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Jupyter Notebooks for Linguists

Introduction to NLP FLAIR with Jupyter

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Jupyter notebooks

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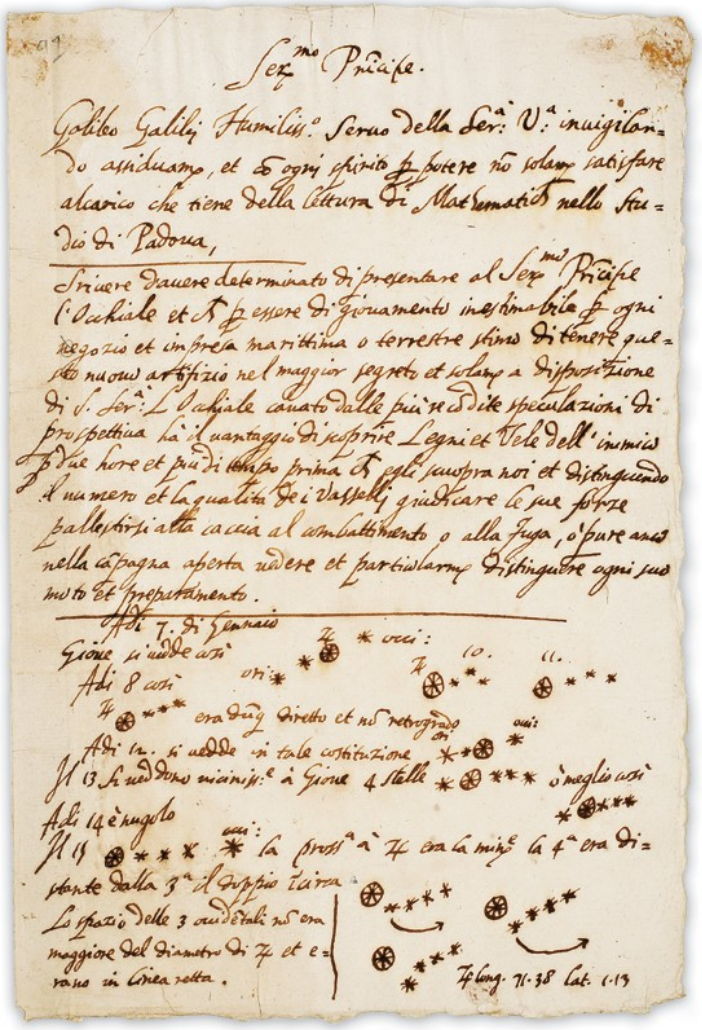
- Invented in 2014 by Fernando Pérez and Brian Granger starting with Julia, Python and R. - Now supporting 137 different kernels (runtime environments, programming languages)
- Inspired by Galileo's famous notebooks recording the discovery of the moons of Jupiter
- Describing text passages and scientific calculations/sketches are mixed in one document allowing a high transparency/documentation of the scientific approach
- This idea of a mixed scientific document is transferred into cloud computing with the possibility of interactive parallel work on the same resources within a browser
- Jupyter notebooks are running on a server: Starting programming works out of the box. There is no installation needed on your device.
- Servers are sometimes providing very fast GPU/TPU calculations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Jupyter notebooks – introduction

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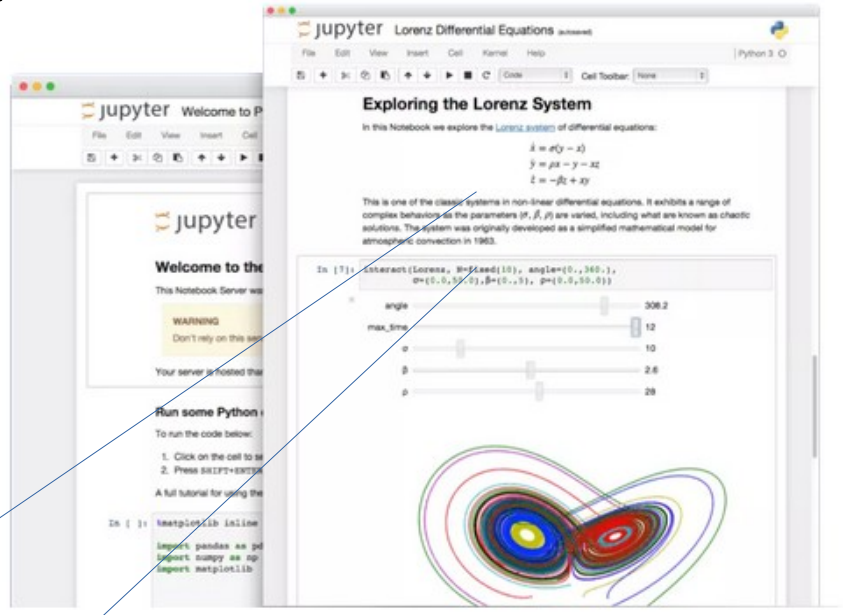
- Can be installed on your own server (or local device). But most commonly used in a maintained cloud environment, like:
  - Google Colaboratory (we will use this service)
  - Kaggle.com
  - Upcoming Jupyter-Hub at hu-berlin.de
- Jupyter-Notebook-Documents (*.ipynb) are stored
- in JSON-format on the server
  - → Every file has to be uploaded
- Two different types of sections:
  - A.) Formatted text sections: Markdown or LaTeX
  - B.) Interactive code sections: Python (and many others)
- Code is executed either entirely or section by section (input sections and output sections; values of variables are stored!)



Jupyter notebooks – introduction

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- Jupyter notebooks are offering a new way of social coding (entirely open-source)
- Scientists can work together with same computing environment, testing code together, data input and results
- 3rd party modules have to be installed with pip (in a code section) like in a local installation. Example:
  - ***!pip install flair***
  - → Everything needed to run a notebook is by definition part of the document (no hidden secrets behind)
    - Whole working environment can be stored (as documentation) in a docker-image (virtual machine):
  - → Results can be reproduced anytime/anywhere with same libs/configuration/code etc.
- → ***Let's start with a first notebook document and install flair on google colab!***

Jupyter notebooks – hands on!

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- You can either work on your own or start a new notebook with someone else
  - → You can share documents in real time with Google Colab
- We will work in the same document the whole course: Let's start with a text section in markdown and produce some formatted text, like a headline and description of our project
- We want to explore Jupyter notebooks with Google Colab by:
  - Uploading a text-file (very small corpus) to Google Colab
  - Reading the content of the file with Python and store it to variable

What is FLAIR?

- A very simple framework for state-of-the-art NLP. Developed by Humboldt University of Berlin and Zalando.
- ***Flair supports:***
- Named entity recognition (NER)
- Part-of-speech tagging (PoS)
- Sense disambiguation and classification
- A growing number of languages
- Text/word embeddings
- Sequence labeling, text classification, similarity learning and text regression
- And much more!

Working with FLAIR

- **What we want today:**

- Read our text file with the FLAIR library
- Perform a POS-tagging on our text
- Perform a NER-tagging on our text
- Optionally perform a semantic frame detection (or search for offensive language)
- Save the results to an excel-sheet (you will need to construct nested cells if you have spans!)
- → You have to work with python documentation, flair documentation and openpyxl documentation

Levels of tagging in flair

- Tagging a whole text
- Tagging a whole sentence
- Tagging spans (ex. NER tagging) “George Washington”
- Tagging tokens (ex. POS tagging)

Solution of the exercise

```
from flair.models import MultiTagger
from flair.data import Sentence
from openpyxl import Workbook


file = open("merkel_interview.txt", "r")
content = file.read()

wb = Workbook()
ws = wb.create_sheet("merkel_interview", 0)

# Header in row 1 columns A,B,C,D,E
ws.append(['TEXT','POS','SCORE','NER','SCORE'])

tagger = MultiTagger.load(['de-ner', 'de-pos'])
sentence = Sentence(content)
tagger.predict(sentence)

for token in sentence:
    label = token.get_label("de-pos")
    txt = token.text
    pos = label.value
    score = label.score
    # POS tagging values beginning at row #2 columns A,B,C
    ws.append([txt,pos,score]);
```

Solution of the exercise 2

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flair

```
# values for ner-tagging are going in column D and E
# Still looking for a better solution than the one below. I'am sorry. This is not beautiful ;-)

for span in sentence.get_spans('de-ner'):

    txt = str(span) # String looks like this: Span[17:19]: "Wiebke Hollersen" → PER (0.9998)
    txt = txt[txt.index('[')+1:txt.index(']')] # we cut everything out within the square brackets
    txt = txt.split(":") # and we get the numbers of the index
    start = int(txt[0])+2 # sheet starts at row #2 because of header. Index of flair starts at 0
    end = int(txt[1])+1 # end position only +1

    ws['D' + str(start)] = span.tag # put values in fields for NER-data
    ws['E' + str(start)] = span.score

    if((end - start) > 0): # NER tagging is a span > token (only one row)
        # we have to merge the cells
        ws.merge_cells('D' + str(start) + ':D' + str(end))
        ws.merge_cells('E' + str(start) + ':E' + str(end))

wb.save('merkel_interview.xlsx')
```

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zalando research

Solution of the exercise 3

Resulting Excel-Sheet with merged cells looks like this:

TEXT	POS	SCORE	NER	SCORE
Angela	NE	0,999997		
Merkel	NE	0,999994	PER	0,999817
:	$.	0,999997		
Sie	PPER	0,999997		
sprach	VVFIN	0,999999		
über	APPR	0,999999		
Putin	NE	0,891732	PER	0,999612
,	$,	1		
den	ART	0,99999		
Krieg	NN	0,999994		
,	$,	1		
aber	KON	0,999842		
nicht	PTKNEG	0,999999		
über	APPR	0,999969		
den	ART	1		
3.	ADJA	1		
Oktober	NN	0,999994		
Wiebke	NE	0,999938		
Hollersen	NE	0,9999	PER	0,999785

Usefull resources

Jupyter

https://jupyter.org/

https://www.datacamp.com/tutorial/tutorial-jupyter-notebook

Flair

https://github.com/flairNLP/flair

We made lessons 1 + 2 of this tutorial
https://github.com/flairNLP/flair/blob/master/resources/docs/TUTORIAL_1_BASICS.md

https://www.informatik.hu-berlin.de/en/forschung-en/gebiete/ml-en/Flair

NLP

https://thomaskrause.github.io/nlp-mit-python/
https://web.stanford.edu/~jurafsky/slp3/