TUTORIAL 9: ADVANCED USES OF LLMS & PYTHON PACKAGES

Creating Business Value with Generative AI
Fall 2025

AARHUS BSS
DEPARTMENT OF MANAGEMENT
AARHUS UNIVERSITY

31. October and 3. November 2025

Magnus Bender
Assistant Professor

TODAY'S TUTORIAL

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   - There is a partly implemented pipeline in a notebook
   - There is a GUI using (importing) your pipeline from the notebook
   - Code examples for text chunking and text extraction from PDFs

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2. Implement a RAG-pipeline on your own
   - There is a partly implemented pipeline in a notebook
   - There is a GUI using (importing) your pipeline from the notebook
   - Code examples for text chunking and text extraction from PDFs
3. Use RAG for your project (*optional*)

PYTHON PACKAGES

- Why we need them
- How to manage them
- Practice in uCloud

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IMPORT CUSTOM MODULES

example_import.py

```python
def hello():
  print("Hello World!")

def bye():
  print("Bye!")

VARIABLE = False
```

IMPORT CUSTOM MODULES

name.py

```
import example_import

print(example_import)
print(example_import.bye, example_import.hello)

print(example_import.VARIABLE)
example_import.bye()
example_import.hello()
```

example_import.py

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- Create two files: `example_import.py` and `name.py`

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<module 'example_import' from './example_import.py'>
<function bye at 0x100be7760>
                    <function hello at 0x100be6200>
```

- Create two files: `example_import.py` and `name.py`
- Import `example_import` in `name.py`
  - `example_import` becomes a module

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Bye!
Hello World!
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MORE IMPORT STATEMENTS

example_import.py

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name.py

```
import example_import
from example_import import hello

print(example_import.hello)
print(hello)
hello()
```

```
<function hello at 0x100be6200>
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import sys, time

from example_import import *

import example_import as ei
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Import a name from a module

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```

The same function, but two ways to access it.

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Import two modules with one import statement

MORE IMPORT STATEMENTS

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Import all variables, classes, and fuctions from a module

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Import with a different name, use `ei.<name>`

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    - Possible to search there for relevant packages
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    - We introduced you to some useful packages

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    - We introduced you to some useful packages
- Modules may be self-created, custom modules
  - Easy way: Place multiple Python files in same directory and use `import <file name>`

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`requirements.txt`

```
requests
tqdm
pdoc

pydantic
nicegui

nltk
numpy
scipy
scikit-learn

openai
ipykernel

pdfminer.six
```

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    - `pip list`
    - `pip install <package name>`

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    - Anyone can publish packages, they may be buggy, not well documented, ...
    - E.g.: Search the web for the name or ask ChatGPT about it

IMPLEMENTATION OF A RAG PIPELINE

- Step by step in a notebook
- Use the notebook with NiceGUI
- RAG pipelines in practice

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    `if __name__ == "__main__": …`
- After you implemented all `TODO`s in the notebook and tested in the notebook, you may run the `gui.py`
  - It contains a simple NiceGUI application running your RAG-pipline from `rag.ipynb`:
    `from rag import category_list, answer_with_rag`

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    `from rag import category_list, answer_with_rag`
- I will upload a `rag_solution.ipynb` later

SOME INSPIRATION

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```
json.loads(row['key'])

messages.append({"role": "","content": ""})

response = client.chat.completions.create(
  model="gpt-5-nano",
  messages=[]
)
response.choices[0].message.content


if categories is None or row['key'] in categories:
```

```
rows.append(row)

categories = set()

with open(file_name, 'r') as f:
  reader = DictReader(f)

client.embeddings.create(
  model="..."
)

if i > top_k:
  break
```

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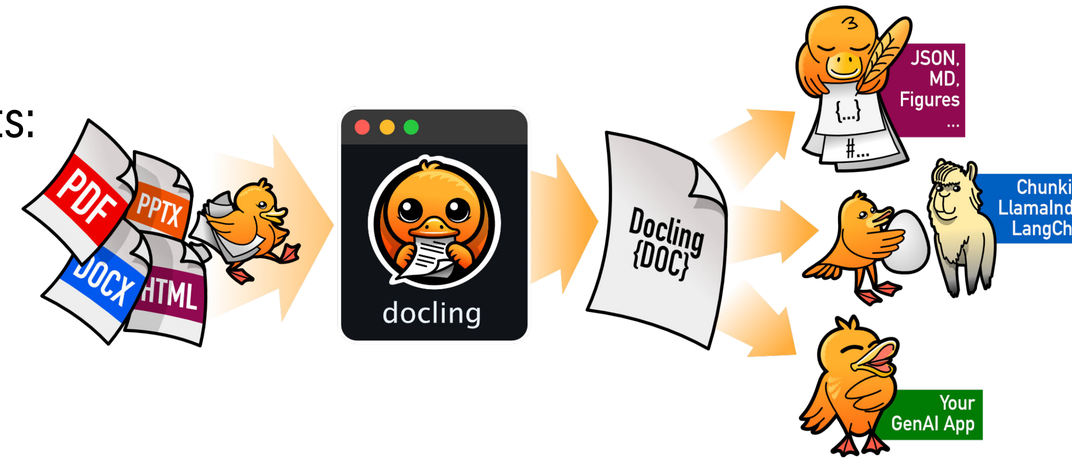
- In case of more complex text extractions or other file formats:
  - Take a look at `docling`



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- In case of more complex text extractions or other file formats:
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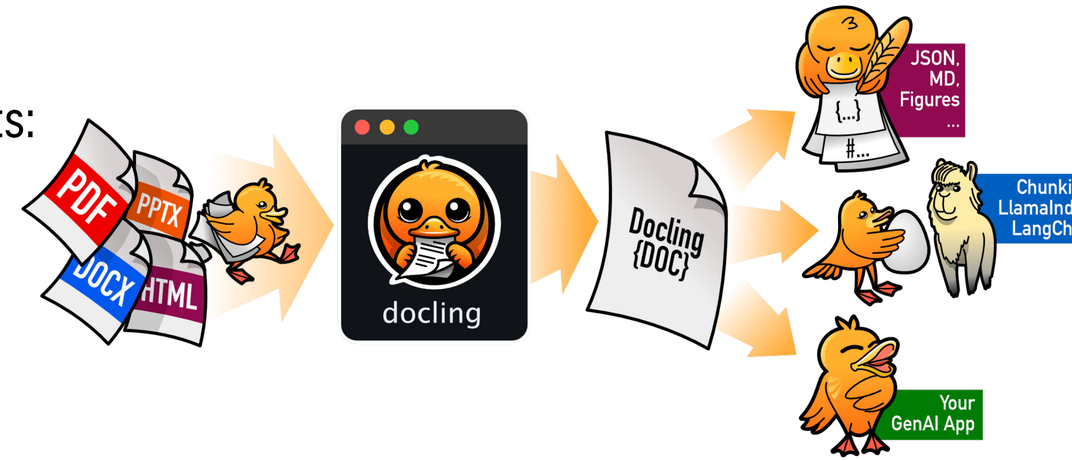
  - It is slightly more complex, but much more powerful
  - It may require more resources



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CHUNK TEXTS

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```
full_text = "...."
chunk_size = 150

chunks = []
for i in range(0, len(full_text), chunk_size):
  print(i, i+chunk_size)
  chunks.append(full_text[i:i+chunk_size])
```

CHUNK TEXTS

- Simple Python code to create chunks of a long string

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- Simple Python code to create chunks of a long string
  - Set a chunk size

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  - Create a list for the chunks

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```
0 150
150 300
300 450
450 600
600 750
750 900
900 1050
1050 1200
1200 1350
1350 1500
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  - Iterate from 0 to length of the full text with the step size of chunk size
  - Use string slicing (same as with lists) to get each chunk
    - First chunk is substring from character 0 to 149
    - Next 150 to 299
    - ...

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EMBEDDINGS AND RETRIEVAL IN PRACTICE: CHROMA DB

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from pathlib import Path
import chromadb # first: pip install chromadb
import chromadb.utils.embedding_functions as embedding_functions
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```
from pathlib import Path
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chroma_client = chromadb.PersistentClient(path=Path(__file__).parent/"chroma")
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{'ids': [['id1']], 'embeddings': None, 'documents': [['This is a
document about pineapple']], 'uris': None, 'included': ['metadatas',
'documents', 'distances'], 'data': None, 'metadatas': [[None]],
'distances': [[0.9091699719429016]]}
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EMBEDDINGS AND RETRIEVAL IN PRACTICE: CHROMA DB

- Will take care of storing the documents and embeddings on disk
- Will call the OpenAI API and retrieve the most similar documents based in embeddings
- Source code available on uCloud!

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DEPARTMENT OF MANAGEMENT
AARHUS UNIVERSITY