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# Computing System: Carbon Emission Calculation Platform based on Green Algorithm

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## Abstract

**This computing platform system is expected to have "three core technologies" when it is initially launched, namely: carbon emission comparison between CPU and GPU, CPU efficiency and memory usage of computing tasks, carbon emission big data computing center, and this system platform has login, main interface, basic architecture of carbon emission computing platform based on green algorithm, and client browser. The platform can establish a diversified and multi-level operation model based on accurate matching in the fields of physical particle simulation, weather forecasting, and natural language processing. In addition, this computing platform synthesizes the research status at home and abroad, first analyzes the influencing factors of data center carbon emissions, from the core power consumption of computing technology, from memory power acquisition to memory power consumption, establishes a prediction model based on LSSVM, and strives to analyze the results, so as to make a good prediction of data center carbon emissions, so as to propose measures to reduce data center carbon emissions and the future development trend of data centers.**

## Keywords

**Carbon Emission; Green Algorithm; Environmental Protection; Green Development Computing System.**

## 1. Introduction

In recent years, greenhouse gases in the atmosphere have had a huge impact on climate change, with global and local consequences. With the continuous development of economic and social civilization, the progress of computers in human society, including the advancement of hardware, software and algorithms, has made scientific research reach an unprecedented speed. Among them, the contribution of data centers and high-performance computing facilities to climate change is enormous. So far, while demand has grown rapidly, the energy efficiency of facilities has been increasing, and the total power consumption of data centers has been relatively stable, but this stability is likely to end in the coming years. For effective carbon emission reduction, a full-featured and highly reliable system platform can enhance the visualization of carbon emissions and calculate the carbon footprint of any task. Thus, the system platform was born.

Green Algorithm, is a free online platform that allows users to estimate and report their calculated carbon footprint. The Green Algorithm tool is easy to integrate with the computing process because it requires minimal information and does not interfere with existing code, while also accounting for a wide range of CPUs, GPUs, cloud computing, local servers, and desktop computers. The computing platform uses a simple, universal framework to quantify the carbon footprint of virtually any calculation.

Market Analysis[1]:

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For the carbon emission calculation platform, its own feasibility is of great practical significance. With the development of economic globalization, climate change is profoundly affecting almost all aspects of life on the earth, including human society, economy and health. Various human activities are responsible for large amounts of greenhouse gas emissions, including data centers and other sources of large-scale data computing. In general, the larger the model, the greater the computational demand, which in turn consumes more energy, which ultimately translates into an environmental impact. Using machine learning, the company proposes a method to estimate the carbon emissions of any computing task using a least squares support vector model, based on processing time, type of compute core, available memory, and efficiency of computing facilities. At the same time, a series of suggestions to reduce CO2 emissions and a look forward to the future development trend of data centers are put forward, hoping to raise environmental awareness and promote green development.

Technical analysis[2]:

In recent years, the domestic machine learning technology has been widely used, this method largely overcomes the traditional methods to deal with massive data, variable relationships and complexity of the lack of accuracy defects, many domestic scholars machine learning methods, such as BP neural networks, support vector machines, etc. in the field of reducing carbon dioxide emissions. The product synthesizes the research status at home and abroad, first analyzes the influencing factors of data center carbon emissions, from the core power consumption of computing technology, from memory power acquisition to memory power consumption, establishes a prediction model based on LSSVM, from the analysis results, the carbon emissions of data centers are well predicted, so as to put forward measures to reduce data center carbon emissions and the future development trend of data centers.

Analysis of advantages and disadvantages[3]:

Advantage:

At present, relevant policies and related technology development have been made in various fields such as data centers, both domestically and internationally, but there are many shortcomings so far. For example, when considering his purchase of a house, most of them will choose cloud providers, and in an effort to achieve carbon neutrality, they use a lot of renewable energy to power their data centers. For example, all of Apple's data centers are powered by clean energy. Another major energy consuming factor for server installations is the central energy usage efficiency hosted by the GPU, which represents the percentage of energy consumed for cooling, power conversion, and other ancillary tasks and can vary widely. On the other hand, while many cloud providers are carbon neutral, some of their data centers may still be carbon intensive because they are connected to the local power grid, while others are low-carbon and powered only by renewable energy, so choosing the right data center location has a big impact on carbon emissions. At the same time, the choice of computing hardware can have a significant impact on data center carbon emissions. Compare between different devices. It can be found that the efficiency of the CPU is ten times lower than that of the GPU, while the efficiency of TPU 3 is 4~8 times higher than that of the GPU.

The carbon emission computing platform based on green algorithm neutralizes the above problems and provides a diversified multi-service computing platform for carbon emission calculation. And that's where this product comes in.

Inferior position:

Although our project uses a variety of technologies, the key difficulty lies in how to achieve the perfect integration of the above technologies, and these technologies are difficult to implement, and it will take a lot of effort to implement this project, and we should think about how to make it easier for users to operate the device, the company is currently small and has not really entered the market.

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In summary, we should give full play to the advantages of enterprises to seize opportunities, use the unique advantages of technology to enter the market, develop the market, and open up popularity in the industry. In view of disadvantages and threats, we should skillfully use technical barriers to avoid risks.

## 2. Algorithm Application

### 2.1. Comparison of Carbon Emissions of CPU and GPU

Green algorithm is a basic complete computing carbon emission platform, it includes most of the tools required in the entire software life cycle, in the promotion of "3060 double carbon" goal to achieve, artificial intelligence will play an important role at the same time, green algorithm platform integrates in the CPU, IO, network, memory four areas of research and development of mixed features, its biggest feature is to achieve dynamic resource scheduling and preemption, high priority containers can lend idle resources to low priority containers for use, When needed, resources can be quickly grabbed from low-priority containers, and the whole process is completed inside the server without the awareness and intervention of the container cluster scheduling level. It truly realizes the unification of resource utilization and service isolation.

In order to more comprehensively observe the comparison of CPU and GPU energy consumption, the Green Algorithm Platform This tool can compare the carbon emissions of CPU and GPU, which can intuitively show the total carbon emissions consumed and the trend of CPU and GPU carbon emission curves, so that users can observe carbon emissions more clearly.

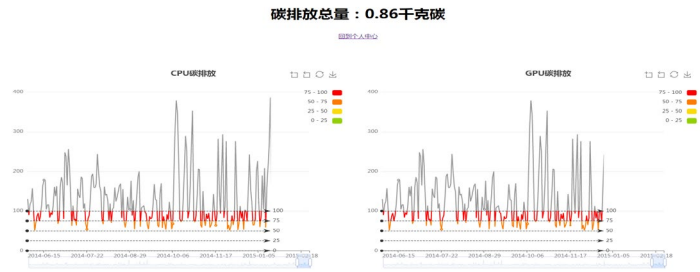


**Figure 1.** Comparison of carbon emissions between CPU and GPU

### 2.2. Calculate the Efficiency of the CPU and Memory Usage of the Task

The system uses the support vector machine learning method, the least squares support vector machine method and the LSSVM model kernel function, and the data storage of computing tasks has the following aspects: computing device information storage, computing task information storage, and user information storage. You can add, delete, and modify previously stored data, and when calculating the carbon emissions of a task on the green algorithm platform, you can see the corresponding CPU usage and memory occupation from the database.

Storage system refers to a system composed of various storage devices, control components and equipment (hardware) and algorithms (software) that store programs and data. The main memory of the computer can not meet the requirements of fast access speed, large storage capacity and low cost at the same time, and there must be a multi-level hierarchical memory from slow to fast and large to small in the computer, with the optimal control scheduling algorithm and reasonable cost, to constitute a storage system with acceptable performance.

### 2.3. Carbon Emission Big Data Computing Center

Using MapReduce cases, reinforcement learning cases, BP neural network cases, XGBoost cases, and LR cases, the carbon emission ranking of users using these cases can be counted, and the

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total running time of their tasks can be seen from the carbon emission big data computing center, and the user access status of this network platform is clear at a glance. The system selects metrics such as the number, type, and processing time of runtime computing cores as factors affecting the carbon emissions of the data center. At the same time, the carbon emission big data center lists the historical chart of carbon emission data in the past 15 days, which can clearly and intuitively see the changes in carbon emissions, and can also see the real-time usage status of system performance CPU and GPU usage from the line chart.


**Figure 2.** Carbon emission big data computing center

## 2.4. Basic Architecture of Carbon Emission Computing Platform based on Green Algorithm

The computing platform uses MapReduce cases, reinforcement learning cases, BP neural network cases, XGBoost cases, LR cases and other cases to realize the calculation of carbon emissions. The computing platform is divided into user layer, application layer, platform layer, component layer, data layer and basic layer. The application layer includes all the functions of the computing platform, including carbon footprint management, energy detection, energy detection, carbon sink management, energy distribution, plan management, data collection, statistical analysis, user management, system management and other functions. The platform layer realizes multiple management systems such as system integration, energy management, detection and command, and one map management through cloud platform management. The component layer consists of data access, permission management, logging, mail, application services, processes, interface management, mobile services and other components. The most important is the data layer, which includes database MYSQL technology, carbon emission database, energy database, energy consumption database, GIS database and other databases. The base layer is unified data storage and compute services.

## 2.5. Application of System Functions

(1) Physical particle simulation

In particle physics, complex simulations are used to simulate the passage of particles through matter. We can estimate the carbon footprint of each configuration using the Green Algorithm platform.

(2) Weather forecast

Weather forecasting is based on sophisticated models that simulate dynamic changes between different components of the Earth. The operational model faces strict time requirements to provide real-time forecasts to the public, with the goal of running about 200 to 300 forecast days in a 50-day period, entering relevant data.

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(3) Natural language processing

In natural language processing, the complexity and economic cost of model training are major issues. This has driven the development of linguistic representations that can mimic the complexity of natural language with a single training and can be used as input to more specialized algorithms. BERT is a very widely used NLP tool, limited information about the power consumption of TPU cores and memory, using 30 days of running time, assuming that TPUs are all used and ignoring memory power consumption, using green algorithms to estimate, running on the GPU for 79 hours, GPU utilization reaches 63%, resulting in a carbon footprint of 75440740 grams of carbon dioxide.

## 3. Summary

At present, a common problem in many domestic science and technology teams is the lack of risk awareness, or do not pay attention to risk management, or the ability of risk management is not mature, and most organizations and enterprises only passively take some compensatory measures after the crisis, resulting in huge losses. The Organization will establish a risk early warning system, analyze, evaluate, infer and predict risks, issue warning information in advance according to the degree of risk, remind venture capital decision-makers to be vigilant against various risks, and take measures to prevent risks, strive to minimize the losses caused by risks, and maximize the pursuit of high-speed and long-term development of the organization.

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