

SCIPY  
CS 010

Design and Implementation of  
Solutions to Computational  
Problems

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# EXTENDING PYTHON

## MODULES EXTEND PYTHON

- Numpy
- Scipy
  - a collection of math algorithms and functions that extend python
  - high-level commands and classes for
    - manipulating data
    - visualizing data
    - (like Matlab, R, or Octave)



[see scipy.org](http://scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- built on numpy and matplotlib
  - but those are separate required modules

```
import numpy as np  
import matplotlib as mpl  
import matplotlib.pyplot as plt
```



# INTRODUCTION TO SCIPY

## INSTALL SCIPY

```
$ pip3 install scipy
Collecting scipy
  Downloading scipy-0.18.1-cp35-cp35m-macosx_10_6_intel.macosx_10_9_intel.
macosx_10_9_x86_64.macosx_10_10_intel.macosx_10_10_x86_64.whl (21.0MB)
    100% |████████████████████████████████| 21.0MB 51kB/s
Requirement already satisfied: numpy>=1.7.1 in /Library/Frameworks/Python.
framework/Versions/3.5/lib/python3.5/site-packages (from scipy)
Installing collected packages: scipy
Successfully installed scipy-0.18.1
```



[see \*scipy.org\*](http://see.scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **cluster**
  - clustering algorithms
  - unsupervised machine learning algorithms
  - Clustering algorithms are useful in information theory, target detection, communications, compression, and other areas. The **vq** module only supports vector quantization and the k-means algorithms.



# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **constants**
  - Physical and mathematical constants
    - speed of light
    - proton mass
    - gravitational constant
    - etc.



# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **fftpack**
  - Fast Fourier Transforms
    - converts raw amplitudes into spectral graphs
    - aka, stereo equalizer



[see `scipy.org`](http://see scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **integrate**
  - Integration and ordinary differential equation solvers



[see `scipy.org`](http://scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **interpolate**
  - Interpolation and smoothing splines



[see `scipy.org`](http://scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **io**
  - modules to read and write files of many different formats
    - wav
    - arff files
    - matlab files



[see `scipy.org`](http://see scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **linalg**
  - Linear algebra functions
    - matrix algebra
    - matrix inversion
    - eigenvalues
    - matrix decompositions



[see `scipy.org`](http://see.scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- `ndimage`
  - N-dimensional image processing



[see `scipy.org`](http://scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- `odr`
  - Orthogonal distance regression
- `optimize`
  - Optimization and root-finding routines
- `signal`
  - signal processing
- `sparse`
  - sparse matrix manipulation



[see `scipy.org`](http://see scipy.org)

# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **spatial**
  - Spatial data structures and algorithms
- **special**
  - Bessel functions, polynomials, ellipsoid
- **stats**
  - This module contains a large number of probability distributions as well as a growing library of statistical functions



# INTRODUCTION TO SCIPY

## SCIPY IS A COLLECTION OF MODULES

- **weave**
  - C/C++ integration



[see \*\*scipy.org\*\*](http://scipy.org)

# CASE STUDY

## SOUND FREQUENCIES

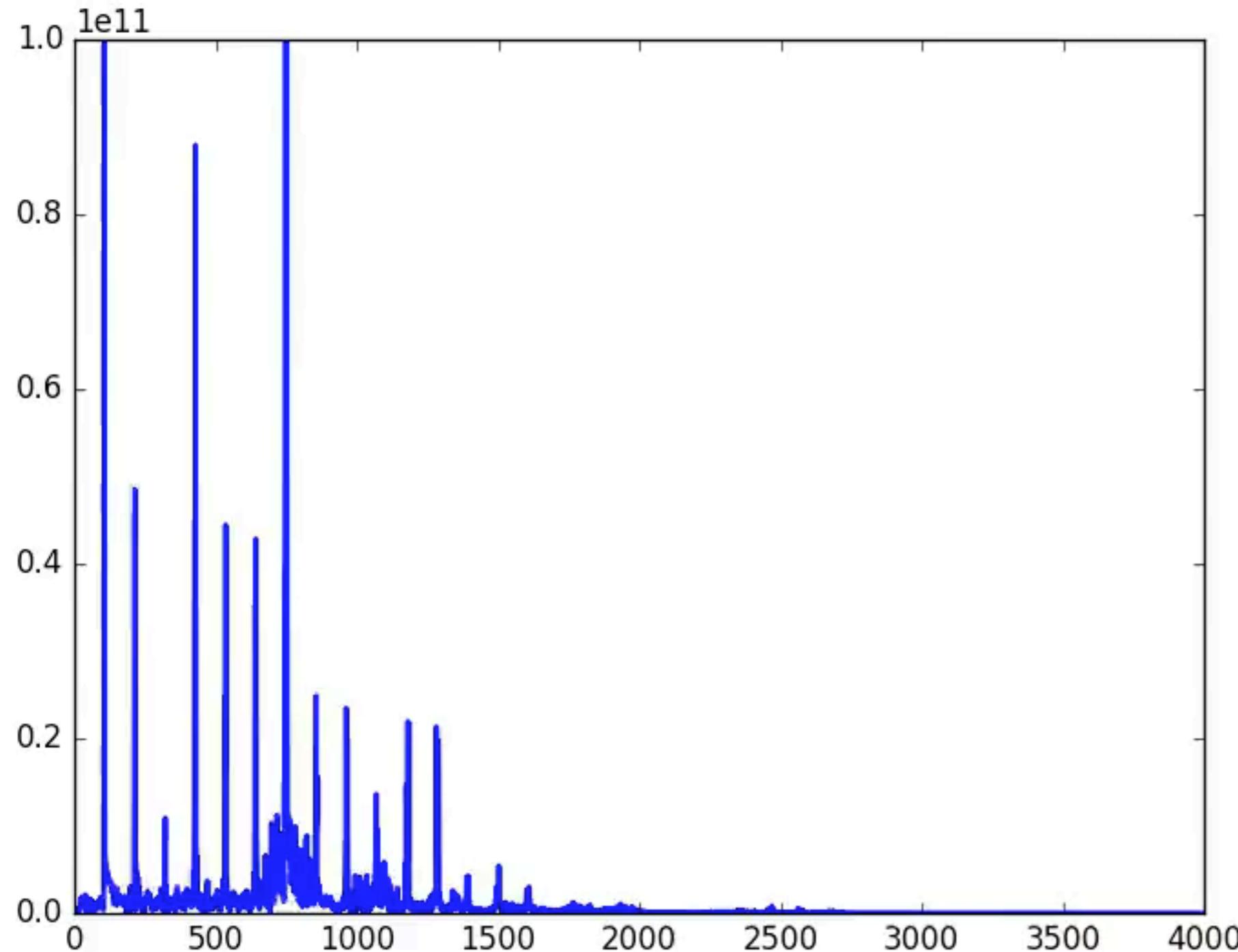
- First create your input audio
- Then read in your sound file in python
- Then convert it to frequencies using FFT
- Then plot it

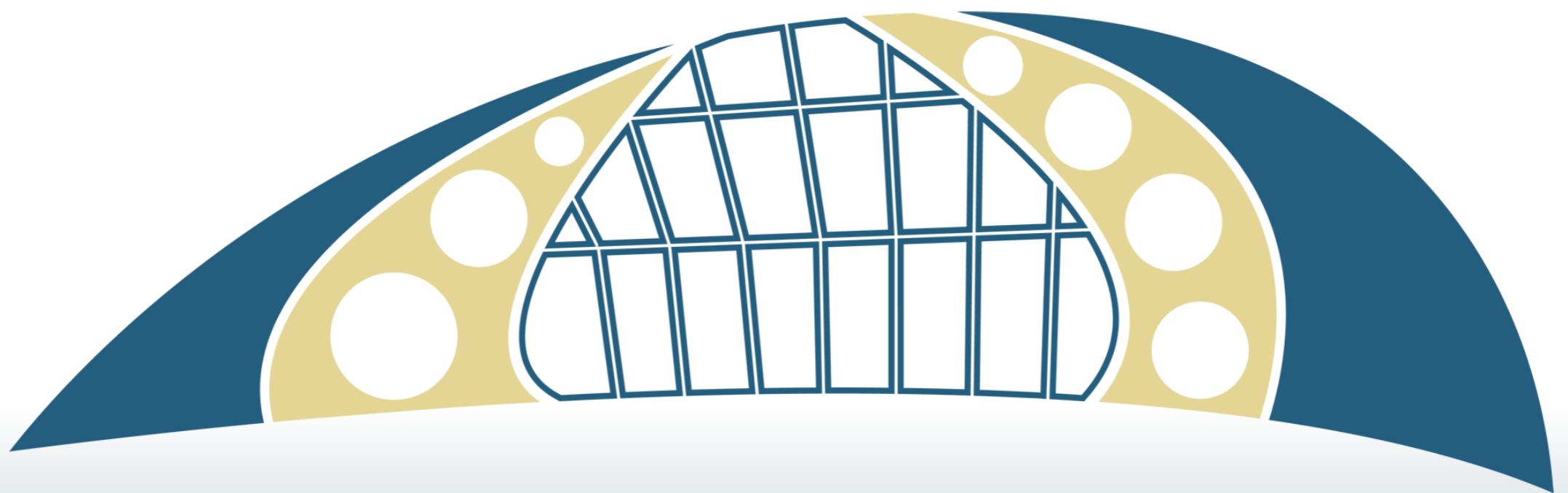


[see `scipy.org`](http://scipy.org)

# CASE STUDY

## ANIMATE SOUND FREQUENCIES





**WESTMONT INSPIRED**  
— COMPUTING LAB —