Study on Discrimination Model and Application of Mine Water Inrush Source Based on Swarm Intelligent Neural Network

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Abstract: Mine water inrush is one of the most threatening natural disasters in the process of mine construction and production. Once mine water inrush occurs, how to quickly determine the cause of water inrush and find out the source of water inrush is the key to solve and further prevent the water inrush disaster. Because hydrochemical data is the most essential feature of groundwater, it is fast, accurate and economical to discriminate the source of mine water inrush from water quality data. Starting from the frontier disciplines of artificial intelligence, bionics, chaos theory, mathematical statistics and computer programming language, BP neural network with non-linear mapping function was introduced into the discrimination of groundwater hydration characteristic components. At the same time, particle swarm optimization (PSO) intelligent optimization algorithm was used to globally optimize the initial weight and threshold of neural network, it could improve the convergence speed, avoid over-fitting and improve the generalization of neural network in the training process of neural network. In order to overcome the "premature" convergence of PSO, an improved particle swarm optimization algorithm (MPSO) was proposed by improving the parameters of inertia weight, cognitive coefficient and social coefficient, random mutation operator and so on. Adaptive chaotic particle swarm optimization (ACPSO) was proposed by introducing the “premature” judgment mechanism and chaotic mapping principle into PSO. MATLAB software was used to design and compile the program, four kinds of non-linear water inrush source discrimination models, BP, PSO-BP, MPSO-BP and ACSO-BP, were constructed. The application results show that the neural network based on swarm intelligence optimization improves the discrimination accuracy of mine water inrush source, but compared with each other, ACPSO-BP is better than MPSO-B, MPSO-BP is better than PSO-BP, PSO-B is better than BP in convergence speed, accuracy and generalization ability. It not only enriches the theory and practice of mine water hazard prevention and control, but also provides a strong guarantee for mine water hazard prevention and control, which has certain application value and significance.

Key words: mine water inrush source, hydration feature extraction, BP neural network, swarm intelligence optimization algorithm, nonlinear discrimination

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