A Study on the Developmental Changes of Green Finance Based on the Context of Big Data

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Abstract. Along with the technological advances and developments of our time, the personal hosts, high performance mainframes or other multi-virtual machine distributed business clusters that people use are developing at a high rate, with high levels of hardware and software capabilities creating huge opportunities for our work and life. But at the same time, the amount of information we are now generating with our resources is exploding, such as the daily forecast, the hourly or minute-by-minute weather conditions, and our spring train ticket bookings, to name but a few. The simplest and most straightforward way to allow for a large allocation of resources is to increase or increase the amount of resources, but it is associated with a huge cost. It becomes particularly important to adopt good resource strategies and algorithms. The promotion of green development has had an impact on the effectiveness of the implementation of green financial policies. Therefore, through the comprehensive application of relevant theories, the practical situation of the specific reasons for the analysis, to effectively improve the effectiveness of the policy implementation of targeted recommendations, has a certain practical reference significance.

Keywords: Big data; Green finance; Policy implementation; Deep Learning

1 Introduction

Climate warming is a major concern for people around the world today, and at the heart of this is the increase in emissions of the greenhouse gas carbon dioxide caused by elevated human activity [1]. In doing so, it approaches the need for individual indicators to be developed separately and for synergy between them to promote progress [2]. In December of the same year, the Secretary of the People's Bank of China proposed to strive to achieve carbon peaking and carbon neutrality as the ultimate goal, and to fully improve the supporting policy system of green finance in China. At the beginning of the following year, the central bank proposed at a relevant meeting to complete China's solemn commitment to achieve peak carbon neutrality with high quality, and to further strengthen the green financial policy system and the construction of relevant supporting incentive mechanisms. Leveraging green finance to accelerate our ambitious goal of becoming carbon neutral by 2060 at a relatively low total cost to society [3].

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2 Smith's Policy Implementation Process Model

In The Policy Implementation Process, Smith (1973) focused on the impact of the policy implementation process on policy effects and developed a model for analysing the policy implementation process [4]. The above model consists of two components: policy formulation and policy implementation. The four factors in Smith's policy implementation process model simulate the various states of the policy implementation process in the field of public administration in modern society through interaction, expression, and feedback transfer, and have good practicality in the actual public administration process [5]. For a more visual impression, this can be seen in detail in Figure 1.

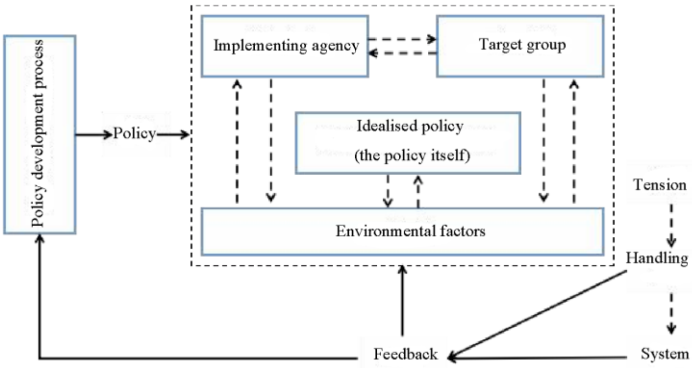

Fig. 1. Smith's Policy Implementation Process Model

3 Deep learning section

3.1 Principles of Convolutional Neural Networks

Convolutional neural networks are very similar to ordinary neural networks in that they both consist of neurons with learnable weights and bias constants (biases). Each neuron receives some input and does some dot product calculations [8], and the output is a score for each classification; some of the computational techniques used in ordinary neural networks still apply here [6].

(1) Local Connectivity

In the same way as a normal neural network, the neurons in the convolutional layer are also three-dimensional data and also have the concept of depth [7]. A convolutional layer consists of many filters (filters), and one filter trains data of one depth. So the number of filters is equal to the size of the depth [8].

For example, an example with input data of size $32 * 32 * 3$ and an output layer of depth 5 would have the same area of connected neurons relative to an output unit of different depth, but at the same location, with only the filter being different as in Figure 2.

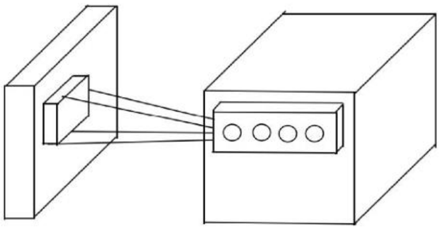

Fig. 2. Local connections.

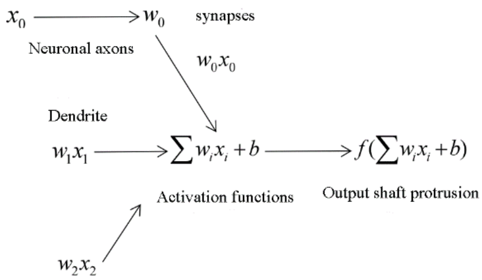

Fig. 3. Calculation method

Convolutional neural networks are calculated in a similar way to neural networks in general. Although all output units are connected to only some parts of the input, these are worth calculating in the same way. This means that the product of the weights and the input points is added to the bias parameter afterwards [9]. This is shown in Figure 3 below:

(2) Spatial arrangement

It is possible to calculate how many hidden cells can be in one output cell in one dimension (width or height) by using the following equation1:

$$\frac{W-F+P}{S}+1 \quad (1)$$

The meaning of each of these variables is as follows W: size of the input cell (width or height), F: receptive field, S: stride, P: number of zero-padding, K: depth, depth of the output cell.

The above formula may result in a calculation that is not an integer, which indicates that perhaps the current data size does not fit perfectly as an input [10].

(3) Convolution

Speaking of applying the concept of parameter sharing, it can also be said that the computations performed by the individual layers are in fact the convolution of the input layers and weights. Also the naming of convolutional neural networks is obtained according to this.As show in fig 4.

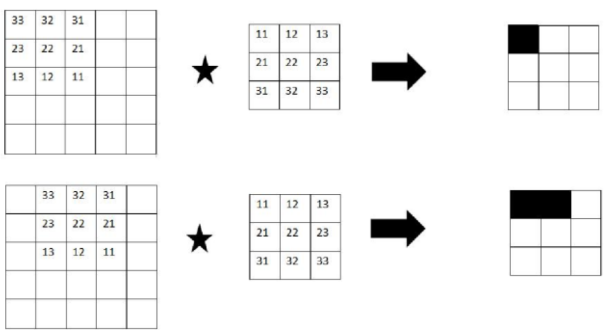

Fig. 4. Convolutional operations

(4) Pooling Layer

The pooling operation, also known as downsamples, is designed to reduce the number of feature maps. Each of these depth slices has its own separate pooling operation, with a regular size set to $2 * 2$. Unlike the previous convolution calculation, pooling has the following pooling algorithms:

The most common of these maximum pooling operations is shown in Figure 5 below, using a pooling size of $2 * 2$ and a step size of 2:

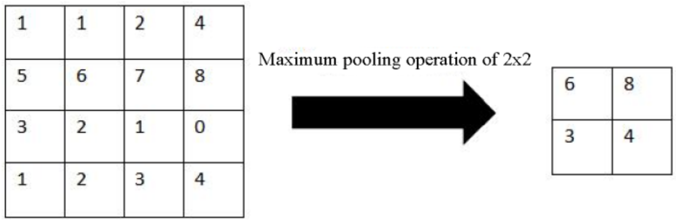

Fig. 5. Pooling operations

The pooling operation is characterised by the fact that it does not change the size of the depth at the end of the operation. Assuming that the input cells of the pooling layer are odd, the original data can be expanded to an even number by adding zeros to the edges and then proceeding with the operation.

3.2 Convolutional Neural Network Implementation

The first is the input to the deep learning network, which consists of a number of two-dimensional matrices, each containing information on system resources, job size, job execution, etc., during the job scheduling process. The specific composition is in the form of Figure 6 below.

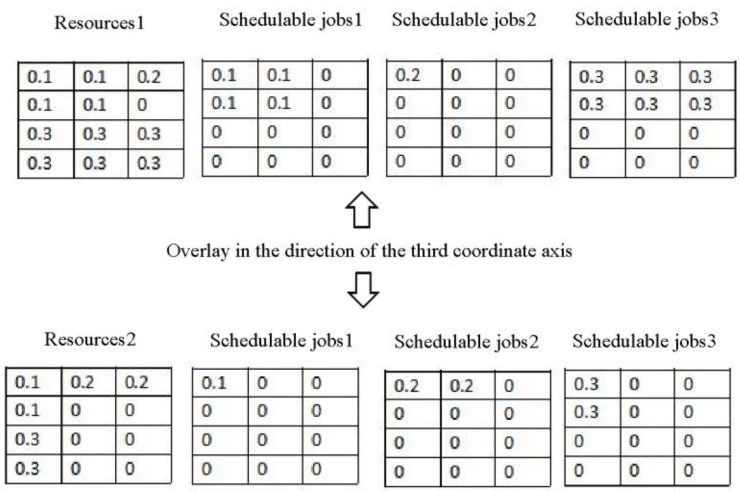

Fig. 6. Input schematic

3.3 Convolutional neural network parameter update

Deep learning parameter updating is achieved by means of an objective function and an optimisation function, where the objective function, often called a loss function, can generally be divided into two broad categories: classification and regression. In this thesis, the model for deep reinforcement learning is considered as a regression problem, which has an output format of a one-dimensional vector and where each element is a real number, first introducing the concept of residuals Eq. 2 as follows:

$$l_t^i = y_t^i - \hat{y}_t^i \tag{2}$$

This thesis uses a regression class objective function defined by the following equation3

$$L_{e_2 loss} = \frac{1}{N} \sum_{i=1}^{N} \sum_{t=1}^{M} (l_t^i)^2 \tag{3}$$

The objective function used in this thesis is a custom modification based on the 2 mentioned above, but it needs to be modified in conjunction with the knowledge of reinforcement learning, so it is left for the next section to be described in detail.

This thesis uses the expression for the commonly used L2 regularisation as follows Equation 4:

$$e_2 = \frac{1}{2} \lambda ||\omega||_2^2 \tag{3}$$

Then comes the optimisation function, as the neural network is updated by the residuals which is the gradient, so our optimisation function is to get the best objective function i.e. to get the smallest gradient, the parameter update method used in this thesis is the Adam algorithm in the gradient descent method, which is a method to calculate the different update rates for each parameter.

3.4 Model implementation

Reinforcement learning can be depicted in the diagram below. It is necessary to extract the environment from the task to be accomplished and from it to abstract the states, actions and rewards used to perform the action. The learning of the model is carried out broadly according to the following flow in Figure 7.

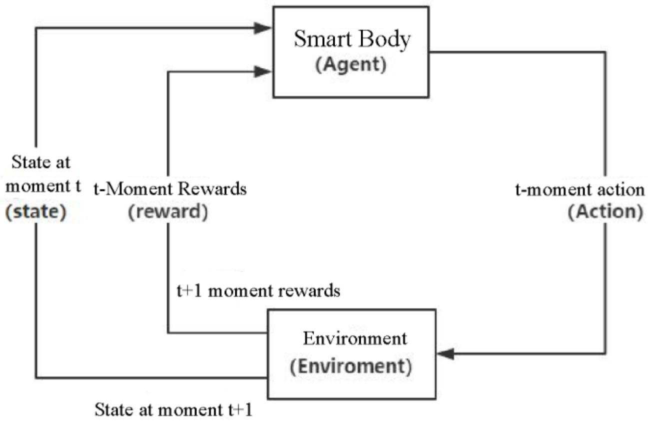

Fig. 7. Intensive learning process

4 Conclusion

Green financial policy refers to a series of institutional and policy arrangements to guide all types of social capital to invest in the development of green industries such as energy conservation, low carbon, environmental protection and new energy through green credit, private equity funds, green bonds, green stocks, green insurance and other financial product services. Theoretically, while pressure is exerted on environmentally polluting enterprises to switch to a low-carbon green development model through higher financing costs, the implementation of green finance policies that provide lower-cost financing to green enterprises can more effectively enhance their green innovation efficiency and ultimately promote the sustainable development of the entire social and economic system.

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