Automatic Identification of Trains from Images

V3C

Abstract

The aim of this project is an ability to automatically detect and read identification numbers of trains from images. Our software solution can identify all types of trains from several european countries. Both the detection task and the optical character recognition problem is enabled by modern machine learning methods based on artificial neural networks.

Abstrakt

Cílem projektu je robustní automatická detekce a čtení identifikačních čísel vlaků z bočních snímků vagónů. Systém je schopen identifikovat všechny běžné typy vlaků z několika evropských zemí. Popsané softwarové řešení obsahuje rychlý detektor a přesné optické rozpoznávání znaků využívající moderní metody strojového učení.

This project develops software that is able to automatically read the UIC wagon numbers on trains in motion. The wagon images are acquired by a stationary line-scan camera system, which produces a sequence of pixel rows. A particular wagon image is then reconstructed from the individual rows based on the train speed. The individual wagon images are saved in separate files.

The identification number is issued in conformance with the International Union of Railways standard and it is usually contained in several lines within the labelling box (see Figure 1). The syntax and style of the labelling may depend on the type of the train (passenger or freight trains with different cargo) as well as the country in which the wagon was manufactured.

Method

Figure 1: Input image example of a goods wagon with highlighted label box (green) and individual textboxes (blue).

The pipeline consists of three main tasks:

1. Detection of the label box with the UIC wagon identification number and exact localization of all rows containing text.

   The detection task is performed using state-of-the-art methods based on convolutional neural networks (CNN). The method does not rely on region proposal techniques and processes the image in one go. This allows for a fast and accurate detection.

2. Optical Character Recognition (OCR).

   Each row is automatically converted into machine-encoded text using CNN.

3. Extraction of the UIC wagon identification number.

Challenges

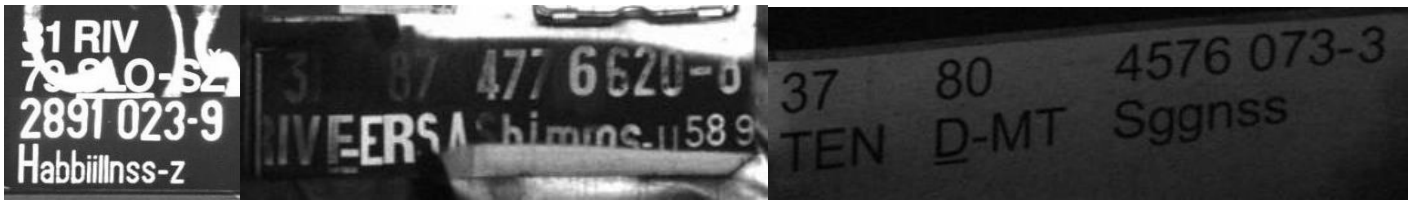

Figure 2: Examples of problematic label boxes. The text may be occluded, damaged or tilted at an angle.

The system must deal with a high variety of labelling styles and syntaxes. Both the detection and OCR must be invariant to rotations since the text is not always horizontally aligned. The text may be damaged or partially occluded by mechanical parts of the train as shown in Figure 2. This level of robustness is enabled by the use of modern machine learning techniques based on convolutional neural networks.

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