DIGITAL ETHICS CANVAS

CONTEXT

Machine learning code for road segmentation

SOLUTION

BENEFITS

Help determine where roads are on a satellite image,
which could be used to create a GPS, for example, or for urban planning studies

WELFARE

RISK

- Can the solution be used in harmful ways, in particular with regards to vulnerable populations?
- What kind of impacts can errors from the solution have?
- What type of protection does the solution have against attacks or misuse?

In its current state, the code does not pose any immediate danger to anyone. However, if our code were used as part of a larger system, such as a road detection code for a GPS or an autonomous vehicle navigation system, an error in our code could have much more significant consequences.

MITIGATION

To prevent misuse of the code, it should warn the user to verify the predictions obtained before using them. This could be added to the README.

FAIRNESS

RISK

- How accessible is the solution?
- What kinds of biases may affect the results ?
- Can the outcomes of the solution be different for different users or groups?
- Could the solution contribute to discrimination against people or groups?

The images used for training and testing all appear to come from satellite images of developed countries. This means that if someone uses our code with images that are not satellite images or images that show different types of roads (for example: non-concrete roads, dirt roads, non-straight roads such as roundabouts, roads of other colours) then the predictions obtained will surely be wrong. Some countries, particularly developing countries, will find it more difficult to use our code.

MITIGATION

This risk of unequal usage is difficult to resolve within the context of the project. To reduce this bias, different images should have been used instead of the ones provided: images of roads from different countries and images that do not come from satellites. This would have been difficult because these images would need to be accompanied by their predictions, which would have to match the format used in our code. However, we tried to reduce this risk by augmenting our data with transformations that allowed us to change, for example, the color of the image and thus the roads, as well as altering the shape of the roads, making them less straight, and adjusting the brightness of the images.

AUTONOMY

RISK

- Can users understand how the solution works and what its limits are?
- Are users able to make choices (e.g. consent, settings) in their use of the solution and how?
- How does the solution affect user autonomy and agency?

Python code, and particularly machine learning code, can sometimes be difficult to understand for beginners in Python. Furthermore, the code uses many libraries and requires modifying certain values to be used outside the scope of the course, which can sometimes prove to be challenging.

MITIGATION

By adding a README to our project that lists all the necessary installations for using the code (such as the libraries and the recommended graphics card), an explanation of the different files and how to use them, an explanation of the image format to be used, and examples of results obtained with the code. Additionally, the code should be well-commented so that any user with basic Python knowledge can read and understand the code and know where to change which constants to obtain the desired predictions.

PRIVACY

RISK

- What data does the solution collect
- Is it collecting personal or sensitive data
- Who has access to the data?
- How is the data protected?
- Could the solution disclose / be used to disclose private information?

Normally, only the user of the code has access to the images they use and the predictions they generate. Therefore, there should be no issues regarding data protection risks.

MITIGATION

No issues regarding data protection risks.

SUSTAINABILITY

RISK

- What is the carbon footprint of the solution?
- What types of resources does it consume (e.g. water) -and produce (e.g. waste)?
- What type of human labor is involved?

From a sustainability perspective, the training part of the code requires a powerful computer or servers to process large datasets, which consumes a lot of energy. Servers, in general, have a very large carbon footprint because they require energy not only to operate but also to ensure proper cooling.

MITIGATION

There aren't many solutions to this problem. To reduce the energy consumption of the code, we could improve its performance by using more powerful and specialized libraries to reduce execution time and memory usage. A basic example is using NumPy arrays for matrix calculations instead of relying on too many for loops.

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