

# Uebung2

July 13, 2024

## 1 Übung 2 Raphael Kropp

### 1.0.1 Dateiinformation

Die Vergleichstests wurden mit der output.wav Datei durchgeführt. Die Datei ist eine Minute lang und verwendet die Frequenzen 42, 420 und 4200.

### 1.0.2 Systeminformation

Die Tests wurden auf einem Notebook mit Intel Core i9 13900HX und einer NVidia GeForce RTX 4070 8GB ausgeführt.

### 1.1 Aufgabe 1 Python

```
[1]: %%python
import os
import sys
sys.path.append(os.path.join(os.path.dirname(__name__), '.'))
sys.path.append(os.path.join(os.path.dirname(__name__), 'A1'))
sys.path.append(os.path.join(os.path.dirname(__name__), 'A3'))
sys.path.append(os.path.join(os.path.dirname(__name__), 'A4'))
```

```
[29699:29718:20240713,220607.597982:ERROR file_io_posix.cc:152] open
/home/rapha/.modular/crashdb/pending/f64c60fc-a6bb-4b01-b84c-bf005bae621b.lock:
File exists (17)
```

### 1.2 Aufgabe 1 Python

```
[2]: %%python
from A1 import A1Python

sample_rate, audio_data = A1Python.read_wave_file('./Audios/output.wav')
durationA1Python = A1Python.calculate(audio_data, sample_rate, block_size=256,
    ↪offset=1, threshold=1_000_000)
print(durationA1Python)
```

```
Frequency: 0.00 Hz, Amplitude: 1641160.11
Frequency: 344.53 Hz, Amplitude: 1029072.78
```

Frequency: 4134.38 Hz, Amplitude: 1105567.05  
12.887814998626709

### 1.3 Aufgabe 1 Mojo

```
[3]: import A1.A1Mojo as A1Mojo
from python import Python, PythonObject
from complex import ComplexFloat64

var readwav = Python.import_module("utils.utils")

var input = readwav.read_wave_file('./Audios/output.wav')
var sample_rate = input[0].to_float64()
var data_input = input[1]
var audio = A1Mojo.ndarray_to_complexlist(data_input)

var ampA1 = A1Mojo.amplitude(256 // 2, audio, sample_rate, 256, 1)
var durationA1Mojo = A1Mojo.calculate(ampA1, 256, 1000000)
print(durationA1Mojo)
```

Freq: 0.0 : 1641160.1144910036  
Freq: 344.53125 : 1029072.7470971501  
Freq: 4134.375 : 1105567.0263031418  
241.53051382699999

### 1.4 Aufgabe 3 Python

```
[4]: %%python
from A3 import A3Python

durationA3Python = A3Python.calculate(audio_data, sample_rate, block_size=256,
    ↪offset=1, threshold=1_000_000)
print(durationA3Python)
```

Cores used: 32  
Frequency: 0.00 Hz, Amplitude: 1641159.91  
Frequency: 344.53 Hz, Amplitude: 1029072.75  
Frequency: 4134.38 Hz, Amplitude: 1105567.05  
1.3409686088562012

### 1.5 Aufgabe 3 Mojo

```
[5]: import A3.A3Mojo as A3Mojo

var inputA3 = readwav.read_wave_file('./Audios/output.wav')
var sample_rateA3 = input[0].to_float64()
var data_inputA3 = input[1]
```

```

var audioA3 = A3Mojo.ndarray_to_complexlist(data_input)

var ampA3 = A3Mojo.ParallelFft(audio, sample_rate, 256, 1)
durationA3Mojo = A3Mojo.calculate(ampA3, 1000000)
print(durationA3Mojo)

```

```

Freq: 0.0 : 1640785.186117402
Freq: 344.53125 : 1028808.2432693008
Freq: 4134.375 : 1104513.9779007167
34.077570283999997

```

## 1.6 Aufgabe 4 Python

```

[6]: %%python
from A4 import A4Batch

durationA4Python = A4Batch.calculate(audio_data, sample_rate, block_size=256,
    ↪offset=1, threshold=1_000_000, batch_size=55296)
print(durationA4Python)

```

```

Batchgröße: 55296
Frequency: 0.00 Hz, Amplitude: 1641160.11
Frequency: 344.53 Hz, Amplitude: 1029072.78
Frequency: 4134.38 Hz, Amplitude: 1105567.05
1.3953607082366943

```

```

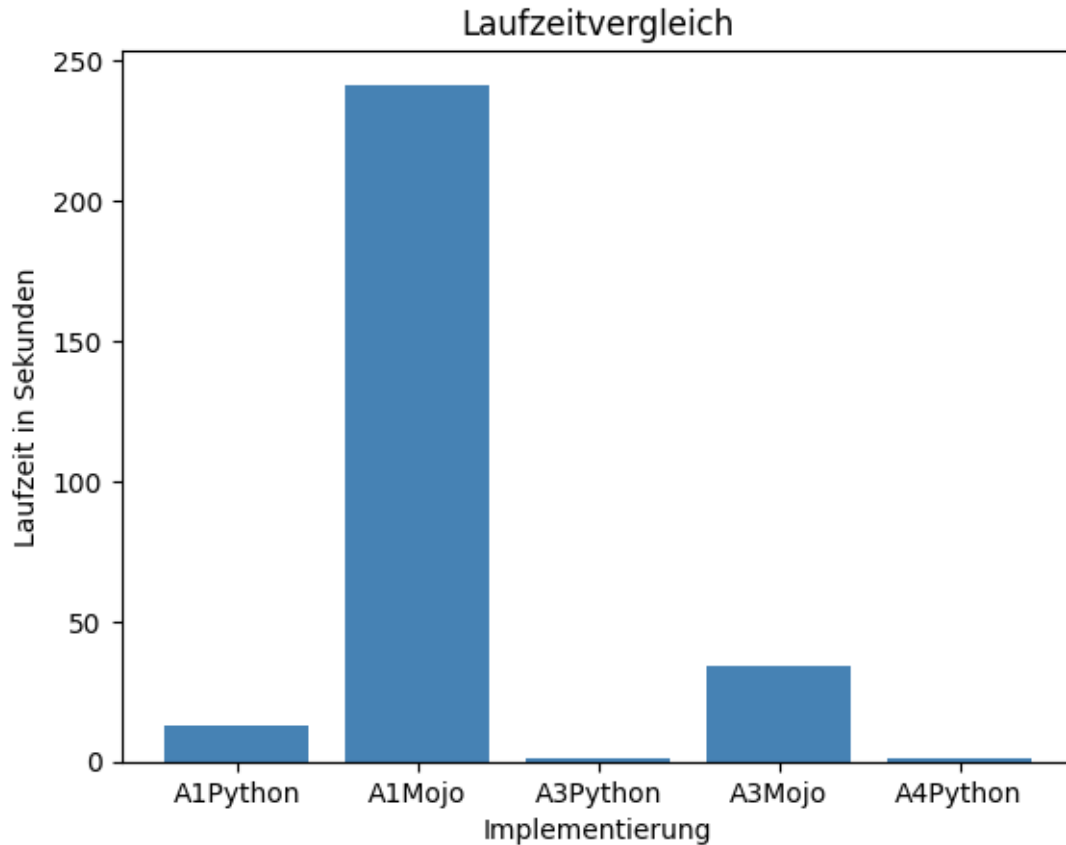
[7]: plt = Python.import_module('matplotlib.pyplot')

var dauer: PyObject = Python.list()
dauer.append(durationA1Python)
dauer.append(durationA1Mojo)
dauer.append(durationA3Python)
dauer.append(durationA3Mojo)
dauer.append(durationA4Python)
var labels: PyObject = Python.list()
labels.append('A1Python')
labels.append('A1Mojo')
labels.append('A3Python')
labels.append('A3Mojo')
labels.append('A4Python')

plt.bar(labels, dauer,color='steelblue')

plt.xlabel('Implementierung')
plt.ylabel('Laufzeit in Sekunden')
plt.title('Laufzeitvergleich')
plt.show()

```



## 1.7 Vergleich zwischen Python A3 und A4

Zum Vergleich der Laufzeiten wurde die Parallel- und Grafikkartenimplementierung auf einer 10 minütigen Audiodatei mit den Frequenzen 42, 420 und 4200 getestet und verglichen.

```
[8]: %%python
print('seriell')
sample_rate, audio_data = A1Python.read_wave_file('./Audios/sound10minutes.wav')
durationA1Python10m = A1Python.calculate(audio_data, sample_rate,
    ↳ block_size=1024, offset=1, threshold=1_000_000)
print(durationA1Python10m, '\n')

print('parallel')
durationA3Python10m = A3Python.calculate(audio_data, sample_rate,
    ↳ block_size=1024, offset=1, threshold=1_000_000)
print(durationA3Python10m, '\n')

print('grafikbeschleunigt')
```

```
durationA4Python10m = A4Batch.calculate(audio_data, sample_rate,
    ↪block_size=1024, offset=1, threshold=1_000_000, batch_size=55296)
print(durationA4Python10m, '\n')
```

seriell

```
Frequency: 43.07 Hz, Amplitude: 5680271.66
Frequency: 387.60 Hz, Amplitude: 1688562.34
Frequency: 430.66 Hz, Amplitude: 5128267.45
Frequency: 473.73 Hz, Amplitude: 1018961.71
Frequency: 4134.38 Hz, Amplitude: 1184162.51
Frequency: 4177.44 Hz, Amplitude: 3444567.31
Frequency: 4220.51 Hz, Amplitude: 3789016.70
Frequency: 4263.57 Hz, Amplitude: 1222348.95
236.25075721740723
```

parallel

```
Cores used: 32
Frequency: 43.07 Hz, Amplitude: 5680271.66
Frequency: 387.60 Hz, Amplitude: 1688562.34
Frequency: 430.66 Hz, Amplitude: 5128267.45
Frequency: 473.73 Hz, Amplitude: 1018961.71
Frequency: 4134.38 Hz, Amplitude: 1184162.51
Frequency: 4177.44 Hz, Amplitude: 3444567.31
Frequency: 4220.51 Hz, Amplitude: 3789016.70
Frequency: 4263.57 Hz, Amplitude: 1222348.95
20.35920810699463
```

grafikbeschleunigt

```
Batchgröße: 55296
Frequency: 43.07 Hz, Amplitude: 5680271.66
Frequency: 387.60 Hz, Amplitude: 1688562.34
Frequency: 430.66 Hz, Amplitude: 5128267.45
Frequency: 473.73 Hz, Amplitude: 1018961.71
Frequency: 4134.38 Hz, Amplitude: 1184162.51
Frequency: 4177.44 Hz, Amplitude: 3444567.31
Frequency: 4220.51 Hz, Amplitude: 3789016.70
Frequency: 4263.57 Hz, Amplitude: 1222348.95
12.682279586791992
```

```
[9]: var dauer10m: PythonObject = Python.list()
dauer10m.append(durationA1Python10m)
dauer10m.append(durationA3Python10m)
dauer10m.append(durationA4Python10m)

var labels10m: PythonObject = Python.list()
labels10m.append('seriell')
```

```

labels10m.append('parallel')
labels10m.append('grafikbeschleunigt')

plt.bar(labels10m, dauer10m, color='steelblue')

plt.xlabel('Implementierung')
plt.ylabel('Laufzeit in Sekunden')
plt.title('Laufzeitvergleich Python 10 min wav')
plt.show()

```

