UNIVERSITY OF LUCERNE

The ABC of Computational Text Analysis

#6 Introduction to Python in VS Code

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Recap last lecture

- perform a frequency analysis using the command-line 🧮
  - specific words or entire vocabulary
- describe text as pattern using RegEx 🧩
  - literal: `initiative a b c`
  - meta: `. \w \s [0-9] *`
  - power of `.*`

Outline

- enter the shiny world of Python 😎
- get familiar with the editor Visual Studio Code


Python

Python is …

a programming language that is …

- general-purpose

  not specific to any task

- interpreted

  no compiling

- very popular in data science

The most common programming and markup languages

How to learn Programming?

Some inconvenient truths 😰

- programming cannot be learnt in a course alone

  I try to make the **start** as easy as possible!

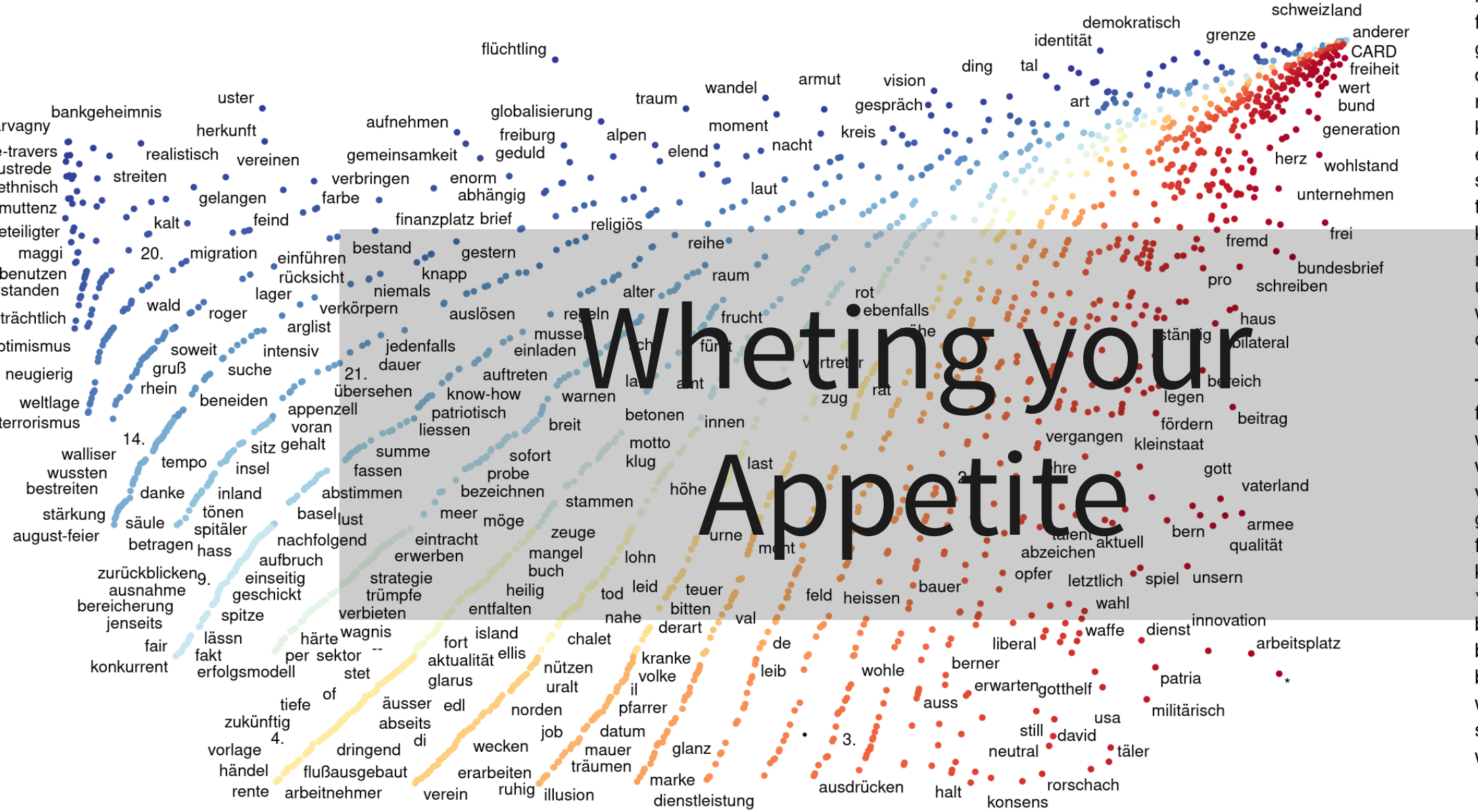
- frustration is part of learning

  fight your way through!

- the Python ecosystem is huge

  grow your skills by step-by-step

Programming can be absolutely captivating! ✌️



Top SP

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Programming Concepts & Python Syntax 🧠

Variables

Variables are kind of storage boxes 🎁

```
# define variables
x = "at your service"
y = 2
z = ", most of the time."

# combine variables
result_matmul = y * y       # for numbers any mathematical operation
text = x + z       # for text only concatenation with +

# show content of variable
print(text)
```

Data types

The type defines the object's properties

Name	What for?	Type	Examples
String	Text	str	`"Hi!"`
Integer, Float	Numbers	int, float	`20`, `4.5`
Boolean	Truth values	bool	`True`, `False`
⋮	⋮	⋮	⋮
List	List of items	list	`["Good", "afternoon", "everybody"]`
Dictionary	Relations of items	dict	`{"a":1, "b": 2, "c": 3}`

Converting data types

Combine variables of the same type only

```
# check the type
type(your_variable)

# convert types (similar for other types)
int("100")  # convert a string to integer
str(100)    # convert an integer to string
str(your_variable) # convert anything to string

# easiest way to use any variable in a text
x = 3
mixed = f"x has the value: {x}"
print(mixed)
```

Confusing equal-sign

= vs. == contradicts the intuition

```
# assign a value to a variable
x = 1
word = "Test"

# compare two values if they are identical
1 == 2              # False
word == "Test"      # True
```

Comments

- lines ignored by Python
- write comments, **documentation helps you**… 
    - to learn initially
    - to understand later

```
# single line comment as documentation

"""
comment across
multiple
lines
"""
```

Visual Studio Code

The (best) editor for programming in Python

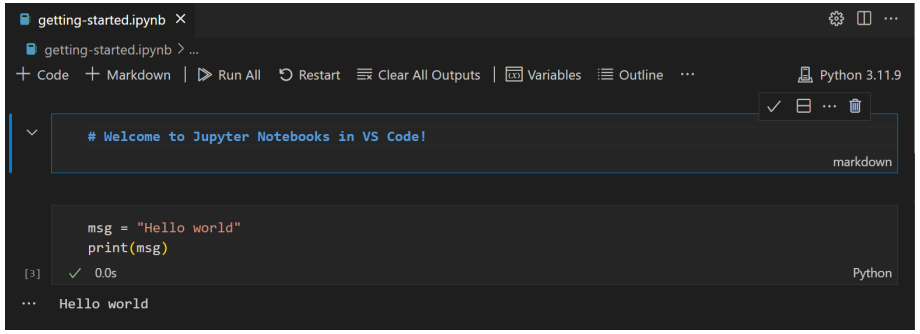
- VS Code features
  - interactive programming
  - integrated development environment (IDE)
  - similar to RStudio
- use `tab` for autocompletion

Visual Studio Code

Where to write Python code?

Write code (and text) in a single document

- file formats for writing Python code:
  - pure Python scripts: `.py`
  - Jupyter Notebooks: `.ipynb`
- `ipynb` is similar to R Markdown
- see also explainer for usage in VS Code



Jupyter Notebooks use cells that can be executed individually

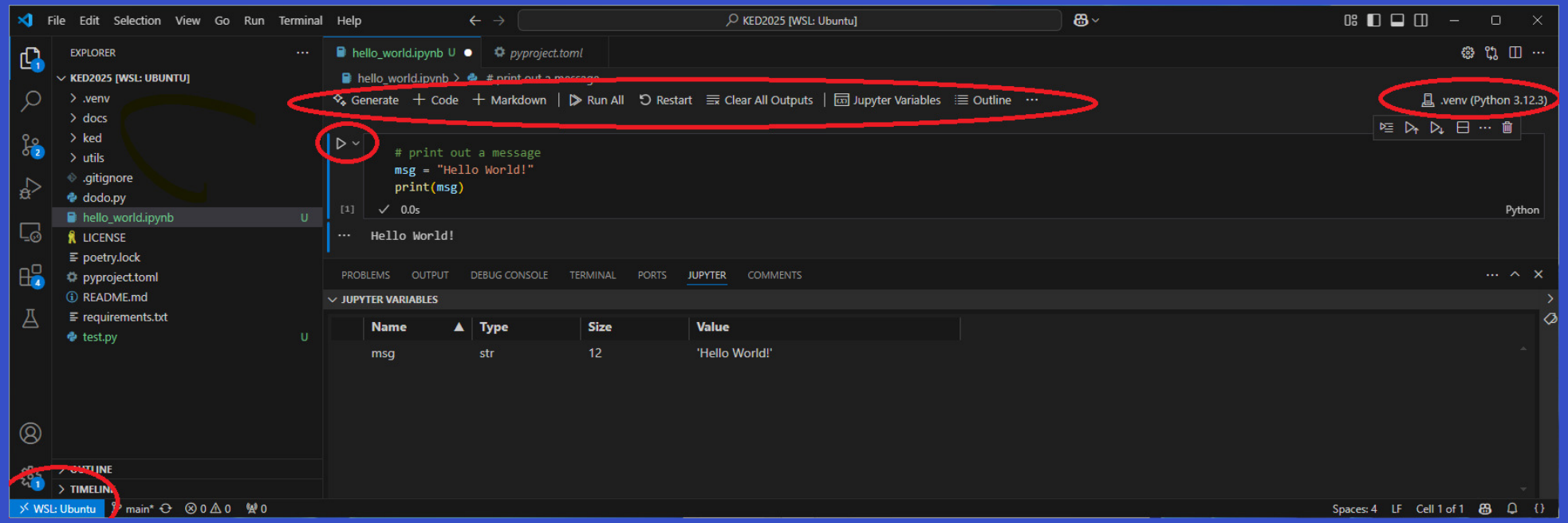
In-class: Get started in VS Code

1. *Windows user only*: Make sure that you are connected to `WSL: Ubuntu` (blue badge in lower-left corner). If not, click on the badge and select `New WSL Window`.
2. Open `KED2025` via menu `File > Open Folder`.
3. Load Python environment `.venv`.
4. Create notebook via menu `File > New File > Jupyter Notebook`.
5. Run code with ▶️ left to the cell or with CTRL+Enter.

   output shows below cell
6. Check out the control bar for global actions at the top.

How it should look like

The output “Hello World!” should look like in the screenshot below.



In-class: Run your first Python program

1. Follow the steps described on the slide `Get started in VS Code`.
2. Create a new file `Jupyter Notebook` with the following content, save it as `hello_world.ipynb` in the `KED2025` folder. Then, run the code.

```
# print out a message
msg = "Hello World!"
print(msg)
```

3. Does the output looks like in the screenshot on the previous slide? If the execution doesn't work as expected, ask your neighbour or me. There might be a technical issue.
4. When you are done already, you can experiment with the data types that we have discussed.

Iterations

for-loop

do something with each element of a collection

```
sentence = ["This", "is", "a", "sentence"]

# iterate over each element
for token in sentence:

    # do something with the element
    print(token)
```

Conditionals

if-else statement

condition an action on variable content

```
sentence = ["This", "is", "a", "sentence"]

if len(sentence) < 3:
    print("This sentence is shorter than 3 tokens")

elif len(sentence) == 3:
    print("This sentence has exactly 3 tokens")

else:
    print("This sentence is longer than 3 tokens")
```

Indentation matters!

- indent code within code blocks

  loops, if-statements etc.

- press `tab` to indent (`shift + tab` to unindent)

✅

```
if 5 > 2:
    print("5 is greater than 2")
```

❌

```
if 5 > 2:
print("5 is greater than 2")
```

Methods: Create new objects

Build your world! 🌍

```
sentence = "This is a sentence"

# split at whitespace and save result in new variable
tokens = sentence.split(" ")

# check the content and type variables
print(sentence, type(sentence), tokens, type(tokens))
```

Methods: Change objects

Depending on the object, you can do different things 🛠️

```
# add something to a list
tokens.append(".")

# concatenate elements to string
tokens = " ".join(tokens)
print(tokens, type(tokens))
```

Functions and arguments

DRY: Don’t Repeat Yourself

- functions have a name and optional arguments

  `function_name(arg1, ..., argn)`

  predefined functions: `print()` `len()` `sorted()` `...`

```
def get_word_properties(word): # define function
    """
    Print properties for a word and return its length.
    """
    length = len(word)
    sorted_letters = sorted(word, reverse=True)
    print(f"{word} has {length} letters: {sorted_letters}".)

    return length # optional return value

word_length = get_word_properties("computer") # call function
```

Indexing

Computers start counting from zero! 😵

```
sentence = ["This", "is", "a", "sentence"]

# element at position X
first_tok = sentence[0]     # "This"

# elements of subsequence [start:end]
sub_seq = sentence[0:3]     # ["This", "is", "a"]

# elements of subsequence backwards
sub_seq_back = sentence[-2:]        # ["a", "sentence"]
```

Errors

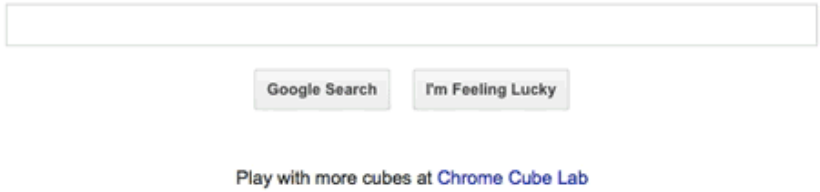
A myriad of things can go wrong 🤦

1. check the underlined (i.e., erroneous) code
2. read the error message
3. find the source of the error

    line number given in code

4. paste error into Google or a chatbot
5. restart interactive environment

    you may have left-over variables defined



Learning by doing, doing by googling

Modules/Packages

No programming from scratch 🎉

- packages provide more objects and functions
- packages need to be installed additionally

```
# import third-party package
import pandas
import spacy
import plotnine
```

In-class: Exercises I

1. Open the Jupyter Notebook with the basics of Python in your Visual Studio Editor: `KED2025/ked/materials/code/python_basics.ipynb`
2. Try to understand the code in each cell and run them by clicking the play symbol left to them. Check the output. Modify some code and data to see how the output changes. Initially, this try-and-error is good strategy to learn. Some more ideas:

    Combine a string and an integer variable without converting it. What error do you get? How can you avoid it?

    Select the two words `is a` from the variable `sentence` using indexing.

In-class: Exercises II

1. Write Python code that
    - takes a text (a string)
    - splits it into words (a list)
    - iterates over all the tokens and print all tokens that are longer than 5 characters
    - Bonus: wrap your code in a function.
2. Go to the next slide. Start with some of the great interactive exercises out there in the web.

Resources

Get more explanations

- Google's Python Class
- Introduction of Python for Social Scientists (Walsh 2021)
- Official Python introduction

Learn basics interactively

- Introduction to Python by IBM Cognitive Class
- LearnPython


Questions?

References

Walsh, Melanie. 2021. “Introduction to Cultural Analytics & Python.” Zenodo. https://doi.org/10.5281/ZENODO.4411250.