Masterarbeit zu vergeben

Data Augmentation in Laboratory Vehicle-Track Model for Improvement of the Fault Classification Performance of Machine Learning Algorithms and Transfer Learning to a full-scale Railway Vehicle

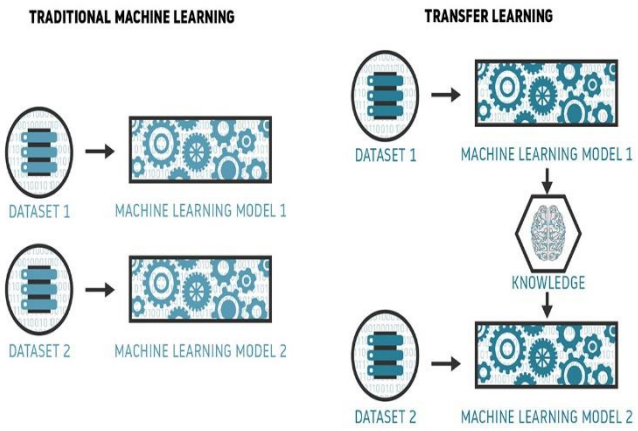
Data Augmentation im Laborfahrzeug-Fahrweg-Modell zur Verbesserung der Fehlerklassifizierungsleistung von Machine Learning Algorithmen und Transfer Learning auf ein vollmaßstäbliches Schienenfahrzeug

Machine Learning (ML) algorithms are data-driven, which means that their efficiency and capabilities depend on the quantity and quality of the available data. However, there are still applications where it is difficult, not affordable or even impossible to gather data. For railways, collecting large, labelled and balanced, real fault data sets is particularly difficult.. A solution to the issues of data sparsity is the data augmentation approach, where synthetic data is generated from just a few instances of information, increasing the amount of available, useful training examples.

A common practice to analyse physical systems is by using down-scaled experimental prototypes or laboratory models, which approximately emulate the conditions of the real system. However, the knowledge gained using laboratory models must still be transferred to the real, full-scale system. A possible way to do so is using the Transfer Learning (TL) approach.

TL is a research problem in ML that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem. The TL approach is especially useful when laboratory algorithms must be applied to real systems.

The objective of this work is the modification of an existing Generator of Track Irregularities implemented using a Conditional Generative Adversarial Networks (CGAN) to synthesize artificial data for a down-scaled vehicle-track interaction model. This to produce a large, rich and balanced dataset of structural faults on the railway track, which may be suitable for FDI applications using ML algorithms. Once the classification models for the laboratory model are properly trained, they may be useful to train further classification models, via TL methods, to detect faults using a dataset coming from a real, full-scale railway vehicle.



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