

# Project report

Author: Domonkos Rózsay, Supervisor: Csaba Sidló

2023. December

Application of artificial intelligence methods for route planning on multilayered maps

## Abstract

The original subject of the project was the further development/enhancement of an existing application using neural networks. The application calculates accessibility scores in a given area based on several different kinds of map layers, which are then highlighted with green, yellow, and red colors corresponding with fully-, partially and not accessible areas. The project's goal was to have an estimate of this score from a layer, such as vegetation or road network, based on satellite imagery using pre-trained neural networks.

## Progress so far

For me, the first and biggest challenge was understanding the working environment. During the project, I worked in a Docker container, and it took a considerable amount of time to become familiar with it. I was told that the map and scores can be effectively visualized using programs like QGIS or MapServer. Since I couldn't find a Docker version of QGIS, I had to deal with MapServer, which does have one. Unfortunately, there is very little mention of running it in a Docker container in the official documentation. Creating it appropriately posed many problems for me, with only this information available on the official website:

```
%%Example Docker Run call
docker run -d -t --name <msdock> -v ./u02 -u:<uid>:<gid> -p <port>:80 mapserver/
mapserver:<tag>
```

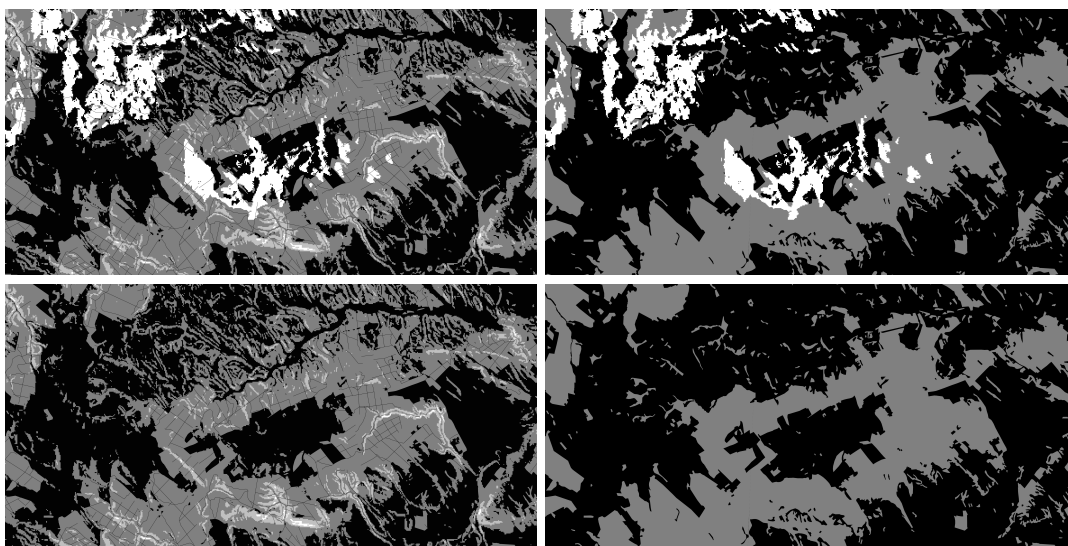
Even after adjusting it correctly, it didn't work; in my opinion, there might be some error or incompatibility with Oracle. In addition to this, I looked at several GitHub pages, most of which had similarly verbose descriptions, and not all of them were up-to-date. The ones I checked were 13-2 years old, and eventually, I managed to run a 7-year-old one from geo-data, which didn't throw back any error or stop immediately.

After successfully installing it, I was able to use the MapServer CGI with a bit of exploration. The official page<sup>1</sup> helped with parameters and syntax, but in some places, I feel that more descriptive documentation or more examples would be helpful. Once this was achieved, I had to display the map made available to me. This also posed several problems, especially in understanding and using the built-in parameters.

The default "browse" mode -which allows interactive and dynamic setting of layers- unfortunately does not work without another "Template" parameter, which I only discovered after a lot of searching and quite late. To circumvent this I used another "map" mode and saved the displayed image. The drawback was that I had to manually set the layer parameters, which required further exploration and tutorial watching.

---

<sup>1</sup><https://mapserver.org/documentation.html>



We can see going from top to bottom, left to right: The full accessibility (top left), everything but visibility score (bottom left), vegetation and visibility (top right) and only the vegetation (bottom right)

Informally, the layers describe how the map, for example from a vegetation file, should display any given pixel. It is important to note that one can set for each layer how the other layers are overwritten in display. In the presented maps, for simplicity, areas are depicted with white-gray-black colors instead of red-yellow-green where black corresponds to walkable and white corresponds to non-walkable. This way, a higher value (e.g. 255-255-255 for white) can overwrite a lower value (e.g. 0-0-0 for black).

## What can be done next?

After my work so far, the next steps could involve breaking down the saved images into smaller areas, possibly pixel by pixel, along with satellite imagery of the same area. Then, a convolutional neural network (CNN) can be trained and tested to predict the accessibility scores on satellite images.