A knowledge-embedded neural network for atmospheric corrosion rate prediction

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Abstract At present, atmospheric corrosion research mainly relies on coupons specimen, which usually generate data once a year[1]. In contrast, atmospheric corrosion monitoring (ACM) technology can reflect the corrosion rate in real time through current[2]. However, it is expensive and difficult to deploy sites over a large area like coupon experiments. Building corrosion maps based on data from a few monitoring stations is a challenging problem.

However, the development of artificial intelligence technology has provided new possibilities for solving this problem. A complex nonlinear relationship between corrosion current and environment is established through a deep network[3], and the corresponding corrosion current is predicted based on the environmental variables of unmonitored locations, thereby helping to analyze the changes in corrosion rate over time and space. However, there are few ACM monitoring sites. In order to enable the neural network to effectively fit the relationship between environmental variables and corrosion currents at different locations, this paper proposes a knowledge embedding neural network (KENN) model for the prediction of atmospheric corrosion rates. Figure 1 shows the overall framework of our model. The model embeds common corrosion knowledge into the neural network, which compensates for the sparsity of monitoring sites and ensures that the prediction results are consistent with the prior knowledge[4].

The data simulation results show that KENN outperform other traditional machine learning methods in terms of prediction accuracy. Additionally, there is good agreement between the corrosion maps built from ACM data and those built from coupon data within one year. According to actual needs, the data obtained through KENN can be used to build corrosion maps for any time period, which can help

researchers better understand the spatial and temporal variations of atmospheric corrosion.

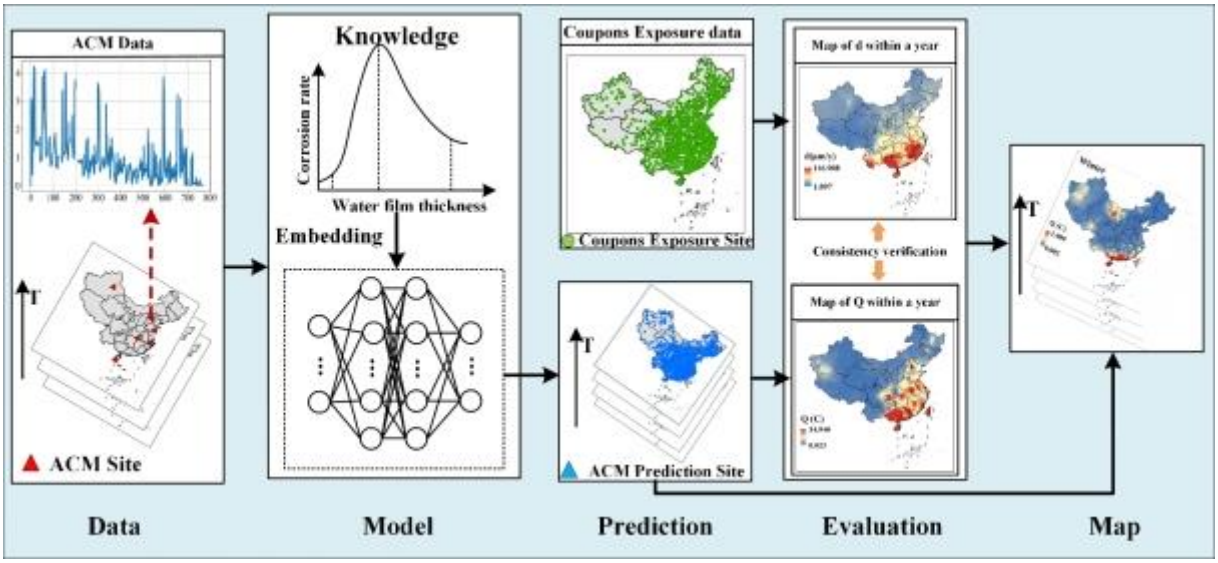

Fig.1 Overall Framework for Corrosion Rate Prediction based on KENN.

Keywords knowledge-embedded, Sparsity, Atmospheric Corrosion Monitoring technology, Corrosion Map

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