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Improvements in Double Q-Learning for Anomalous Radiation Source Searching

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Abstract : In the task of searching for anomalous radiation sources, personnel holding radiation detectors to search for radiation sources may be exposed to unnecessary radiation risk, and automated search using machines becomes a required project. The research uses various sophisticated algorithms, which are double Q learning, dueling network, and NoisyNet, of deep reinforcement learning to search for radiation sources. The simulation environment, which is a 10*10 grid and one shielding wall setting in it, improves the development of the AI model by training 1 million episodes. In each episode of training, the radiation source position, the radiation source intensity, agent position, shielding wall position, and shielding wall length are all set randomly. The three algorithms are applied to run AI model training in four environments where the training shielding wall is a full-shielding wall, a lead wall, a concrete wall, and a lead wall or a concrete wall appearing randomly. The 12 best performance AI models are selected by observing the reward value during the training period and are evaluated by comparing these AI models with the gradient search algorithm. The results show that the performance of the AI model, no matter which one algorithm, is far better than the gradient search algorithm. In addition, the simulation environment becomes more complex, the AI model which applied Double DQN combined Dueling and NosiyNet algorithm performs better.

Keywords : double Q learning,dueling network,NoisyNet,source searching
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