

Python and Classifying Spectra

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1 Introduction

Python has become one of the main tools that astronomers use in everyday life. Therefore learning how to use it is an important, though seldom taught, part of any astronomy university course. Here we will take a first look into programming with Python, based on the approach of “**learning by doing**”.

In this exercise we will use Python to take a hands on look at classifying raw spectra. Stellar spectra provide a wealth of information about different stellar parameters like mass, luminosity class, surface temperature, surface gravity, radius, metallicity, etc. Thus being able to view and manipulate the data is a useful skill to acquire.

2 Data

A random collection of 12 spectra ranging from spectral types O5V to M6V will be provided. Two reference spectra for an A0V and an A0I star are provided for comparison. The filter spectral response curves for the Bessel-Johnson B, V and R filters are also included. We will look at each of these spectra in turn.

3 Software

For this exercise you will need a working version of Python (> 3.6) and the several dependencies. If you are completely new to Python, the package manager “Anaconda” has everything you need to get started. Download (<https://www.continuum.io/downloads>) the file to your operating system and install it. That’s all.

If you prefer to manage your own packages, you will need the following:

- **Numpy**: `pip install numpy`

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- **Matplotlib:** `pip install matplotlib`
- **Astropy:** `pip install astropy`
- **Jupyter notebook:** `pip install jupyter`

4 Task

Use Python to read and display spectra, and then classify them according to the Harvard system (see the extra pdf “Spektralklassifizierung Flowchart” on moodle). Open the iPython notebook “SpectralTypeClassification.ipynb” (“Jupyter Notebook” on moodle) and complete the exercises there.

5 What to include in your report

For this section of the practicum, you can either write a usual report (in case you do not want to use Jupyter, see extra pdf for info), or, if you prefer, you will also be allowed to submit a completed Jupyter notebook with the relevant tables and graphs instead.

6 Resources for learning Python by doing exercises

- **Learning Python the Hard Way:** A standard book for learning Python and programming in general. The exercises are short and easy to understand.
<https://learnpythonthehardway.org/book/ex1.html>
- **Let’s learn Python Basics:** If you don’t like reading, [here](#) is a series of Youtube videos explaining the basics of programming with Python.
- Hundreds of exercises for all aspects of python:
<http://www.w3resource.com/python-exercises/>
- 100 exercises for numpy
<https://github.com/rougier/numpy-100>