Imperial College London
Department of Earth Science and Engineering
MSc in Applied Computational Science and Engineering

Independent Research Project
Project Plan

ARGOWorks: Developing of a new software platform to analyse and visualize ARGO floats data

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by
Vagif R. Aliyev

va719@imperial.ac.uk

GitHub login: acse-va719

Supervisors:
Dr. Yves Plancherel

Ophelie Meuriot

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Abstract

Start with a roughly 200-word (no more than 300 word) abstract, and a maximum of six keywords describing your project and solution (e.g “fluid dynamics”, “machine learning”, “wind turbines”).

Contents

1 Introduction

Your introduction should include a brief summary of the problem that your code/or computational analysis addresses. Describe your objectives and/or hypotheses, and outline the tasks completed during the independent research project. Describe state-of-the-art of solutions to the problem, including commercial and academic approaches, and cite these using the reference style described in the "Guide for Authors" document from the SoftwareX journal. Describe briefly the requirements of your solution (Software Requirement Specification – SRS). Clearly state how your independent research project goes beyond the state-of-the-art and what original work you have done.

Studying ocean is very essential for Earth as it cover 70 % of its surface, absorbs 1/3 of carbon dioxide emissions and plays the major role in protecting us from the effects of greenhouse. Thus, obtaining data and understanding it in this field has become more essential as these factors have become more threating. One of the leading providers of ocean data is ARGO floats with over 3200 floats (growing) reporting with 10,000 profiles per month, providing a range of properties such as water mass, salinity, temperature etc (Argo Research use, n.d.).

The goal of the project is to take advantage of this data revolution to apply modern computing techniques to provide new user-friendly software to democratize access to this new ARGO data stream. The target is to aid and facilitate analysis of these data for researchers in this field.

1.1 Problem Statement

As mentioned on page 1

Argo floats has been first deployed in 1999 to combat the lack of data in the field and efforts are still being put to increase the number of floats (Roemmich, n.d.). Thus, there is an abundance of data available to study the ocean better. The primary goal of the project is to develop a machine learning algorithm that can be trained by the users to detect similar patterns in salinity (initially) across other current and historical data. This will be beneficial to scientist to observe how one part of the ocean can affect other parts across different or same timeline.

Through research I have found the Argo.py python library that eases the Argo data access, manipulation and visualisation (Maze, 2020). For the initial stages of the project, I will be making use of this library to access the data however the plan is to create my own data retriever functions at the end to make my programme less dependent on others work.

As of 2 December 2019, the ARGO Google Earth layer provided by ARGO itself has stopped functioning (Argo and Google Earth, n.d.). There are few alternatives available however it does not provide the same quality and ability to manipulate the data freely by the user. Thus, one of the goals of the project is to fill the void left behind and build up a new platform using the Google. There are two options available. Google Earth which enable user to travel and explore the world interactively. On the other hand, Earth Engine is a tool specially created for analysing geospatial information. Using this, properties such as water coverage and etc can be analysed as well.

2 Methodology (Software Description)

Describe the technical back-end of your solution. Describe if it was developed as a standalone code or if it is an extension of a pre-existing piece of code. In the latter case, briefly describe the ecosystem in which you developed your solution. List and describe what development and operation tools (devops) have been used, outline the development methodologies used, and describe why. Add an architectural design diagram of your solution if relevant. Describe your design rationale and your implementation strategy, including the description of main data structures, routines, and any parallelisation paradigm (shared vs. distributed), and their respective verification and validation routines. Add algorithms, pseudo-code, and if required also code snippets of the most important functionality that you implemented. Emphasise the novelty and creativity of your own work.

3 Code metadata

You should succinctly describe the technical platform of your implementation, including any compilation requirements or dependencies – such as programming languages and libraries (open source or proprietary), as well as a description of both the implementation and deployment platforms (operating system, basic hardware requirements if any). Add the current code version number of your software/computational solution, a link to the code (such as a link to the repository), and links to any developer documentation, user and/or developer support documents. This can be a table, or a short paragraph.

4 Results

Describe the simulation features and capabilities, as well as the test/study cases investigated during your IRP. Describe the unit or system tests, and where applicable also integration tests, that you ran to determine if your program accurately solves the stated problem. Present validation and/or verification results. Describe the implementation of your design, the functionality of your code, and how it may affect accuracy, efficiency and scaling of your computational solution. Present the results of your computational analysis and quantify your results.

5 Discussion and Conclusions

Add a brief discussion session to the report. What were the most difficult tasks to resolve in completing the implementation? What are the strengths and limitations of your solution? What are the next steps? What worked and what did not work? Be formal in your analysis, as if you were writing a journal paper, quantify your statements and base your conclusions on findings of your study. If applicable, briefly describe any planned future work related to your project.