The e-learning Python for Ocean Mapping project

Empowering the next generation of ocean mappers with effective programming skills

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Abstract— **The next generation of ocean mappers will need to master programming skills to face the increasingly higher expectations for timely ping-to-public data workflows. As such, the e-learning Python for Ocean Mapping (ePOM) project was established to support new ocean mapping students and professionals in reaching a minimum level of programming skills. These skills are then expanded with further powerful capabilities by leveraging the open-source Python scientific stack and the NOAA Office of Coast Survey's Pydro distribution.**

Keywords—next generation ocean mappers; Python; ocean data science; scientific computing; education; programming

I. Introduction

The next generation of ocean mappers will need to have, and constantly expand, a set of solid programming skills to face the exponential growth in the amount, and complexity, of newly-collected data. Based on current trends in technological evolution, this will be exacerbated by even higher future expectations for the timely transposition of those data from "ping" (data acquisition) to "public" (e.g., updates to nautical charts). Since newcomers entering the ocean mapping field often have limited programming experience, the need arises to help them in reaching a minimum level of programming skills to successfully embark on such a highly-specialized career.

II. The ePOM Project

A. Rationale

The Python programming language is a natural choice as a means to provide programming skills to Ocean Mapping students and professionals alike. The language is simple to learn for inexperienced programmers, increasing popular, and freely available. Python is quite popular for academic work, and it is publicly available at no cost to ocean mapping agencies around the world. At the same time, Python is a popular solution among embedded scripting languages for GIS applications (e.g., both QGIS and ESRI ArcMap support Python scripting). Furthermore, the NOAA Office of Coast Survey has made Pydro publicly available. Pydro is a Python distribution and a suite of several libraries and applications developed to support effective hydrographic workflows. Based on such considerations, the Center for Coastal and Ocean Mapping/NOAA-UNH Joint Hydrographic Center (CCOM/JHC) has recently decided to include Python language training in its hydrographic curriculum. This decision triggered the creation of the e-learning Python for Ocean Mapping (ePOM) project (https://www.hydroffice.org/epom) in January 2019.

B. Teaching Goals and Project Structure

The teaching goals are to familiarize ocean mapping students and professionals with key programming concepts and, at the same time, to teach them programming habits and skills that can be easily translated to other programming languages. Given the popularity of Python, there is much online material about the language. This can be overwhelming. The ePOM project aims to help navigate through the huge amount of online resources. Last, but not least, ePOM aims to familiarize users with the popular open-source Python scientific stack and the Pydro distribution. The project was developed using Jupyter notebooks. It was structured with two main sets of notebooks: 1) *Programming Basics with Python*, with a focus on basic programming concepts with ocean mapping applications; and, 2) *Introduction to Ocean Data Science*, providing elements of object-oriented programming, data visualization, scientific computing, and geospatial data formats. During the summer of 2019, both sets have gone through an incubation phase and received feedback and comments from a number of volunteer beta testers.

C. The First Teaching Cycle and the Worldwide Interest

The last part of this paper presents and discusses the evaluations collected after the first teaching cycle that occurred at CCOM/JHC during Fall Term 2019. The extremely positive feedback from the enrolled students (as well as from several Center's faculty and staff), combined with the progressive increase in quality of their produced work, strongly supports the validity of the solutions currently adopted by the ePOM project. At the same time, the project has obtained the attention of agencies and individuals around the world, highlighting the potential impact of such an initiative for the ocean mapping field in the coming years.