

Course 3a: Python II



**Geavanceerde concepten
in Python en
programmeren voor
bio-informatica
toepassingen**

Opzet OWE 3a

es	Onderwerp	Theorie	Opgaven
1	<ul style="list-style-type: none"> Review Python I Pseudocode Flowcharts Documenteren en Testen 	H1..8 SowP*	1 Afvinkopdracht
2	<ul style="list-style-type: none"> Graphs Strings 	Matplotlib tutorial H9 More about Strings	2 Afvinkopdracht
3	<ul style="list-style-type: none"> Datastructuren: Dictionaries Sets 	H10 Dictionaries and Sets	3 Afvinkopdracht
4	<ul style="list-style-type: none"> Text and Language Processing Regular Expressions 	H7 DiP **	4 Afvinkopdracht
5	<ul style="list-style-type: none"> Object-Oriented Programming 	H11 Classes and Object-Oriented Programming H12 Inheritance	5 Afvinkopdracht
6	<ul style="list-style-type: none"> Recursion 	H13 Recursion	6 Afvinkopdracht
7	<ul style="list-style-type: none"> GUI Programming 	H14 GUI Programming	Voorbeeld thematotoets

Graphics in Python

Matplotlib

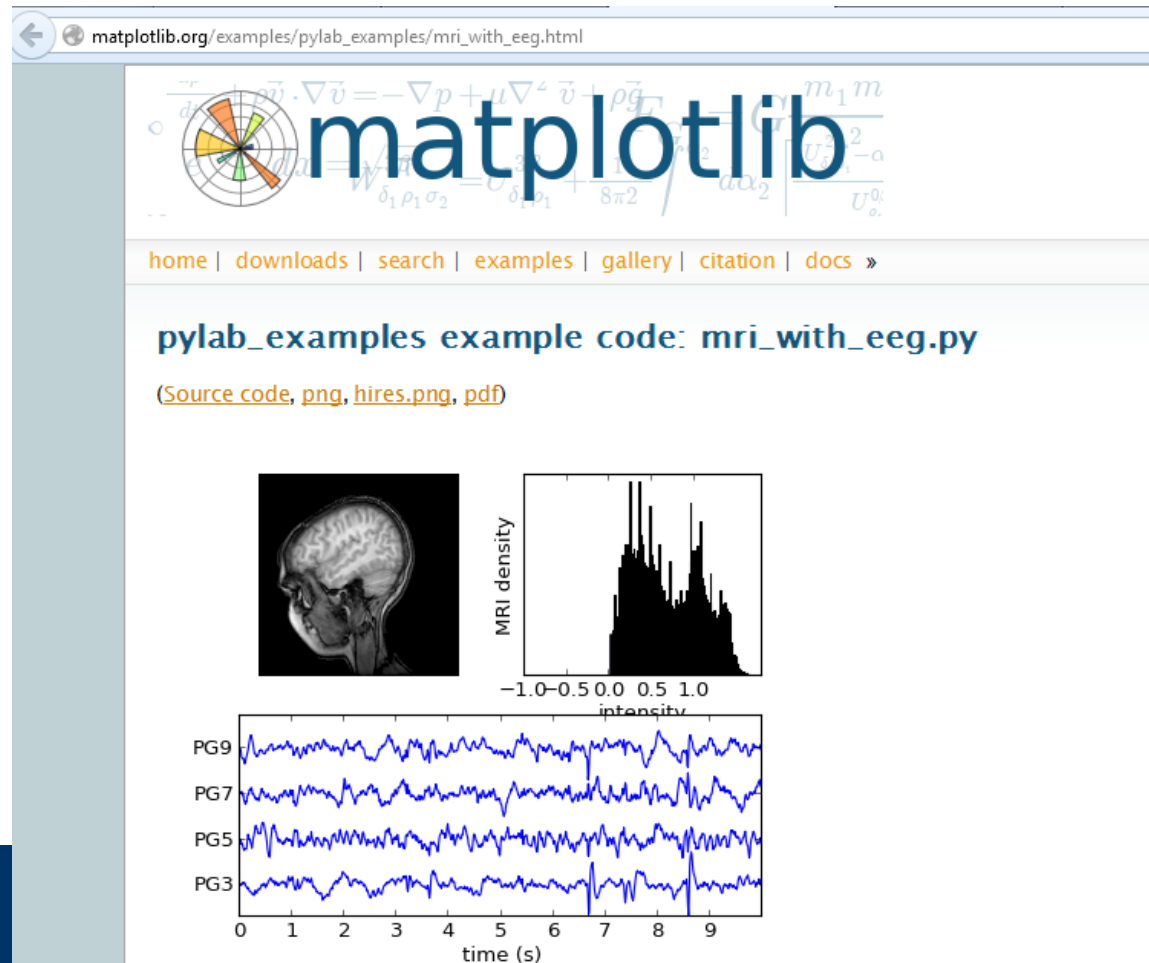
<http://matplotlib.sourceforge.net>

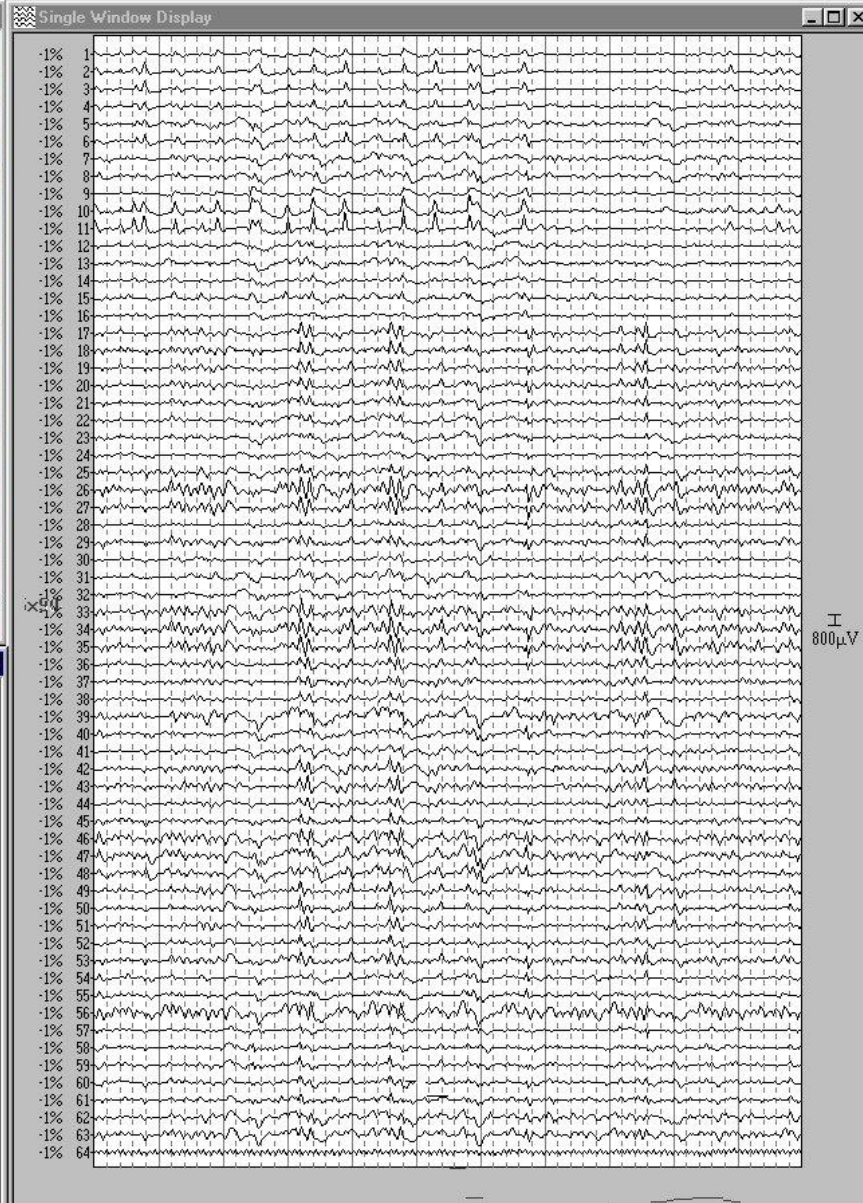
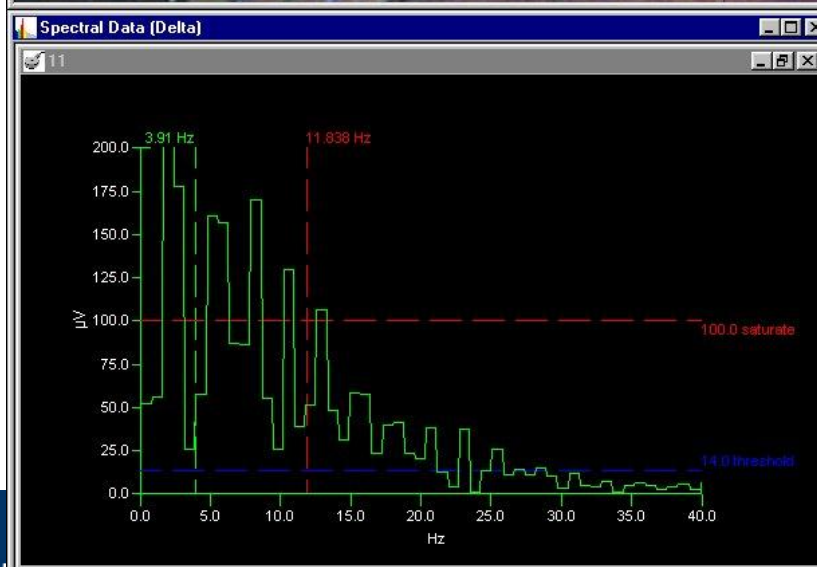
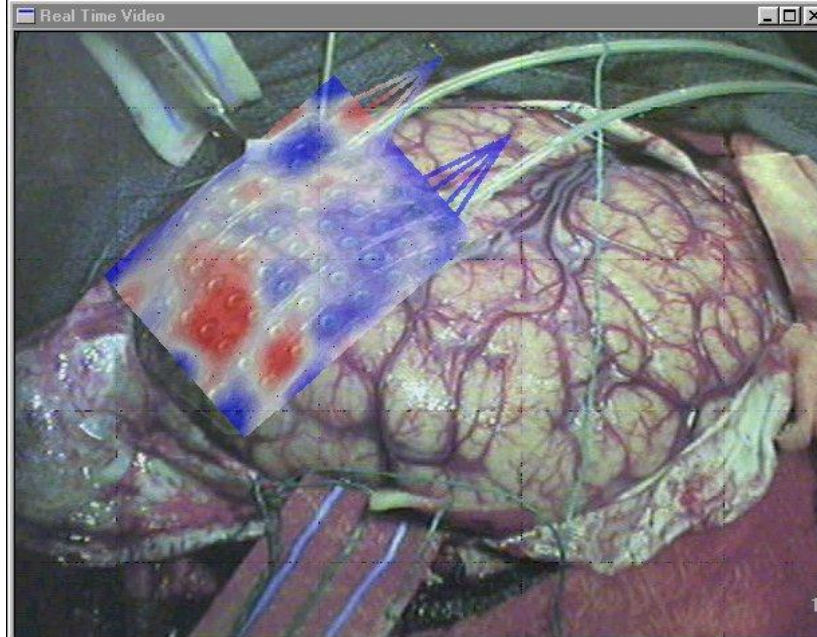
Matplotlib

<http://matplotlib.sourceforge.net>

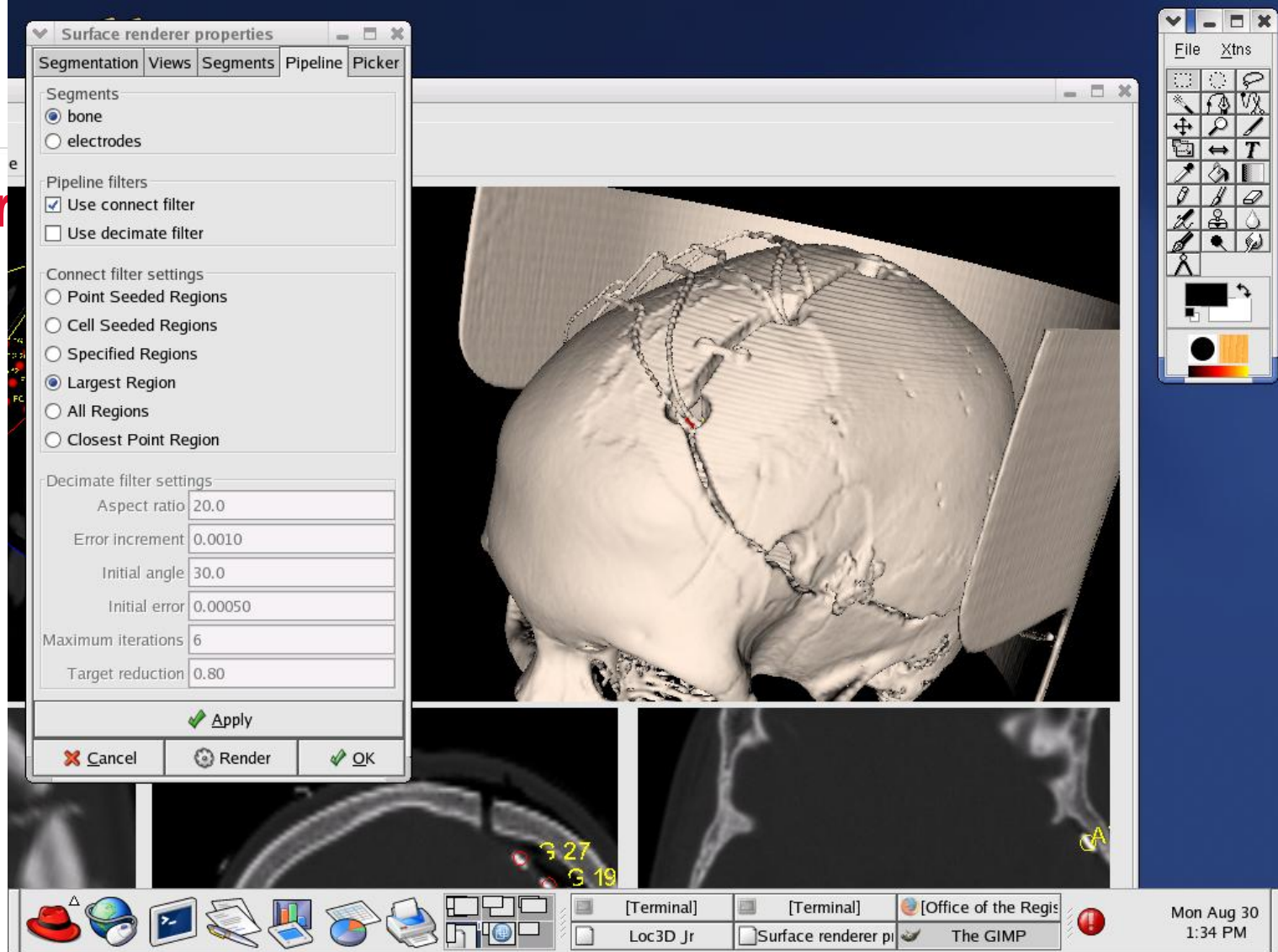
Agenda

- Wat kan Matplotlib?
- Installatie van Matplotlib
- Hoe werkt Matplotlib?





pbr



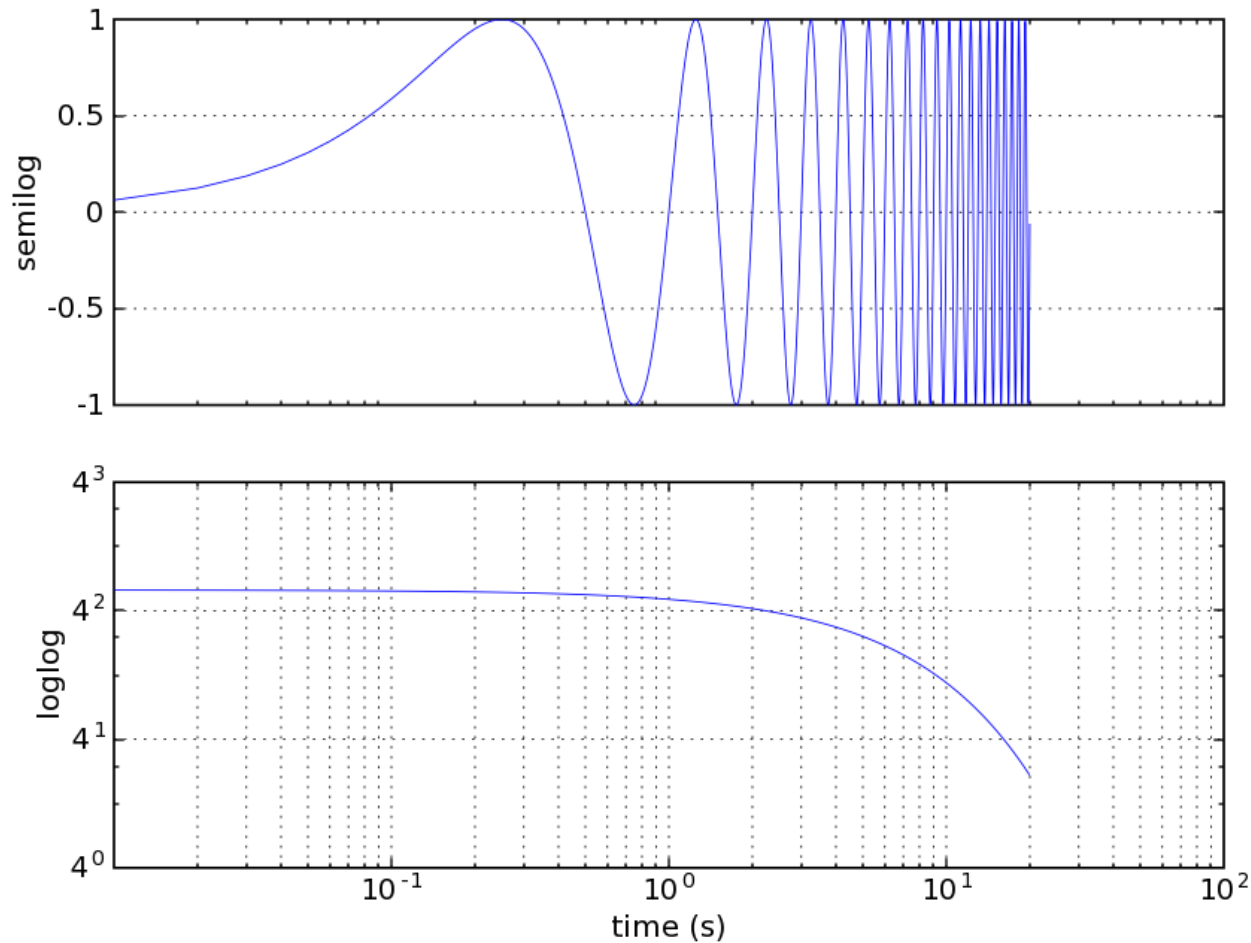

```
# matplotlib 0.1
~/python/matplot_gtk12> ls
README      matplotlib.py  subplot_demo.py
data        simple_plot.py view_data.py
matplot.py  stock_demo.py  vline_demo.py
```

```
# matplotlib 0.73
53 python modules
17 files of extension code
44,000 lines of code
130 examples
```

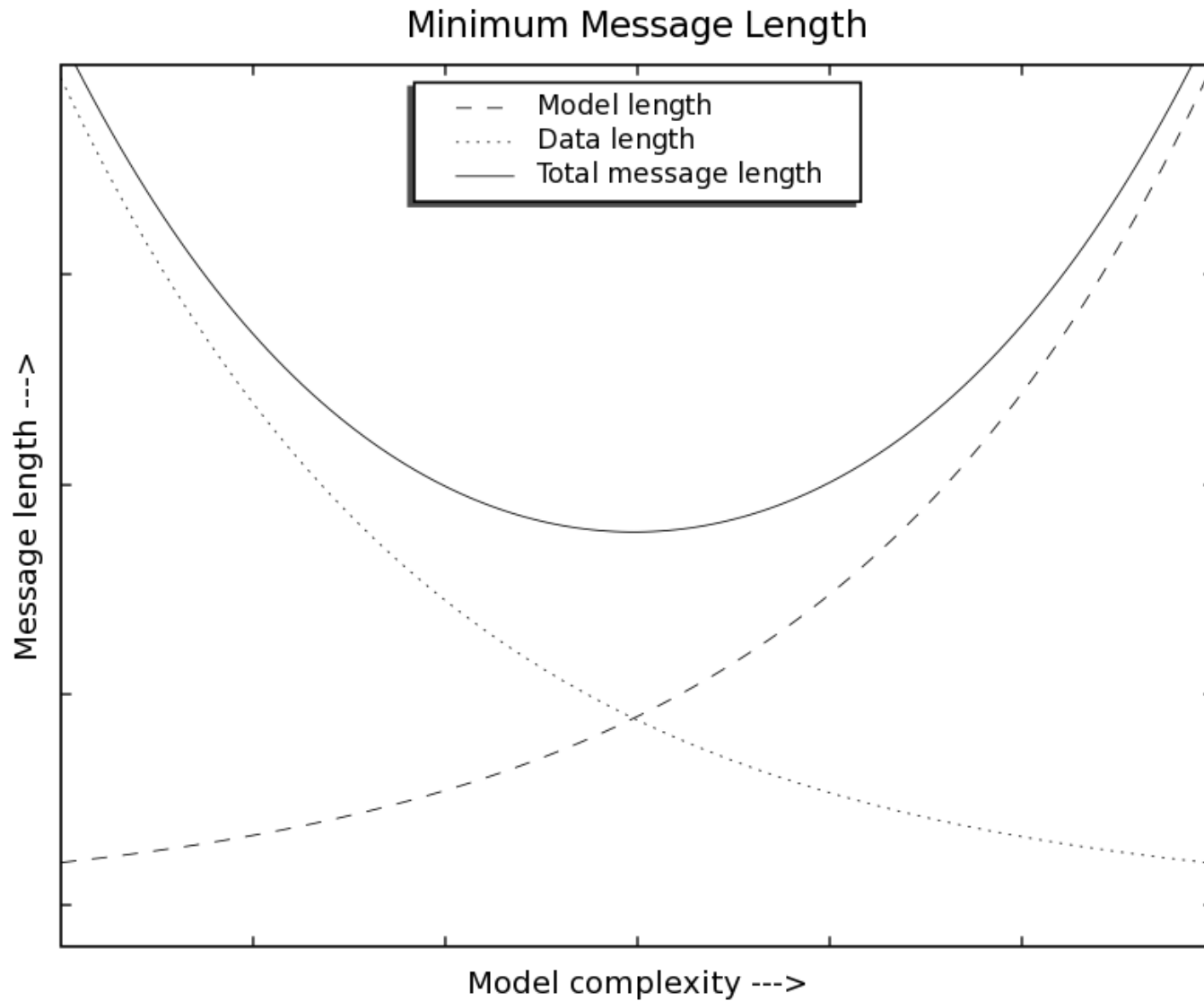
- 2-5 ontwikkelaars en 25 contributors
- Ontwikkeld samen met NASA, STScI en JPL
- 1200-1500 downloads per maand



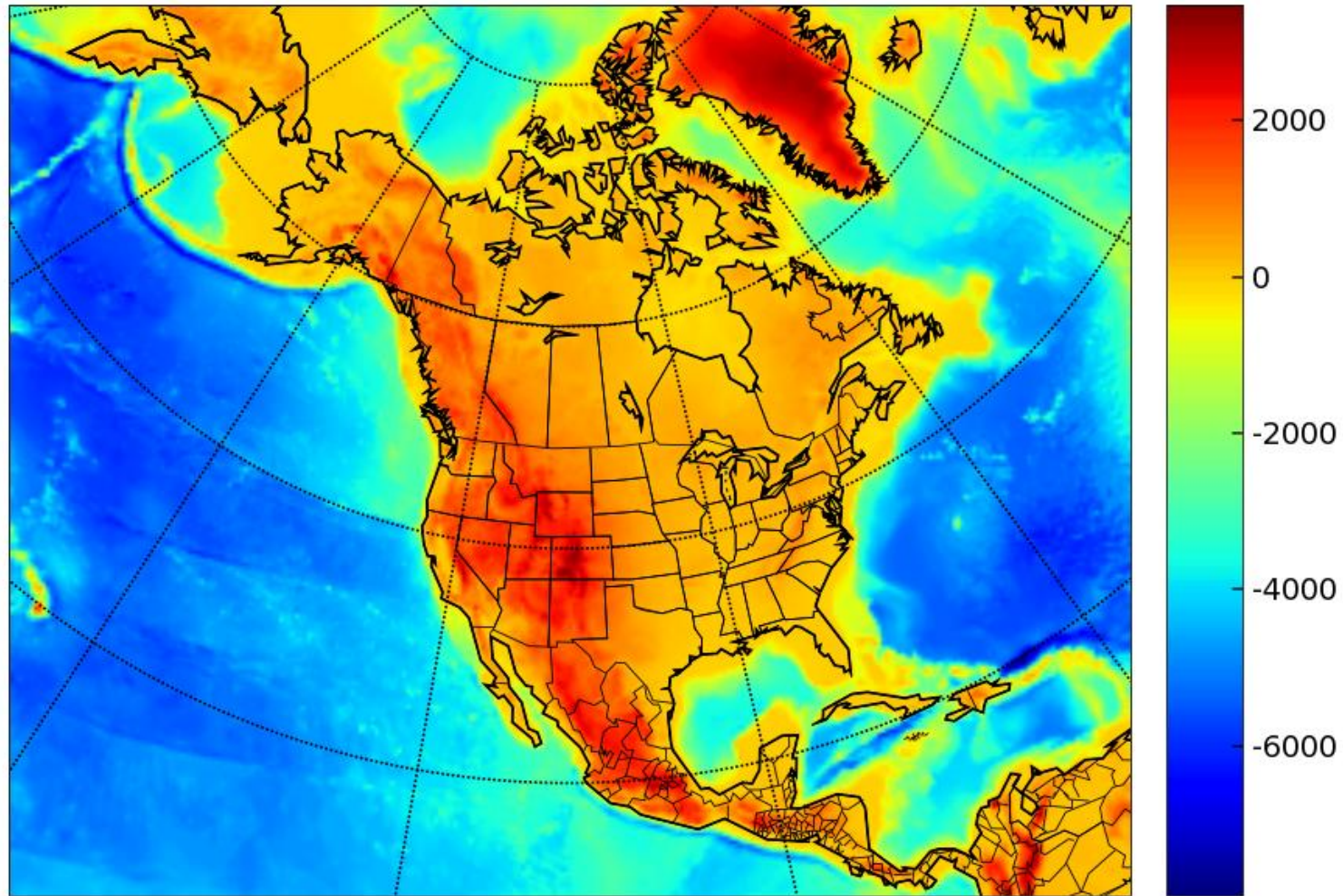
log demo



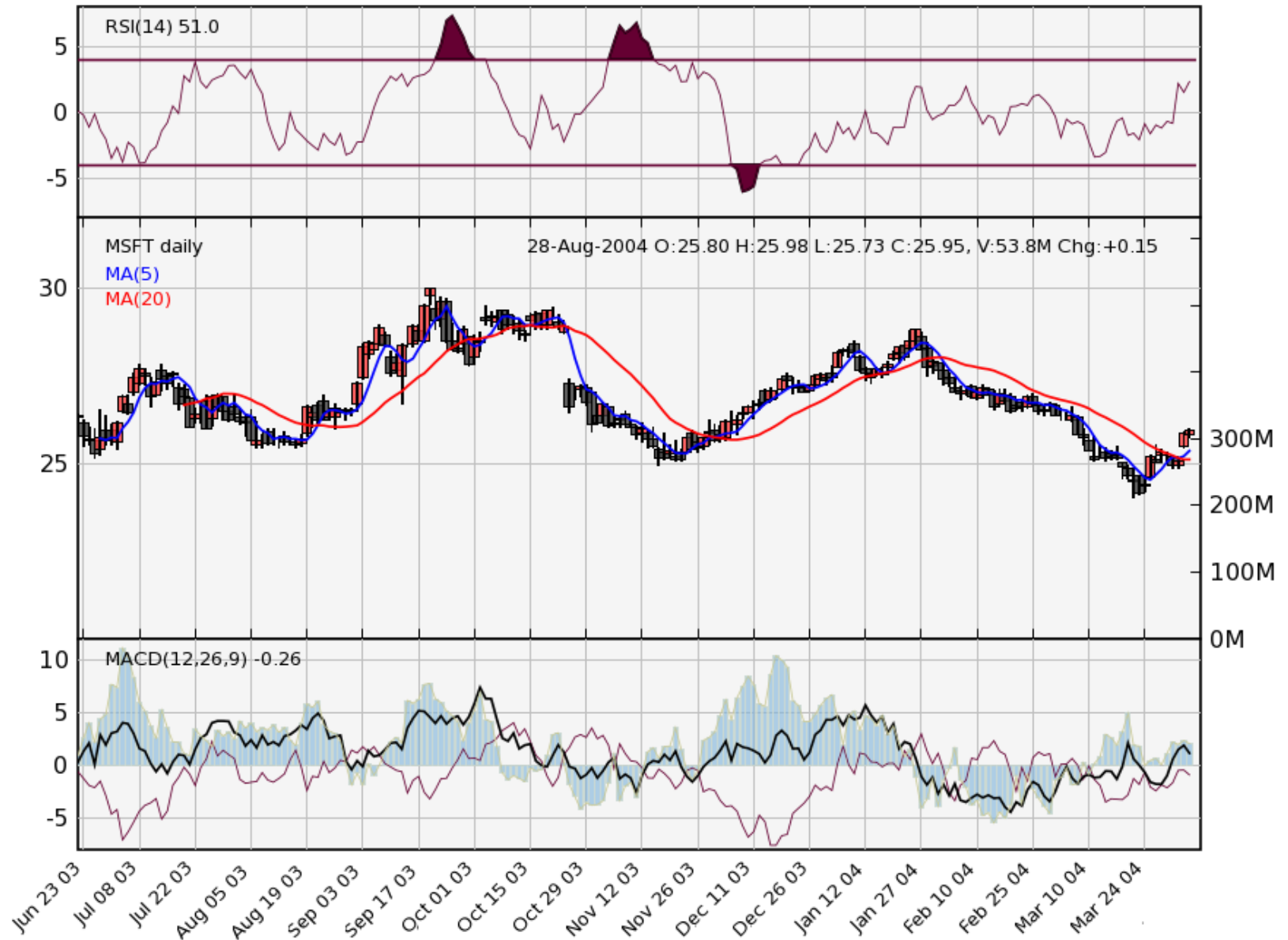
```
subplot(212)
loglog(t, 20*exp(-t/10.0), basey=4)
grid(True)
gca().xaxis.grid(True, which='minor')
xlabel('time (s)')
```



ETOPO Topography - Lambert Conformal Conic



Microsoft Corp (MSFT)




Installatie Matplotlib

Installatie

- Installeer Numpy
- Installeer Matplotlib

Installatie Numpy

- <http://www.numpy.org/>



The screenshot shows the NumPy website homepage. At the top is the NumPy logo. Below it are five icons with labels: 'Download' (a green arrow pointing down), 'Getting Started' (a yellow circle with a white 'S'), 'Documentation' (a blue circle with a white 'S' and a book icon), 'Report Bugs' (a blue circle with a white 'S' and a red bug icon), and 'Read the Blog' (an orange RSS icon). Below these icons is a paragraph describing NumPy as the fundamental package for scientific computing with Python, listing its capabilities: a powerful N-dimensional array object, sophisticated (broadcasting) functions, tools for integrating C/C++ and Fortran code, and useful linear algebra, Fourier transform, and random number capabilities. It also mentions that NumPy can be used as an efficient multi-dimensional container of generic arrays and can seamlessly and speedily integrate with a wide variety of databases. The page is licensed under the BSD license. At the bottom, there is a 'Getting Started' section with a list of links: 'Getting NumPy', 'Installing NumPy and SciPy', 'NumPy and SciPy documentation page', 'NumPy Tutorial', 'NumPy for MATLAB® Users', 'NumPy functions by category', and 'NumPy mailing List'.

NumPy

[Download](#) [Getting Started](#) [Documentation](#) [Report Bugs](#) [Read the Blog](#)

NumPy is the fundamental package for scientific computing with Python. It contains among other things:

- a powerful N-dimensional array object
- sophisticated (broadcasting) functions
- tools for integrating C/C++ and Fortran code
- useful linear algebra, Fourier transform, and random number capabilities

Besides its obvious scientific uses, NumPy can also be used as an efficient multi-dimensional container of generic arrays. This enables

NumPy to seamlessly and speedily integrate with a wide variety of databases.

NumPy is licensed under the [BSD license](#), enabling reuse with few restrictions.

Getting Started

- [Getting NumPy](#)
- [Installing NumPy and SciPy](#)
- [NumPy and SciPy documentation page](#)
- [NumPy Tutorial](#)
- [NumPy for MATLAB® Users](#)
- [NumPy functions by category](#)
- [NumPy mailing List](#)

Installatie

- <http://matplotlib.org/downloads.html>



home

Downloads

1.2.0 — Latest stable version

- [matplotlib-1.2.0-py2.7-python.org-macosx10.3.dmg](#)
- [matplotlib-1.2.0-py2.7-python.org-macosx10.6.dmg](#)
- [matplotlib-1.2.0.tar.gz](#)
- [matplotlib-1.2.0.win-amd64-py2.6.exe](#)
- [matplotlib-1.2.0.win-amd64-py2.7.exe](#)
- [matplotlib-1.2.0.win-amd64-py3.2.exe](#)
- [matplotlib-1.2.0.win-amd64-py3.3.exe](#)
- [matplotlib-1.2.0.win32-py2.6.exe](#)
- [matplotlib-1.2.0.win32-py2.7.exe](#)
- [matplotlib-1.2.0.win32-py3.2.exe](#)
- [matplotlib-1.2.0.win32-py3.3.exe](#)

Voorbeelden

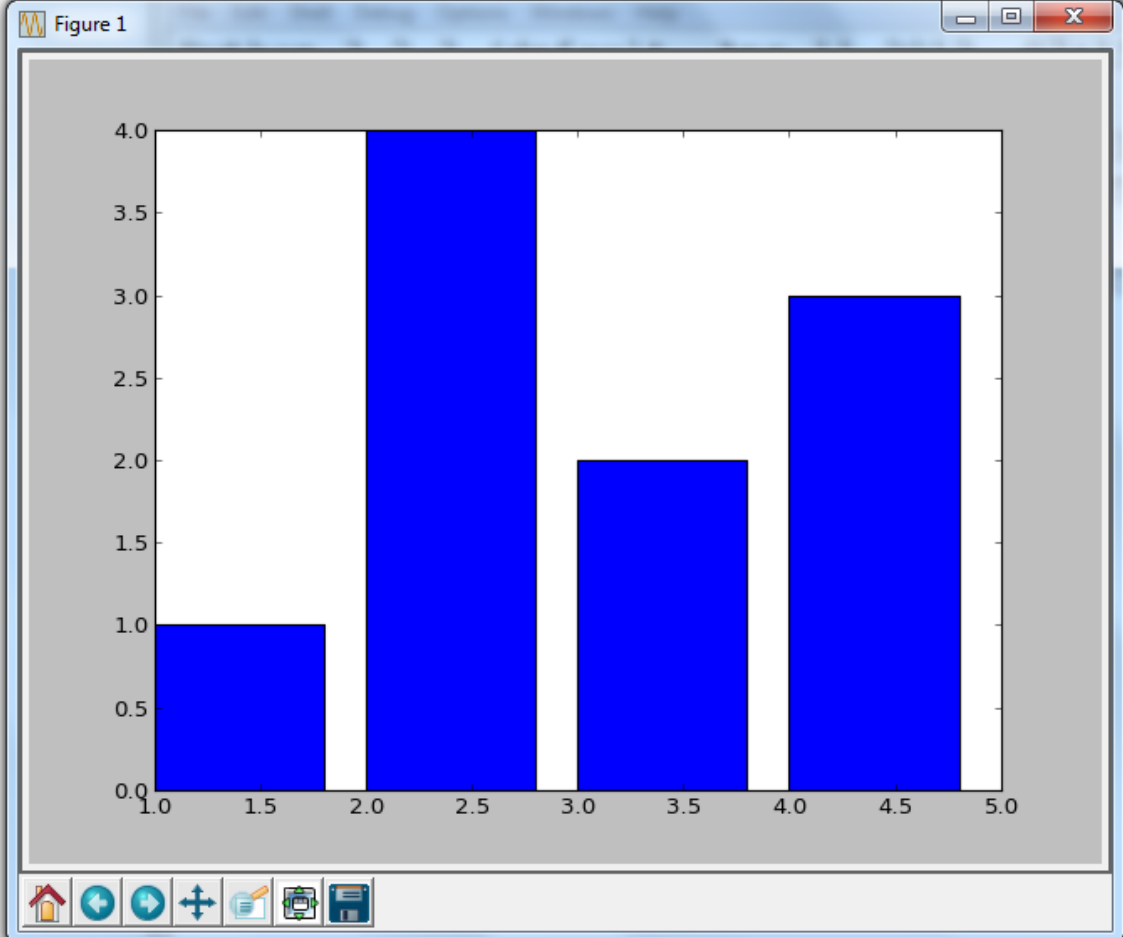
Eenvoudig voorbeeld

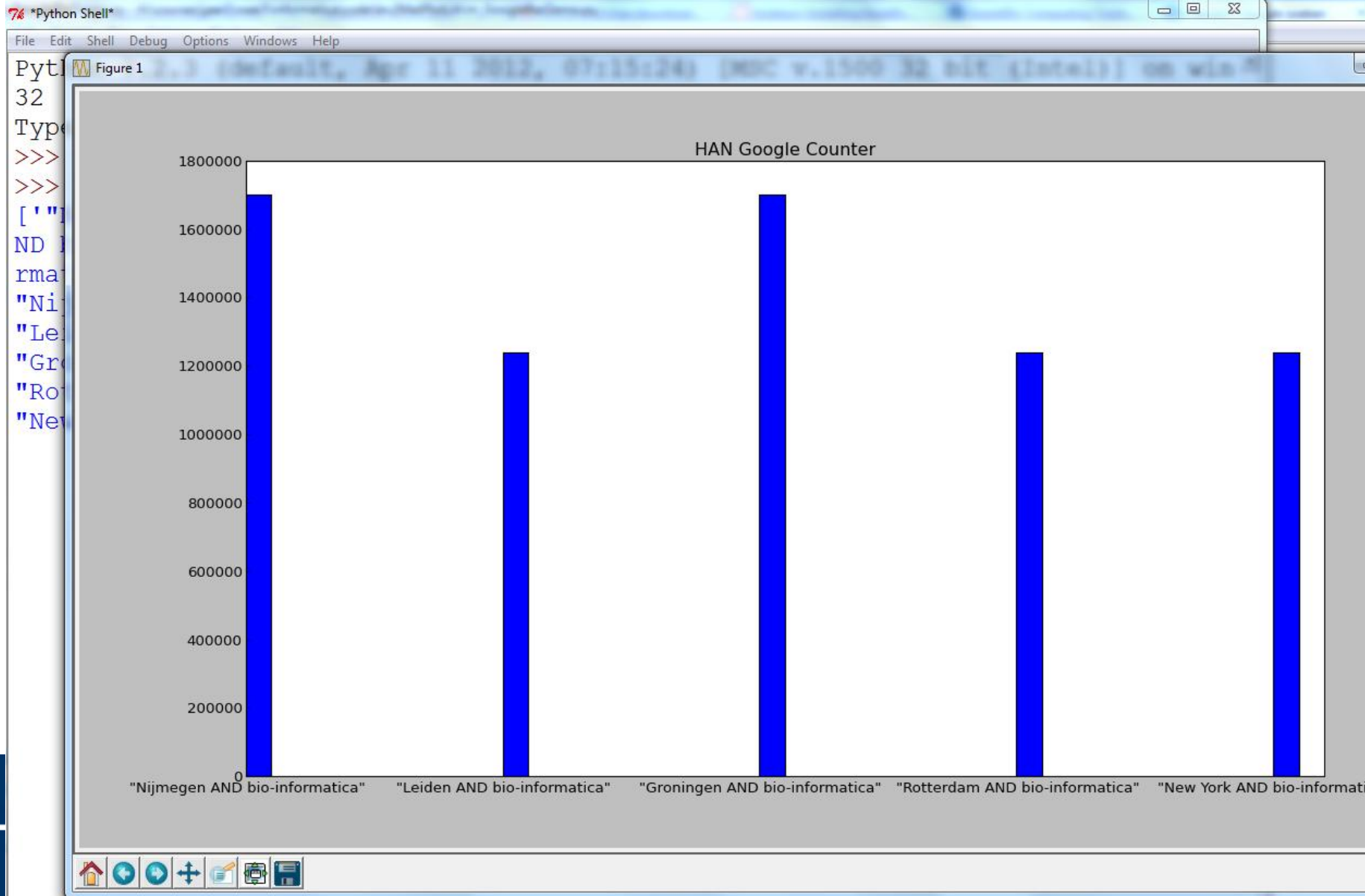
m_startSimpleBar.py - H:\courses\jaar1\owe3\informatica\code\les2Matplotlib\m_startSimpleBar.py

File Edit Format Run Options Windows Help

Python Shell

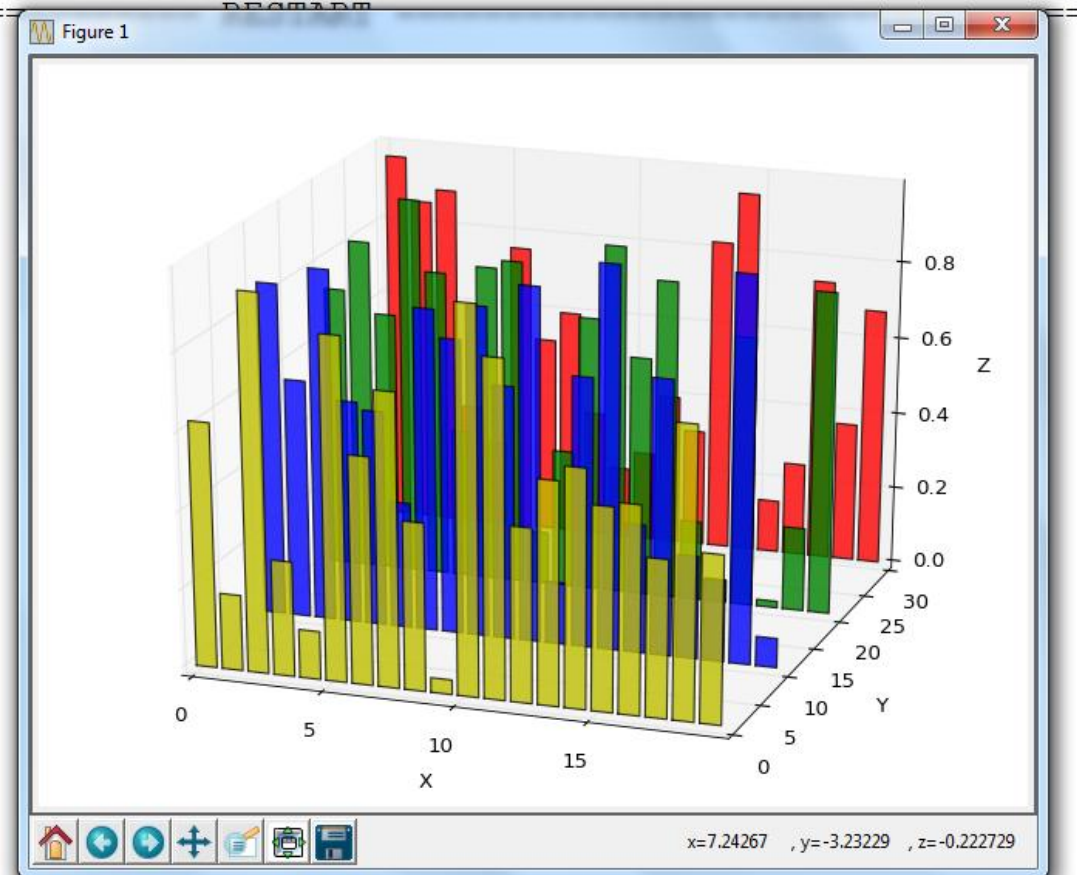
```
from pylab import *  
listx = [1,3,4,2]  
listy = [1,2,3,4]  
bar(listx, listy)  
show()
```





Grafieken in 3D

credits" or "license()" for more information.

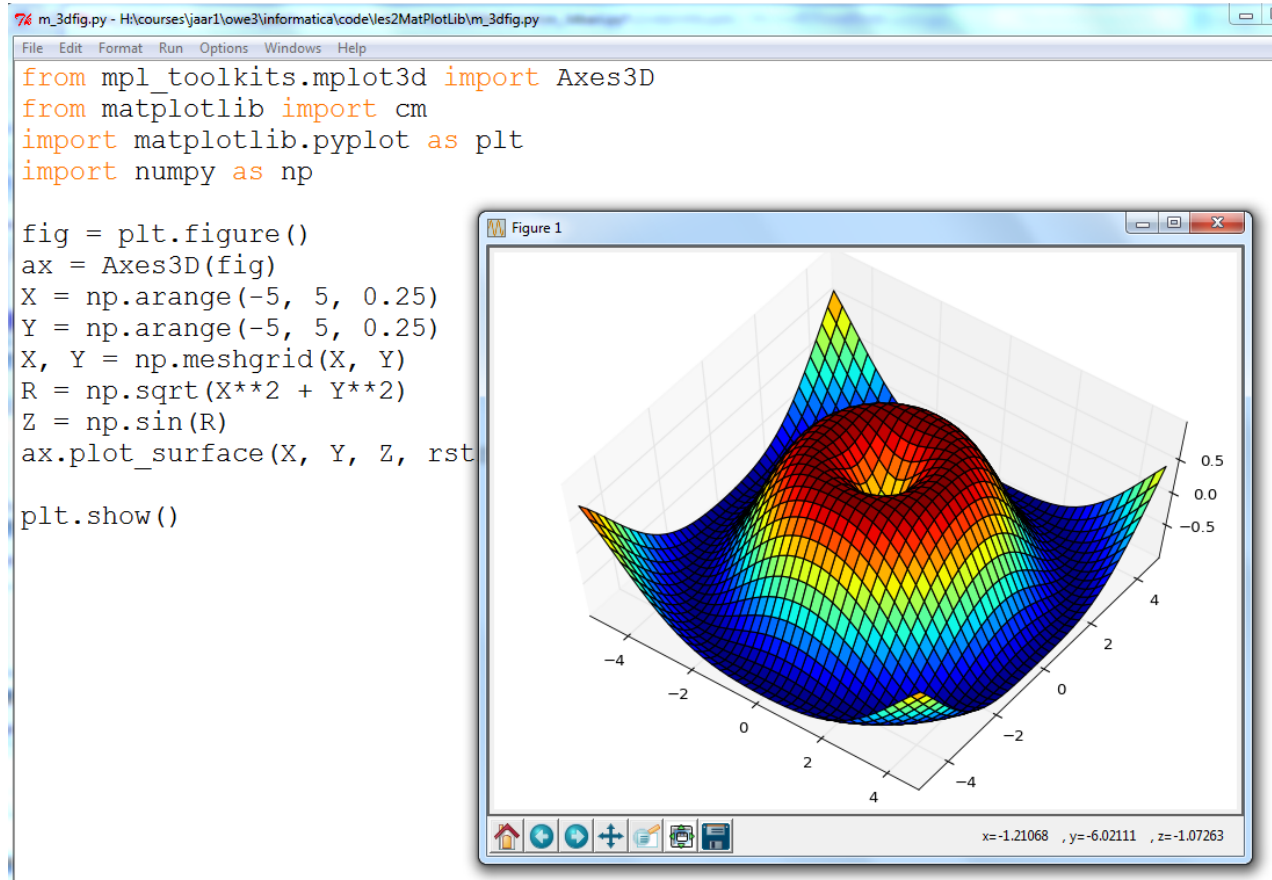


Code voor grafiek

```
from mpl_toolkits.mplot3d import Axes3D
import matplotlib.pyplot as plt
import numpy as np

fig = plt.figure()
ax = Axes3D(fig)
for c, z in zip(['r', 'g', 'b', 'y'], [30, 20, 10, 0]):
    xs = np.arange(20)
    ys = np.random.rand(20)
    ax.bar(xs, ys, zs=z, zdir='y', color=c, alpha=0.8)
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
plt.show()
```

3D figuur



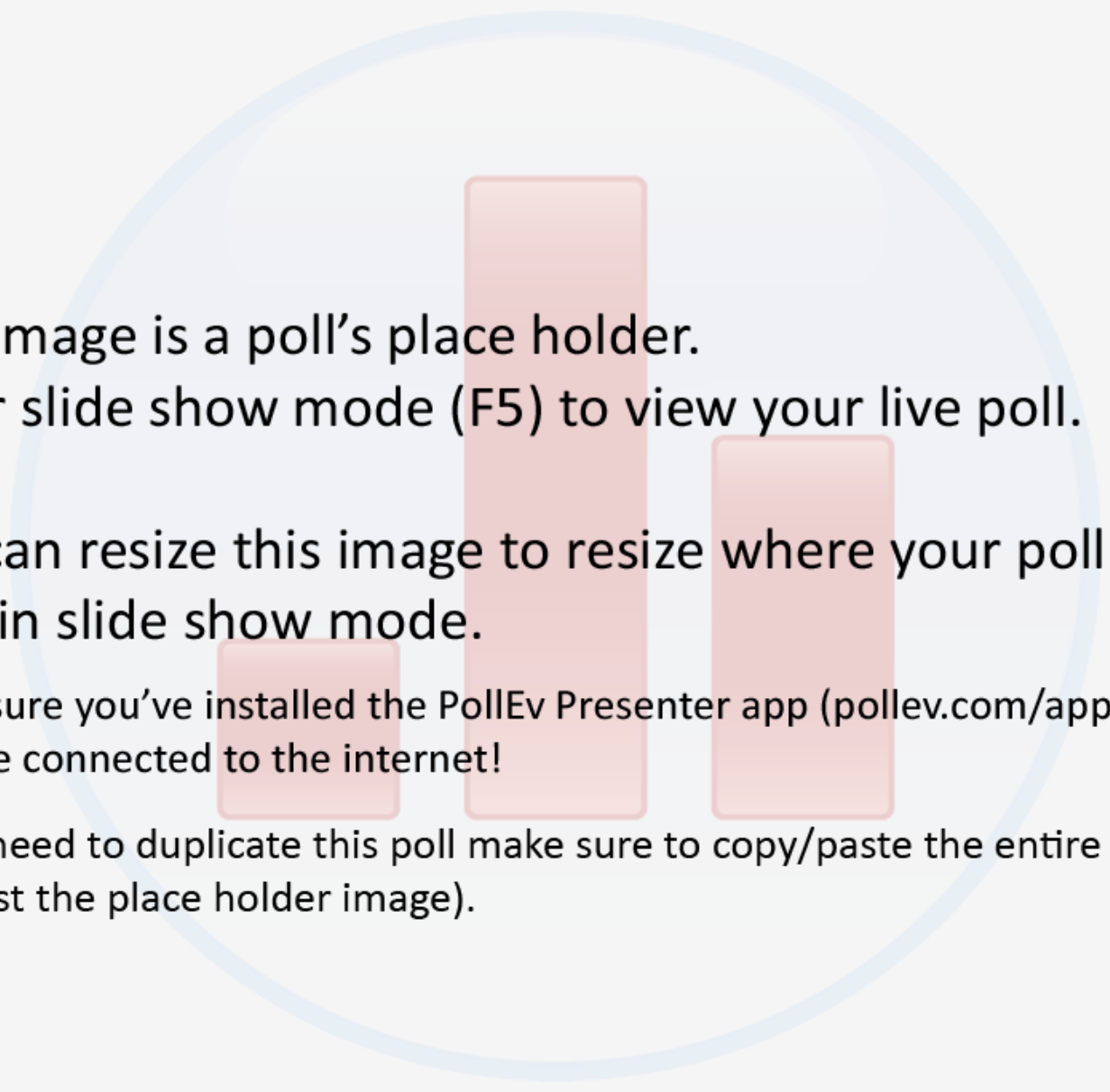
Samenvatting

- Graphics can be easily created using matplotlib

Meer over strings

Vraag

- Wat zijn Strings?



This image is a poll's place holder.
Enter slide show mode (F5) to view your live poll.

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load in slide show mode.

Make sure you've installed the PollEv Presenter app (pollev.com/app)
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Strings

- **Introductie strings**
- **Basale string operaties**
- **String slicing**
- **Manipulatie van strings**

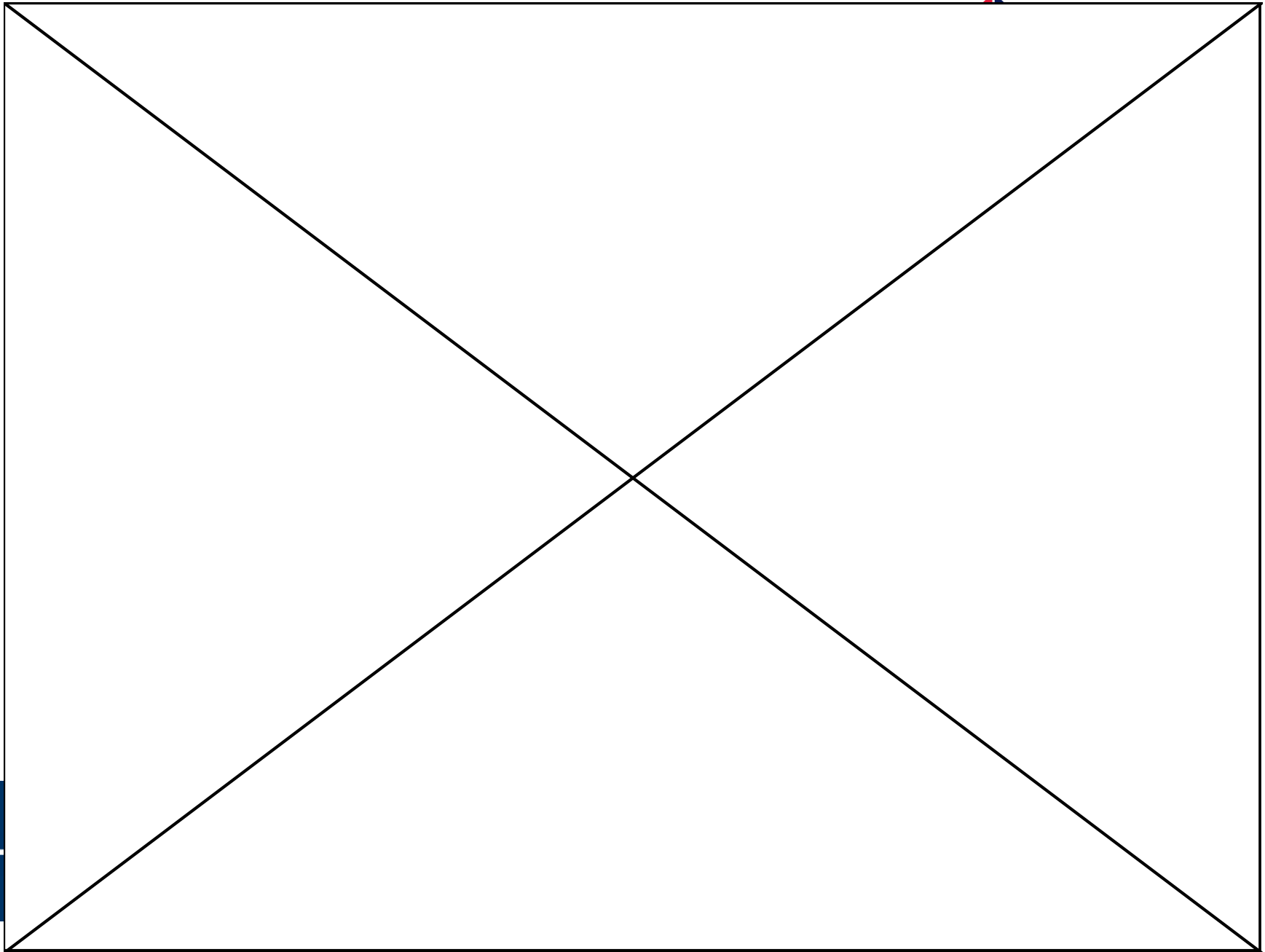
Inleiding

- **Strings zijn belangrijk in vrijwel ieder programma**
- **Strings zijn “kleine stukjes tekst”**
- **In de bio-informatica zijn strings (tekst analyse) extreem belangrijk**



Basis string operaties (1)

- Over een string is te *lopen* met een **for**
- Met een index is een karakter op te halen
- Met de **in** operator is te toetsen of een substring voorkomt



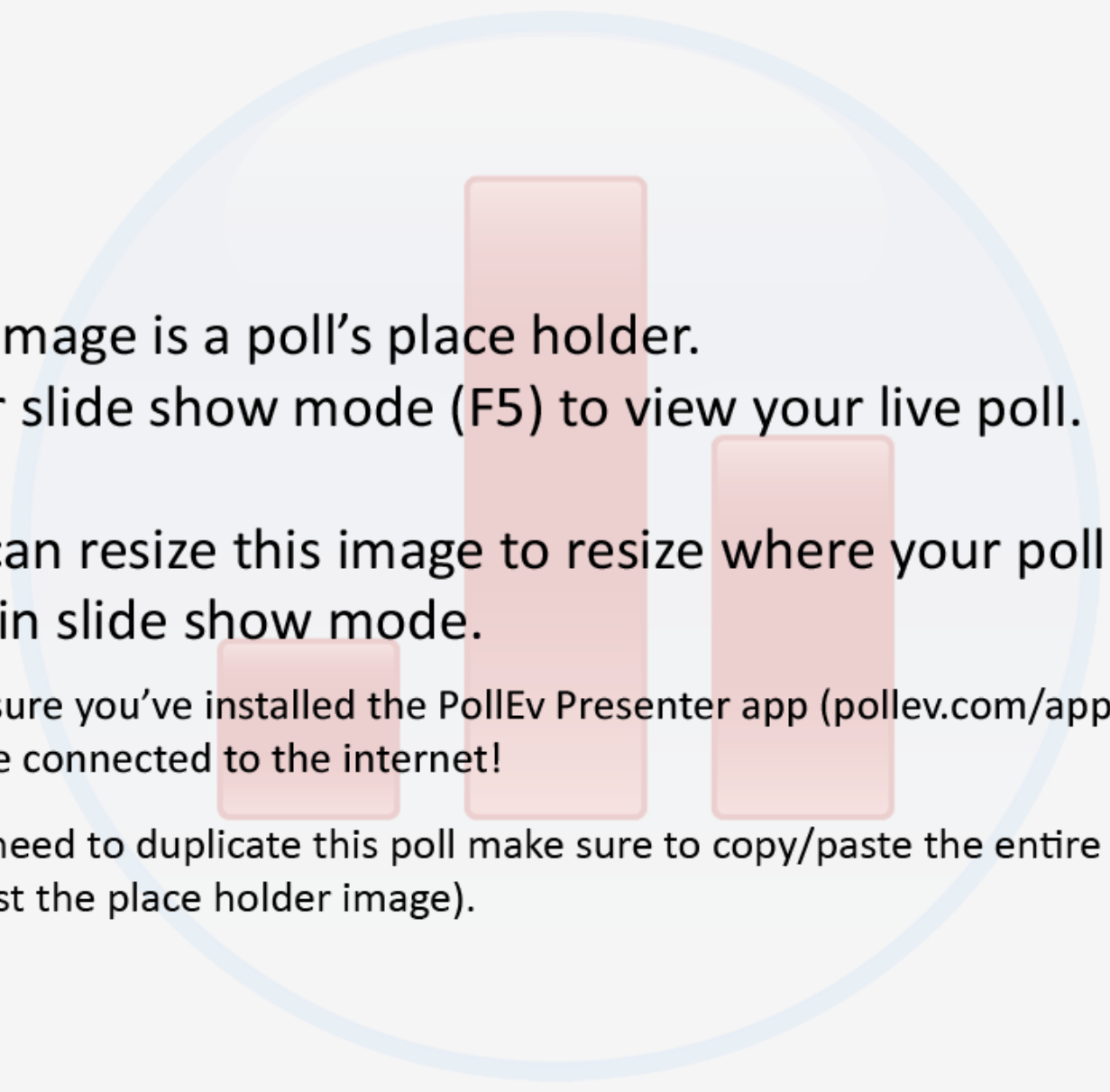
Basis string operaties (2)

- Met `len` is de lengte van een string op te vragen
- Wanneer je een karakter op wilt halen buiten het bereik ontstaat een `IndexError`



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Strings zijn immutable

- Het plakken van strings aan elkaar of het vervangen van letters leidt steeds tot een nieuwe string

s += “World”



Wat zijn de gevolgen voor het veel wijzigen van Strings?

- **Memory?**
- **Snelheid?**

Strings

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- **String slicing**
- **Manipulatie van strings**

String manipulaties

- `s = "Hello World!"`
- `s[5] = "a" → Kan niet`

Strings

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String operaties

- Met de punt notaties is een groot aantal vragen te stellen aan een string

Samenvattend

- **Strings zijn ontzettend belangrijk in software ontwikkeling**
- **Zeker in de bio-informatica nemen ze een zeer belangrijke rol in**

Verantwoording

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