SUMMARY

The subject of this dissertation is the development of a modern solution, based on artificial intelligence algorithms, that can significantly improve the efficiency of bridge inspector's work. A strong emphasis is placed on the application of techniques for reducing the algorithms' demand for computational power and heterogeneous sets of learning data. The dissertation addresses the important issue of detecting concrete surface defects during bridge inspections. The focus is on a common but difficult to pinpoint and identify damage such as a crack with a width not exceeding 0.2 mm.

The paper contains an extensive literature study covering the methods of assessing the technical condition of bridges currently used in the world and in Poland, as well as the latest solutions in bridge technical condition monitoring described in research papers. A separate literature study was prepared for methods using artificial intelligence algorithms in structural engineering problems. Based on the literature analysis, the features of a useful engineering tool that can increase the efficiency of bridge inspections were concluded.

In the further part of the dissertation the method of development and implementation of the bridge inspector support tool was described. The algorithms used and their mode of operation are described, as well as the criteria for their selection. The created tool for supporting the construction and division of the data set into subsets for algorithms training is also presented. The proposed solution was also verified in terms of prediction accuracy on previously unseen datasets, as well as in comparison to the current state of the art methods in defect detection, represented by current, trained deep machine learning algorithms.

In the next part of the work, the proposed solution was extended to include a system capable of automating the damage vectorization and measurement of its parameters based on the data contained in the image, enriched by the determined camera to target distance. This system consisted of a designed peripheral smartphone add-on measuring the distance, communicating with the smartphone during image capturing, and logic allowing for defect segmentation. It was subjected to usability evaluation as the second step of the bridge inspector support tool proposed in the dissertation.

As a result of the experiments, the main thesis of the dissertation was confirmed. The dissertation was concluded by indicating potential directions for further research work and describing conclusions regarding tools and methods used in the inspection of concrete bridges.

12.07.2022