Abstract: To extract the feature information of lung parenchyma in Chest X-ray images and realize the auxiliary diagnosis of COVID-19 pneumonia, this paper proposed an end-to-end deep learning model based on the combination of convolution, multilayer perceptron (MLP) and bidirectional long short memory (Bi-LSTM) network. The model is mainly composed of region proposal network (RPN) object detection, multi-scale depth feature extraction, and multi-channel fusion classification modules. Firstly, the RPN object detection module used the deep convolutional neural network as the backbone to detect the chest cavity region, and returned the backbone model according to the coordinate information of the detection frame to achieve the feature extraction of four convolution layer with different receptive fields, combined with original image as the multi-channel input of classification module. Then, the 5-dimensional feature maps were input into the multi-channel pyramid MLP layer to achieve global feature analysis. Finally, the correlation analysis of feature maps from multi-channel output was realized by Bi-LSTM module, and finally the auxiliary diagnosis of pneumonia disease was realized through the classification module. Experimental results show that the proposed model has better classification performance and diagnosis effect than previous methods, which also proves that the proposed model has great clinical application potential.