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Applying machine learning for rapid and automatic characterizations of concrete rebars based on EMI and GPR data

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The properties of concrete rebars are usually difficult to be accurately and rapidly detected by a conventional non-destructive detection method. An EMI-GPR dual-sensor device has been developed for simultaneous determination of rebar diameter and cover thickness. In this work, we propose to apply machine learning algorithms in the EMI and GPR data to implement a rapid and automatic rebar identification. We use YOLOv3, an object detection algorithm, to extract the hyperbolic reflections from the GPR images, through which the location, number and spacing of the rebars can be rapidly determined. Then, we use the reverse time migration method to estimate the possible range of the cover thickness as the constraint condition of EMI data. Finally, a general regression neural network (GRNN), which is trained by the EMI calibration dataset, is applied to estimate the rebar diameter and cover thickness. The study shows that machine learning algorithms are able to rapidly and automatically characterize the rebar properties, expected to relieve the labor-consuming field inspection work.