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Hyper Parameter Optimization of Deep Convolutional Neural Networks for Pavement Distress Classification

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Abstract : Pavement distress is the main factor responsible for the deterioration of road structure durability, damage vehicles, and driver comfort. Transportation agencies spend a high proportion of their funds on pavement monitoring and maintenance. The auscultation of pavement distress was based on the manual survey, which was extremely time consuming, labor intensive, and required domain expertise. Therefore, the automatic distress detection is needed to reduce the cost of manual inspection and avoid more serious damage by implementing the appropriate remediation actions at the right time. Inspired by recent deep learning applications, this paper proposes an algorithm for automatic road distress detection and classification using on the Deep Convolutional Neural Network (DCNN). In this study, the types of pavement distress are classified as transverse or longitudinal cracking, alligator, pothole, and intact pavement. The dataset used in this work is composed of public asphalt pavement images. In order to learn the structure of the different type of distress, the DCNN models are trained and tested as a multi-label classification task. In addition, to get the highest accuracy for our model, we adjust the structural optimization hyper parameters such as the number of convolutions and max pooling, filers, size of filters, loss functions, activation functions, and optimizer and fine-tuning hyper parameters that conclude batch size and learning rate. The optimization of the model is executed by checking all feasible combinations and selecting the best performing one. The model, after being optimized, performance metrics is calculated, which describe the training and validation accuracies, precision, recall, and F1 score.

Keywords : distress pavement, hyperparameters, automatic classification, deep learning
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