

# A Multi-Stage AI-based Approach for Automatic Analyzation of Bike Paths: Stage 1 – Road Surface Detection

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**Abstract.** This paper presents a system that uses a multi-stage AI analysis method for determining the condition and status of bicycle paths using machine learning methods. The approach for analyzing bicycle paths includes three stages of analysis: detection of the road surface, investigation of the condition of the bicycle paths, and identification of substrate characteristics. In this study, we focus on the first stage of the analysis. This approach employs a low-threshold data collection method using smartphone-generated video data for image recognition, in order to automatically capture and classify surface condition and status.

For the analysis convolutional neural networks (CNN) are employed. CNNs have proven to be effective in image recognition tasks and are particularly well-suited for analyzing the surface condition of bicycle paths, as they can identify patterns and features in images. By training the CNN on a large dataset of images with known surface conditions, the network can learn to identify common features and patterns and reliably classify them.

The results of the analysis are then displayed on digital maps and can be utilized in areas such as bicycle logistics, route planning, and maintenance. This can improve safety and comfort for cyclists while promoting cycling as a mode of transportation. It can also assist authorities in maintaining and optimizing bicycle paths, leading to more sustainable and efficient transportation system.

**Keywords:** AI, Machine Learning, Image Recognition, CNN, Automatic Detection, Conditions Analysis, Bicycle Paths, Surface Condition.