Take-Home Challenge - Computer vision engineer

1. Computer vision programming

- Find a satellite image, covering at least 1km^2
- Write a C++ program that takes as an input **(satellite_image, x, y, altitude_m, tilt_degrees)**, and:
    - generates a “camera image” that is an imitation of an image from a drone camera
    - captured at location **x,y** of the satellite image (in coordinates relative to image size, so that 0.5,0.5 is the center of the image)
    - at the altitude **altitude_m**
    - with pitch angle: **tilt_degrees**

Bonus points for:

- instead of being given the image, the program acquires the satellite image for any given geographical coordinates
- “camera image” looks like it’s a different season (f. ex. winter instead of summer)
- “camera image” looks like it’s from a thermal camera

2. System design

- Design an NN-based system that:
    - takes a camera image similar to what’s generated by the program above
    - has access to at least 100 satellite images (each is a 1km^2 tile)
    - matches this image to specific coordinates on a specific tile
- the system must run in real time on RPi5 or equivalent
- this part is very free-form, it can be one end-to-end NN, or several neural networks, with any kind of additional modules as needed.
- For the neural network(s)
    - write prototype-level Pytorch models/modules code.
    - it should cover the model architecture, and loss computation
    - it does not have to actually work/run/train, some parts that are not related to architecture/loss can be skipped
    - Instead of python/pytorch code you can just write a detailed description of the NN(s) architectures, losses, and other details

Bonus points for:

- the neural network(s) are fully implemented and work (given weights and dataset(s))
- training can at least overfit to a single data point

Delivery

Please decide yourself on the details of the delivery/presentation
The basic delivery is:
- code for the C++ program (plus a report document, or you can present yourself in person)
- for the C++ program: binary that can run on Ubuntu 24.04, or a well documented build process that would work on Ubuntu 24.04

- report and Python/Pytorch code for the NN-based system part

Questions

- This task is expecting you to make your own decisions and tradeoffs on the details that are under-specified. After all, in this position, you should feel comfortable with creative freedom, and enjoy high levels of autonomy
- Still, If anything in this task needs clarification, please do not hesitate to reach out to Sergii, sergii@lendurai.com

Submission

Send the repository link (or zip) plus the design notes by **00:00 UTC one week from receipt**.