Algorithm Engineering Lab Assignment 12

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1. What are extension types in the context of Python?

Extension types can be used like Python objects. Since they are compiled code, they are as fast as built-in object types when implemented correctly. These constructs also enable wrapping external C/C++ code while giving it a Python-similar interface. Implementing a Cython extension types is mostly the same as creating a Python class. Thus, they are a good alternative compared to the complex implementation of a C extension type.

2. How do extension type data fields in Cython differ from data fields in Python classes?

Cython data fields are only accessible within the Cython unless the programmer provides access for Python by declaring the data field as public. Python data fields can be declared within the initialize routine. However, Cython data fields have to be declared upfront at the class level. Furthermore, field access to Cython extension types is faster than Python classes. Both Python and Cython allow declaring fields that are themselves classes/extension types.

3. Give a simple description of how to wrap C / C ++ code in Cython.

A way to use a C/C++ library with python is by wrapping it with Cython. That can be achieved by working through the following steps.

First, create a .pyx file as an interface.

Second, set the distutils. Distutils give your compiler hints how to compile the library such as language (e.g., C or C++), source files, compile flags (e.g., -march=native (gcc), -fopenmp(gcc), ...), link flags (e.g., -fopenmp(gcc), ...), etc.

Third, define the Cython compiler directives. Examples were given in assignment 11 exercise 4.

Fourth, import the required C library(s) (parts). Often, special data types are needed to invoke C/C++ libraries.

Fifth, list the functions which should be wrapped. The programmer provides information about the C/C++ interface and, about the function to be used in the actual wrapper function. Check, if there are structures and deallocation functions that should be imported, either.

Sixth, write the actual Cython wrapper function. Therefore, it's important to perform all necessary type-casts correctly. Ensure that no longer used memory is deallocated before the function determines.