SEMI-SUPERVISED DEEP LEARNING FOR POINT CLOUD SEGMENTATION

The digitalization of railroad infrastructure is aimed at the improvement of maintenance and construction activities. Currently, inspections are done manually, with a domain expert classifying objects. This is a challenging task, considering the Netherlands has more than 3,400 km of railways that need to be inspected and maintained.

Point cloud

3D Object model

Point cloud and 3D object model matches.

Point cloud and 3D Object Model do not match

The research group (lectoraat) Ambient Intelligence collaborates with Strukton Rail to work with point clouds, which are sets of spatial data points captured by 3D scanning techniques such as lidar. These point clouds contain many million points of data, resulting in 3D representations of the railway environment. Point cloud data can be used to create machine learning models for segmentation: automatic classification and localization of objects in railway infrastructure. One hurdle is the reliance on labeled data set to train such models. Since the data is labeled manually, which is an error-prone process, secondly, it requires a great deal of effort to label data.

In this assignment, you have the opportunity to contribute directly to going beyond the state-of-the-art in applied research. You will become part of our research team as an active member with direct lines to our researchers and domain experts at Strukton Rail.

TASK DESCRIPTION

In this project, the aim is to use semi-supervised learning in a deep learning context to deal with sparsely labeled data and create classification models that can segment railroad objects to a certain degree of accuracy. More concretely, in this project, you will:

- Prepare a state-of-the-art overview for semi-supervised deep learning.[1,2]
- Train a semi-supervised learning-based model for point cloud segmentation on the dataset.
- Establish what the minimum number of labels is which is required for a usable model.
- Integrate the model into a dashboard for visualization of results.

PRACTICAL INFORMATION

- **Student profile:** HBO-ICT, Applied Computer Science, MSc computer science. The student must have basic knowledge of data science; experience with scikit-learn or a similar framework is preferable.
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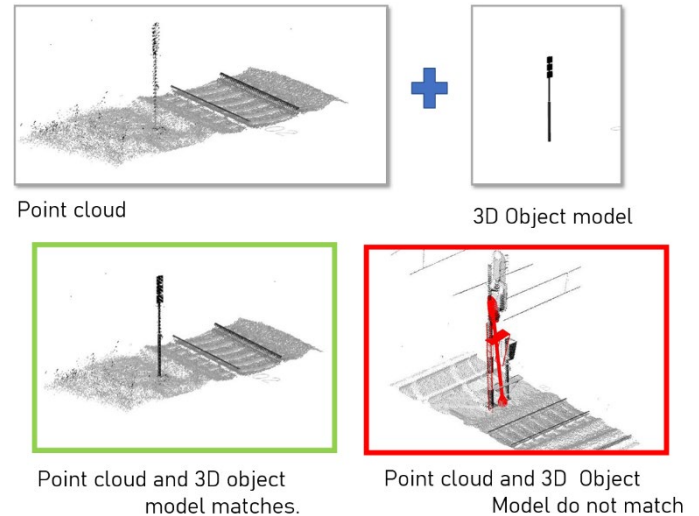
[1] Kipf, T. N., & Welling, M. (2016). Semi-supervised classification with graph convolutional networks. arXiv preprint arXiv:1609.02907.

[2] Wang, Y., Sun, Y., Liu, Z., Sarma, S. E., Bronstein, M. M., & Solomon, J. M. (2019). Dynamic graph CNN for learning on point clouds. Acm Transactions On Graphics, 38(5), 1-12.