENTER or ENTER after typing y

```
:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>conda create -n bj2 python=3.8
Collecting package metadata (current_repodata.json): done
Solving environment: done
==> WARNING: A newer version of conda exists. <==
 current version: 22.9.0
 latest version: 23.11.0
Please update conda by running
   $ conda update -n base -c defaults conda
## Package Plan ##
 environment location: C:\Users\user\anaconda3\envs\bj2
  added / updated specs:
   - python=3.8
The following packages will be downloaded:
                                           build
   package
   ca-certificates-2023.12.12
                                       haa95532 0
                                                         127 KB
   libffi-3.4.4
                                                         113 KB
                                       hd77b12b 0
   openssl-3.0.12
                                      h2bbff1b_0
                                                         7.4 MB
   pip-23.3.1
                                                         2.8 MB
                                  py38haa95532_0
   python-3.8.18
                                       h1aa4202 0
                                                         20.5 MB
                                  pv38haa95532 0
   setuptools-68.2.2
                                                         933 KB
   wheel-0.41.2
                                  py38haa95532_0
                                                         126 KB
                                                         31.9 MB
                                           Total:
The following NEW packages will be INSTALLED:
                    pkgs/main/win-64::ca-certificates-2023.12.12-haa95532 0 None
 ca-certificates
 libffi
                    pkgs/main/win-64::libffi-3.4.4-hd77b12b 0 None
                    pkgs/main/win-64::openssl-3.0.12-h2bbff1b 0 None
 openssl
                    pkgs/main/win-64::pip-23.3.1-py38haa95532_0 None
 python
                    pkgs/main/win-64::python-3.8.18-h1aa4202_0 None
 setuptools
                    pkgs/main/win-64::setuptools-68.2.2-py38haa95532 0 None
 salite
                    pkgs/main/win-64::sqlite-3.41.2-h2bbff1b 0 None
                    pkgs/main/win-64::vc-14.2-h21ff451_1 None
                    pkgs/main/win-64::vs2015 runtime-14.27.29016-h5e58377 2 None
 vs2015 runtime
 wheel
                    pkgs/main/win-64::wheel-0.41.2-py38haa95532_0 None
Proceed ([y]/n)?
```

Connecting to Anaconda in VSCode

- How to connect to virtual env. on command prompt (Cont'd)
 - Check your virtual env. as follows:

Downloading and Extra	cting Package	25		
wheel-0.41.2	126 KB	. *************************************	1	00%
pip-23.3.1	2.8 MB	***************************************	1	00%
ca-certificates-2023	127 KB	. *************************************	1	00%
python-3.8.18	20.5 MB	*************************************	1	00%
setuptools-68.2.2	933 KB	_	1	00%
openssl-3.0.12	7.4 MB	***************************************	1	00%
libffi-3.4.4	113 KB	. *************************************	1	00%
Preparing transaction:	: done			
Verifying transaction:	: done			
Executing transaction:	: done			
#				
# To activate this env	vironment, us	5e		
#				
# \$ conda activate	e bj2			
#				
# To deactivate an act	tive environm	nent, use		
#				
# \$ conda deactivate				
Retrieving notices:	working	done		

- conda activate [ENV_NAME]
 - Ex) conda activate bj2
- Check appearing [ENV_NAME] at leftmost command line
 - Ex) (bj2) C:₩....

C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>conda activate bj2 (bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>

- Check your Python version
 - Enter python --version on command prompt
 - Current version (for me): Python 3.8.18

(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python --version Python 3.8.18

- *Caution
 - It is a version installed on Anaconda virtual environment
 - Might have different versions if you command in other space (e.g. local)
 - Might be version conflict when running your program out of the virtual env.

C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python --version Python 3.9.13

Installing packages in Anaconda

- How to install packages in Anaconda virtual environment
 - Use "pip" or "conda" command
 - pip install [PKG_NAME] or conda install [PKG_NAME]
 - Ex) pip install jupyter

(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>pip install jupyter Collecting jupyter Downloading jupyter-1.0.0-py2.py3-none-any.whl (2.7 kB) Collecting notebook (from jupyter) Downloading notebook-7.0.6-py3-none-any.whl.metadata (10 kB) Collecting qtconsole (from jupyter) Downloading qtconsole-5.5.1-py3-none-any.whl.metadata (5.1 kB) Collecting jupyter-console (from jupyter) Downloading jupyter_console-6.6.3-py3-none-any.whl (24 kB) Collecting nbconvert (from jupyter) Downloading nbconvert (from jupyter) Downloading nbconvert-7.14.0-py3-none-any.whl.metadata (7.7 kB) Requirement already satisfied: ipykernel in c:\users\user\anaconda3\envs\bi2\lib\site-packages (from jupyter) (6.28.0)

- pip install vs. conda install
 - pip: Package installer for Python; Official packages by Python
 - conda: Part of the Conda package management system; an open-source package management
 - Please be careful about version conflict when you use both of them

Hello, World!

- Create Python file (.py)
 - Type "hello_word.py" in Explorer
 - Please type an extension ".py"
 - Extension related with Python
 - .py : Python source file executable on command prompt
 - .ipynb : Python source code executable on iPython Notebook (Jupyter) (not execution file)
- print("Hello, World!")



Hello, World!

- Execute Python file (.py)
 - Enter the follows on Anaconda virtual env., command prompt
 - python [.py FILE_NAME]
 - Ex) python hello_world.py

(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python hello_world.py Hello, World!

- Interactive window in VSCode
 - Right click on sour code window → Run in Interactive Windows → Run Current File in Interactive Windows
 - Available after Jupyter and ipykernel installation
 - Support the interactive interpreter by Jupyter Notebook (ipykernel)

hello_world.py × hello_world.py		🗢 hello_world.py ×	▷ ~ []] …
1 print("Hell 2	o, WarLd1**) Go to Definition Go to Deparation Go to References Shift+F12 Peek Peek Find All References Shift+Alt+F12 Show Tayle Hierarchy Find All References Charles all Occurrences Charles al	<pre> hello_world.py 1 print("Hello, World!") 2 </pre>	<pre> Interrupt × Clear All ♡ Restart</pre>
	Run in Interactive Window > Run Current File in Interactive Window		
	Run Python Run From Line in Interactive Window Run Selection/Line in Interactive Window Shift+ Commond Belette Crt4-Shift-R	ter	
	Run To Line in Interactive Window		Type 'python' code here and press Shift+Enter to run

- Interactive window in VSCode
 - Good for Python newbie
 - Can see the names, types, values for variables for the current usage
 - But, not provided by programming test (기업 코딩테스트 등)

🗢 hello_world.py ×		≣ Interactive-1 ×
<pre> hello_world.py print("Hello, World!") 2 </pre>		🗆 Interrupt 🗙 Clear All 🍤 Restart 📼 Variables 🎲 Save 💕 Export … 🚊 Python 3.11.2
		Connected to Python 3.11.2
		<pre>✓ print("Hello, World!") …</pre>
		··· Hello, World!
		a = 3
		[2] V 0.0s
		▶ Type 'python' code here and press Shift+Enter to run
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS		^ X
✓ JUPYTER: VARIABLES		
Name 🔺 Type Size	Value	
a int	3	

- Interactive window in VSCode
 - Note.
 - ** Setting of Python interpreter for interactive window



Change kernel for '\Interactive-1.interactive'	
Python 3.11.2 ~\AppData\Local\Programs\Python\Python311\python.exe - Currently Selected	
Select Another Kernel	

÷	Select Another Kernel	
Type to choose a kernel sour	ce	
Python Environments		í
Existing Jupyter Server		

÷	Select a Python Environment	С С
+ Create Python Environment		
★ Python 3.11.2 ~\AppData\Local	\Programs\Python\Python311\python.exe	Recommended
anaconda3 (Python 3.9.13) ~\ana	conda3\python.exe	Conda Env
bj (Python 3.8.16) ~\anaconda3\en	ws\bj\python.exe	

- Google Colab
 - Access <u>https://colab.google/</u> on web browser
 - Available directly from New Notebook for Python programming (no separate installation required)



- Python quickstart on command prompt
 - Enter "python" on command prompt (please on virtual env.)
 - Line by line execution for Python code by interpreter

(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python Python 3.8.18 (default, Sep 11 2023, 13:39:12) [MSC v.1916 64 bit (AMD64)] :: Anaconda, Inc. on win32 Type "help", "copyright", "credits" or "license" for more information. >>>

• Write "Hello, World!" in the command line:

```
(bj2) C:\Users\user\OneDrive - sch.ac.kr\#5 Lecture resource\#3 2024 Spring\#2 파이썬프로그래밍\src>python
Python 3.8.18 (default, Sep 11 2023, 13:39:12) [MSC v.1916 64 bit (AMD64)] :: Anaconda, Inc. on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> print("Hello, World!")
Hello, World!
>>> []
```

Tips

- Check if the current file is saved or not
 - See a "point" next to the file name
 - Let's make file saving (Ctrl+S) a habit



- The importance of "PATH"
 - If the location of the .py file and the location where I am trying to execute the Python file are different, it will not execute
 - My current location: C:₩Users₩user₩LectureSourceGit
 - Python file location: C:₩Users₩user₩#2 파이썬프로그래밍₩src
 - When the location of the .py file and my current path are different
 - \rightarrow Change your current location to where the .py file is located
 - Use the "cd" command → cd [FILE_PATH]
 - Ex) cd ..
 - Move to the previous directory (folder) (.. represent one level up from the current space)
 - Ex) cd C:₩Users₩user₩#2 파이썬프로그래밍₩src
 - Move to the current location of the .py file

Tips

workspace

- When the .py file you are working on does not appear in Explorer, or when you need to add a new ٠ directory for work
 - Right click in Explorer and click "Add Folder to Workspace" to add the desired directory to the



Tips

- Popular shortcuts
 - F1: command palette open
 - Alt + Shift + F: Code clearance (improves readability)





End of slide