

KTP recruitment technical challenge

0183-24 - ML Engineer for Traffic Modelling - KTP Associate

Technical Task

May 15, 2024

Introduction

This challenge has been designed to have a clearer understanding of your technical skills and to elicit questions for the interviews. Ideally, you would provide a working solution, but it is not necessarily expected. Partial solutions are welcome; for instance, a decomposition of the problem into smaller problems along with a solution for a subset of those smaller problems.

This challenge must be completed **individually**. We are providing data (as NumPy compressed files) and Python code as a starting point – but you can use any language for development. Your prototype must be fully and easily reproducible using the data files provided (see below).

Task Details

Assume that you secured the job and your first task is to develop software to detect changes in a specific environment. The environment is a circuit in the premises of one of Smart Transport Hub's clients. Due to operational constraints, the company decided to develop a prototype in a simulated environment first, so that it can be deployed on a car later (manoeuvred, *i.e.* not autonomous). To guide your design decisions, you can also assume that the car will be endowed with a camera of similar characteristics and a NVIDIA Jetson AGX Orin as an onboard computer.

Your task is to:

1. Develop software to detect changes using the recordings provided. If possible, including labels for the items that have appeared, disappeared, or moved.
2. Write a short report (1 page), briefly describing:
 - your solution,
 - the rationale behind the design choices you made, and
 - how you would improve the prototype if you were given 6 more months (*e.g.*, ideas that you would test).

What you are provided with

We have shared a compressed folder in a file named `challenge_data.zip`. You can find this file in the following URL: <https://aston.box.com/s/ccsmtsaw6d17ma3y6cbvi6gcdakbd298>.

In the compressed folder `challenge_data`, you will find **two NPZ** files (named `base.npz` and `test.npz`) with the same structure. The goal is to detect changes in the scenarios captured in `test.npz` with respect to `base.npz`. Each of these two files contains three arrays:

- **images:** A `uint8` array of shape (2735, 200, 400, 4). It contains 2735 RGBA images corresponding to the 2735 time steps for which data has been recorded.
- **gps:** A `float` array of shape (2735, 3), corresponding to the x , y and z coordinates of the vehicle at each time step. Gaussian noise has been added to these measurements.
- **compass:** A `float` array of shape (2735, 3), corresponding to the magnetic field in the x , y and z axes at each time step. Gaussian noise has been added to these measurements.

You are also provided with a Python script that you can use as a starting point: `play.py`.

Submission

More specifically, your solution must contain:

1. **Code:** There are no restrictions in terms of libraries and code re-used, as long as use of third party code is acknowledged and publicly available. You can structure your code in multiple classes modules and files, as you deem appropriate.
2. **Brief report:** It should be a 1-page PDF file with a font size no smaller than 11pt. The content expected is described in the section “task details”.

To submit your answer to the challenge, please place all the necessary files –**with the only exception of the NPZ files**– into a folder and compress the folder as an unencrypted ZIP file. Then, attach the ZIP file to an email and send it to Luis Manso (l.manso@aston.ac.uk) by 23:59 BST of the 23rd of May, with the subject “KTP 0183-24”.

Please, ensure that you do not include the NPZ files in your email, as the email server would reject it due to their size.