Using deep learning to protect the diversity of the ecological environment Based on the prevention and control of alien species

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Abstract. Ecological environmental protection has gradually changed from the original protected species to the protection of the entire ecosystem, controlling the destruction of biological resources and the ecological environment. The protection of the diversity of the ecological environment is one of the important measures to prevent the destruction of the ecological environment, and the invasion of alien species is one of the important reasons for the destruction of the ecological diversity. The expansion of invasive alien species not only brings various disturbances or damages to the native ecosystem, but also pays a great price for human health and economic and social development. This article uses deep learning related models and methods to identify alien species to help strengthen the prevention and control of alien species. Based on the data of 3000 reporters of the Asian Hornet invading the United States, this paper trains and uses the Bi-LSTM model and the CNN model to identify the pictures of the Asian Hornet reporter's explanation and feedback, and makes full use of the above two models through XGBoost The output identification results and the temperature, humidity, air pressure and other parameters of the corresponding area were finally screened out of the invalid reports of sightings of the Asian Hornet reported by the masses. Compared with the 1,386 test data, the accuracy rate was as high as 0.956. The results can effectively identify and Prevent and control new species and protect ecological diversity.

1. Introduction
On July 23, 2020, the Ministry of Ecology and Environment of China issued the "Chinese Citizens' Ecological Environment and Health Literacy" (Announcement No. 36, 2020). The report clearly pointed out that "the prosperity of ecology leads to the prosperity of civilization, and the decline of ecology leads to the decline of civilization." It is the foundation for the healthy survival of mankind and the support for mankind to move towards the future. Human activities and their needs have caused pollution, resource depletion, forest degradation, marine environmental degradation, and biodiversity reduction, which in turn endangers one's own health and sustainable development. [10] The sharp decline in biodiversity has become an important manifestation of the destruction of the ecological environment. In addition to human factors, the expansion of invasive alien species is also an important reason for the destruction of the original ecosystem. New species are not complete in new areas. The ecological
environment chain may cause the rapid reproduction of species, and further have important impacts on plants, soil, other organisms, human health, and social economy. For example, Australia originally had no rabbits. In 1859, some rabbits were brought from Europe. Australia has lush pastures, which are suitable for the growth of rabbits, but there are no natural enemies. The annual expansion area of rabbits reaches 100km², less than 100 years, all Australian rabbits Reached 7.5 billion, eating grass equivalent to 750 million sheep, while rabbits burrowed holes in the pastures to make nests, which caused great damage to the grasslands and greatly reduced the livestock capacity of the pastures. [11]

The Asian hornet, belonging to the Vespa family of the order Hymenoptera (about 5000 species of Hufeng family in the world [3]), is the largest known wasp species in the world, ranging in length from 38-50 mm. Compared with other wasps, the head It is orange and bald (Lee 2010; Matsuura and Sakagami 1973). Such wasps are mainly distributed in dense woodlands and mountains, and their nests are also generally placed in existing caves, snake holes or rotting tree roots (Archer 1995). The Asian Hornet has a greater impact on humans, some invertebrates, and the economy. The venom of the bumblebee not only causes pain in humans, it may cause allergic reactions, and in severe cases, it may damage related human tissues (Schmidt 2019). Such wasps are predatory and usually feed on various terrestrial invertebrates, especially honeybees. [6] As the main way of pollen transmission, bees have a serious impact on effective pollination due to the death of a large number of bees, which in turn affects the development of agriculture. [5]

Due to the wide variety of organisms, how to identify and further prevent and control new species has brought us a huge test. Based on the data of 3000 reporters, this paper trains and uses the Bi-LSTM model (bidirectional recurrent neural network) and the CNN model (convolutional neural network) to identify the images of the Asian Hornet reporters and feedback, and use the XGBoost model Based on the two identification results, combined with Bumblebee's suitable temperature, humidity, air pressure and other parameters, finally successfully screened out the invalid reports of the witnessed subspecies Bumblebee reported by the masses. By comparing with 1386 test data, the accuracy rate is as high as 0.956.

2. Process and method

This paper uses the Bi-LSTM model (long short-term memory network) and the CNN model (convolutional neural network) to respectively identify the pictures of the Asian Hornet reporter's explanation and feedback, and through XGBoost, based on the two recognition results, combined The suitable temperature, humidity, air pressure and other parameters of the bumblebee will finally identify the Asian bumblebee so that the government can prevent and control this alien species. The specific research process is as follows:

![Classification Model](image)

2.1. Text Sentiment Classification Model

Recurrent Neural Network (Recurrent Neural Network, RNN) is a type of recursive neural network that takes sequence data as input, recurses according to the evolution direction of the sequence, and all nodes...
(recurrent units) are connected in a chain. neural network) [7]. Bidirectional RNN (Bi-RNN) and Long Short-Term Memory networks (LSTM) are common recurrent neural networks [8].

Text emotion processing includes three major parts: INPUT MODULE, LSTM MODULE, and Output MODULE. The details are as follows:

| Input MODULE | LSTM MODULE | Output MODULE |
|--------------|-------------|---------------|
| Note text    | Output Layer | Linear Layer  |
| Preprocess   | O₁ \rightarrow H₁ | Predicted Feature Vector |
| Index        | O₂ \rightarrow H₂ | Negative Or Not |
| Word Embed    | Forward Layer |            |
| System       | \rightarrow H₃ |     |
| Input Embed   | Backward Layer |            |
| Vector       | \rightarrow H₄ |     |
|             |             |     |

**Figure 2. Text Sentiment Classification Model**

2.1.1. **Input Module.** Data preprocessing, the process is as follows:

1. In this paper, 2320 pieces of report information about the Asian Hornet are used as the training set, and each piece of data is divided into spaces, and each word is reserved. Use the minimum number of occurrences of 5 as the standard to construct a vocabulary.

2. Create a dictionary and word index table, and convert the above data set text from string form to word subscript sequence form.

3. Put the above text in the embedding layer to reduce the dimension of the vector, and finally obtain the word vector of the LSTM model.

2.1.2. **Bidirectional LSTM Module.** Because the LSTM model is unidirectional. Bidirectional LSTM is composed of two layers of LSTM. The input directions of the two layers are opposite. The newly added layer transfers the state to the previous element of the sequence step by step. See the BI-LSTM MODULE part in the figure above for details. Two hidden layers, Backward Layer and Forward Layer, represent forward propagation and backward propagation, respectively. Finally, combine the output of the two layers to get the final result.

2.1.3. **Output Module.** Output Module means that a linear layer is placed on the basis of Bidirectional LSTM Module, and the predicted feature vector is obtained from the output of the linear layer, and then the subscript of a larger number is selected from it to obtain the output category, that is, whether the mass witness report is an error report.

2.1.4. **Result analysis.** This article uses 2091 reports about the Asian Hornet as the test set. First, the model results are tested through cross entropy. This article assumes that the probability distribution p is the expected output and the probability distribution q is the actual output. The test result can be as low as 0.0995. The smaller the value of cross entropy, the higher the accuracy of recognition. Secondly, according to the ratio of the number of samples correctly reported to the total number of samples, this article calculates the accuracy rate of whether the forecast report is wrong, and the highest rate can reach 0.742.
2.2. CNN Model
This model can be divided into three independent modules: Input Moudle, CNN module and Output Moudle.

2.2.1. Input Moudle. Based on 4375 Asian Hornet images, this paper first preprocesses the image data, and divides the images into two categories: correct images and wrong images.

Put the above preprocessed data in the Input Module, and convert the image to the same capacity, and then enhance the image, including Random Crop, Color jitter, Random Grayscale, Rawdow Rotation, etc. On this basis, noise processing is added to the image. Image noise is an important enhancement step that enables the model to better separate the signal and noise in the image. Finally, for image standardization, the processing formula is as follows:

\[
\text{channel} = \frac{\text{channel} - \text{mean}}{\text{std}}
\]  

The standardized data will be used as the input data of the CNN Module.

2.2.2. CNN Module. The CNN model in this article uses the resnet50 model. As shown below:

![Resnet 50](image)

The Resnet model proposes to use residual learning to solve the degradation problem. For the stacked layer structure (multi-layer stacking), when x is input, the acquired feature record is denoted as H(x). In the residual learning, this article hopes to obtain the residual F(x)=H(x)−x, so the original learning feature is actually F(x) + x. When the residual is 0, the accumulation layer only performs identity mapping at this time, the network performance will not decrease, and the actual residual error will not be 0, so that the accumulation layer can learn new features based on the input features, thus having Better performance.

The model used in this article has two linear layers behind resnet50. Between the linear layer and the linear layer, this paper uses the RELU activation function to transform the data in order to increase the nonlinearity of the model. The functional formula of RELU is as follows:

\[
f(x) = \max(0, x)
\]

In the above training process, this article uses dropout. Dropout is to temporarily discard the neural network unit from the network according to a certain probability during the training process of the deep learning network. Note that for the time being, for stochastic gradient descent, because it is randomly discarded, each mini-batch is training a different network. The dropout can prevent CNN Moudle from overfitting.

2.2.3. Output Moudle. In order to obtain the dimension of the output result, Output Moudle uses a linear layer to convert the result output by CNN Moudle into the data dimension, that is, whether the report data is an error report.
2.2.4. Result analysis. This paper randomly selects 1000 photos as the test set, and the rest of the data as the training set. Using the model training set data to predict the test set, the accuracy rate can reach 0.943.

2.3. Classification model
First of all, this article queries its altitude, temperature, humidity, precipitation, wind speed, air pressure, cloud cover and average solar radiation based on the recorded data of the report.

Then, according to the text sentiment classification model, each report record data is predicted and classified, and the classification result is added to the above data as a new feature sentiment list. In addition, this article uses the CNN model to predict and classify based on the bumblebee image data.

Finally, through the xgboost model, the above model and data are combined, and 3000 pieces of data are used as the training set to train this model. The trained model is predicted on 1386 test set data, and its prediction results are compared with the real results. The accuracy can reach 0.956. The results show that this method can effectively identify and further prevent and control alien species, and effectively maintain the diversification of the ecological environment.

3. Conclusion
As one of the important reasons for the sharp decline of biodiversity, the invasion of alien species has had a serious impact on the ecological environment, and further affected plants, animals, soil, and even humans themselves and their socio-economic development. Human beings are paying higher and higher prices in this process. Based on the related model methods of deep learning, this paper proposes to effectively identify new species through language and pictures, and then help the government to quickly screen and count effective mass reporting reports, so as to quickly identify the location of new species, prevent and control new species, and protect local ecosystems. And the environment.

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