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International Legal Study on Energy Cooperation between Eurasian Economic Union Countries and China Based on Big Data Integration

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Abstract

The study of international laws on energy cooperation between Eurasian Economic Union countries and China is helpful to maintain China's initiative and fairness in the cooperation. In this paper, parallel SVM algorithms are incorporated into the study based on big data fusion to construct global parallel SVM algorithms. Two algorithms, IW-BNAM and BBT-SVM, are used to test the classification accuracy and recognition efficiency of international laws, so as to judge the rationality of the algorithm constructed in this paper. The results show that: BBT-SVM has higher accuracy than MR-C-SVM, MR-NPP-SVM, and MR-CS-SVM in international law classification recognition overall. The average accuracy of MR-C-SVM is 87%, MR-NPP-SVM is 89%, MR-CS-SVM is 87.75%, and BBT- SVM is at the level of 90.25% overall. In terms of recognition efficiency, the IW-BNAW algorithms proposed in this paper all have the highest speedup ratios, which increase with the increase of the number of nodes. It can be seen that the algorithm in this paper has high accuracy, and it is of positive significance to be applied in international cooperation to identify international legal class clauses, etc.

Keywords: *big data, SVM algorithm; international energy law, energy cooperation; BBT-SVM algorithm*

Introduction

The international energy economy is the entire activities of countries around the world around the exploration, development, storage and transportation, refining, petrochemicals and oil consumption of oil and natural gas. Natural resources are important for a nation's economic and social growth, while strategic resources are crucial for maintaining national security. Energy possesses both of these qualities. International energy trade activities are influenced by economic and non-economic factors, especially the comprehensive strength and influence of importing countries will have a greater role in energy cooperation. With the development of energy globalization, this energy economy, which is limited to the domestic of each country, gradually goes beyond the boundary between countries and becomes a complex interactions and interdependence of a kind of international energy cooperation relationship (Khan, Hou, Zakari, & Tawiah, 2021) (Yang, 2022). This relationship is an organic whole formed by the establishment of international energy market, which enables the energy of each country through international

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division of labor and international exchange. International energy cooperation can mitigate the risks of the highly uneven distribution of hydrocarbon resources on an international scale as well as investments in hydrocarbon exploration and development (Naito, 2021).

Literature (Kaczmarski, 2017) Eurasian integration is an important governing concept of Russian President Vladimir Putin during his third term, and the idea actually existed at the beginning of the independence of the CIS, when the Alma-Ata Declaration was signed in December 1991. In the post-Soviet era, Russia sought to establish an exclusive sphere of influence in order to maintain its great power status and control over the region. In studying the pilot carbon market in China, the literature (J. Liu, Tang, & Chang, 2021) found that carbon market prices are mainly influenced by coal prices in the HF sector. From the available studies, it is known that coal prices can affect carbon prices directly, or through the indirect route of influencing electricity prices, and their impact on carbon prices is more intense. Mechanistically, the increase of coal price may lead to the decrease of carbon price. The current energy cooperation mechanism is based on the energy cooperation among the SCO member countries, and the energy cooperation is developing from bilateral to multilateral under the SCO framework. However, the legal mechanism for energy cooperation is still lacking. In the literature (H. Liu, Hou, & Ramzani, 2022), it is argued that one of the important factors limiting the operation of the energy cooperation mechanism of the Silk Road Economic Belt is environmental issues.

The literature (Jin, Takumah, & Jorenby, 2018) finds that political controversies have a positive impact on the current structure of monetary policy as well as the movement towards a more open and internationalized Chinese currency by examining the relationship between rights and politics in the internationalization of China's currency. Chinese political interests and political process controversies are found to have their roots in many political economy-related problems. According to the literature (T. Liu, Wang, & Woo, 2019), a gravity model is used to explain the geographic distribution of the use of foreign currencies in financial transactions. It claims that greater economic integration and stable macroeconomic conditions increase the use of major currencies like the US dollar and the euro abroad. Commodity trade and portfolio investments are the main drivers of increased direct currency use, while foreign direct investment has a stronger impact on currency exchange rates. The literature (Lee & Yoon, 2020) considers Brent crude oil price as the most significant energy price influencing the price in the European carbon market. In terms of the correlation linkage mechanism, crude oil prices can have a long-term, negative and asymmetric impact on carbon prices. Between the markets for carbon and crude oil (Panahov, 2020), there is a significant two-way linear and non-linear spillover impact. The impact of oil prices on carbon prices follows a process of "substitution effect to production disincentive effect to a new round of production disincentive effect".

In conclusion, the majority of research have looked at how energy prices affect carbon prices. Energy price changes may have a direct impact on carbon prices, with coal and natural gas prices among those that may do so by impacting electricity prices. Different types of energy sources

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have different directions and degrees of impact on carbon price fluctuations, and there are also differences in their long-term and short-term impacts. The transformation of the energy mix also causes carbon price volatility. Energy issues are not only related to the energy industry itself, but also to economic security, social distribution, environmental protection and international relations. Energy law issues need to be studied from an interdisciplinary perspective. According to the mainstream view of international jurisprudence, the scope of international energy cooperation mainly includes three aspects: new energy development system issues, energy and environment issues, and energy security issues. As a result, it is clear that international cooperation in the energy sector encompasses both public international law and the pertinent areas of international economic law. Therefore, when conducting the analysis of its basic principles, it is possible to draw on the basic principles of these two main branches of law (Howse & Appleton, 2022). The improvement and control of international energy cooperation and international energy cooperation mechanisms have a certain inevitability, whether from the theory of international relations or from the existing condition of international cooperation in the sphere of energy. After clarifying the connotation and extension of international energy mechanisms, the importance of establishing legal principles of cooperation in international energy mechanisms is highlighted in the light of the current practice of the international community.

The three-step full-text research is focused on the present state of cooperative development in the Eurasian Economic Union nations in the context of big data convergence, with a particular emphasis on the extent of application of their international laws on energy cooperation with China. In the first part, the general context of big data fusion is introduced into the specific algorithm - SVM algorithm, and IW-BNAW and BBT-SVM local multiclassification algorithms are constructed for full-text technical analysis. In the second section, both Chinese energy law and national law are used to examine and introduce the international legal framework for energy cooperation between Eurasian Economic Union nations and China. In the third part, the feasibility study of international law identification and international classification accuracy study using IW-BNAW and BBT-SVM algorithms are conducted, and the superiority of this paper's algorithm over other algorithms is derived.

Parallel SVM algorithm under big data fusion

Classification of vector machines

The classification problem in two dimensions is shown in Figure 1. The red dots and green dots represent positive class samples and negative class samples, respectively, and L0 and L1 in the figure can directly separate the two classes of samples, and in higher dimensions, the splitting of the different classes of samples is called a linear classification hyperplane, which is collectively referred to as being linearly separable in this case. SVM is a classification algorithm that hopes to find an optimal classification hyperplane that makes it possible to maximize the spacing of the two classes of samples, so that the trained classifier has the advantage of better classification and higher generalization ability (Sharma, 2022).

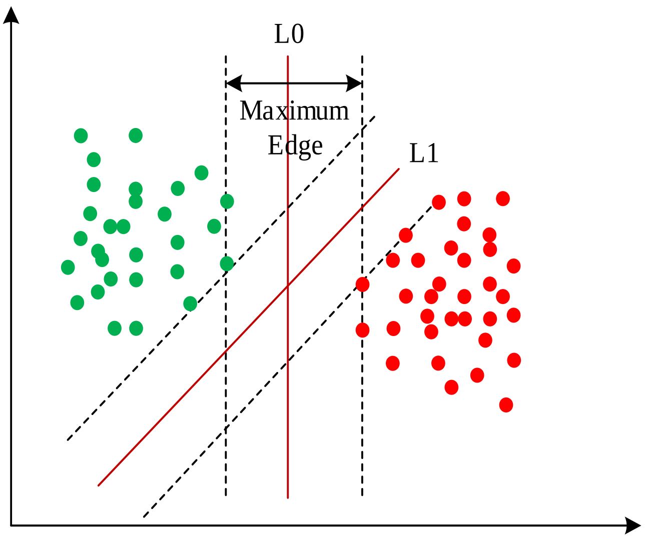

Figure 1: Schematic diagram of linear hyperplane

Adaptive nonlinear convergence factor

In this study, we suggest a novel approach for calculating the convergence factor that will make it nonlinearly decreasing and better reflect the WOA algorithm's capacity for optimal search. Beta distribution function can describe various shapes in the interval [0,1], and this paper uses the beta distribution function to improve the convergence factor a.

The improved adaptive nonlinear convergence factor $\hat{a}$ is calculated as follows:

$$\hat{a} = 2 - 2\cos\left[\frac{\pi}{2}\left(\frac{t}{T_{\max}} - 1\right)\right] - \varepsilon B(\alpha, \beta) \tag{1}$$

Where, Let $T_{\max}$ signify the most iterations, t signify the population's current iterations, and $B(\alpha,\beta)$ denotes the beta distribution function for the perturbation of $\hat{a}$, which makes the algorithm more searchable.

Proof: The convergence factor a of the standard WOA algorithm is linearly decreasing in the range [2,0], and the derivative of $\hat{a}$ yields $\hat{a}' = \frac{\pi}{T_{\max}}\sin\left[\frac{\pi}{2}\left(\frac{t}{T_{\max}} - 1\right)\right]$, where

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$\frac{\pi}{2}\left(\frac{t}{T_{\max}}-1\right)\in\left(\frac{\pi}{2},0\right]$, so there is $\hat{a}'\leq 0$, satisfying the decreasing property, when the number of iterations $t=1$, $\hat{a}$ obtains the maximum value 2, when the number of iterations $t\to T_{\max}$, $\hat{a}\to 0^{+}$, satisfying the non-negativity. $\hat{a}$ Gradually the nonlinearity decreases from 2 to 0 as the number of iterations increases and can be used as the convergence factor of the WOA algorithm.

Adaptive inertia weights

In this paper, we propose the following method for optimization: the least fitness value for whale populations in the t st iteration is $fit(t)_{\min}$, the maximum fitness value is $fit(t)_{\min}$, and the average fitness value for all individuals is $fit(t)_{avg0}=\left(\sum_{i}^{n} fit(t)_{i}\right)/n$. These fitness values are ordered in descending order.

We then mean the fitness values of $fit(t)_{avg1}=\left(\sum_{i}^{m} fit(t)_{i}\right)/m$, where $m=\text{count}\left(fit(t)_{i}<fit(t)_{\arg 0}\right)$, and for whale populations bigger than $fit(t)_{\arg 0}$, we average the fitness values of $fit(t)_{avg}=\left(\sum_{m+1}^{n} fit(t)_{i}\right)/(n-m)$. This is done for whale populations with fitness less than $fit(t)_{arg}$.

A population of whales is deemed to be of good quality if its fitness value for the tth generation is $fit(t)_{\min}\leq fit(t)_{i}<fit(t)_{avg1}$. then the whale is regarded as a stock of excellent quality. The whale is regarded as a common stock if $fit(t)_{arg1}<fit(t)_{i}<fit(t)_{avg2}$. If $fit(t)_{\arg 2}<fit(t)_{i}\leq fit(t)_{\max}$, the whale is viewed as a stock of low grade (Kamarposhti, Shokouhandeh, Colak, & Eguchi, 2022) (Yan, Zhang, Zeng, & Tang, 2021). The weight needed to update a whale's position grows lighter and lighter as it gets closer to the ideal position. When executing position updates, different classes of whales are assigned various inertia weights, and the suggested adaptive inertia weights w depending on the whale search state are updated using the following equations (2) and (4):

(1) Only a lesser weight has to be set to disturb the high quality population since it is already near to the ideal location. The weight of its position update is computed as:

$$w_1(t)=w_{\min}+(w_{\min}+w_{\max})\left(1-\frac{t}{T_{\max}}\right)*\frac{fit(t)_i-fit(t)_{\min}}{fit(t)_{\text{avg}1}-fit(t)_{\min}} \quad (2)$$

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(2) The general population location update's weights are determined by using the following formula:

$$w_2(t) = w_{\min} + (w_{\min} + w_{\max})\left(1 - \frac{t}{T_{\max}}\right) * \frac{fit(t)_i - fit(t)_{avg1}}{fit(t)_{avg2} - fit(t)_{avg1}} \quad (3)$$

(3) The weights of the subpar population location update are determined as follows:

$$w_3(t) = w_{\max} + (w_{\min} + w_{\max})\left(1 - \frac{t}{T_{\max}}\right) * \frac{fit(t)_i - fit(t)_{avg}2}{fit(t)_{\max} - fit(t)_{avg2}} \quad (4)$$

where t denotes the number of iterations, $T_{\max}$ the maximum number of iterations, and $w_{\min}$ and $w_{\max}$, respectively, denote the initial minimum and maximum weights.

Proof: The weights needed to update each whale's position grow increasingly less as they approach the ideal position. Since t is gradually increasing, we have $\frac{t}{T_{\max}} \to 1$, because $fit(t)_{avg1} - fit(t)_{\min} > fit(t)_i - fit(t)_{\min}$, so $\frac{fit(t)_i - fit(t)_{\min}}{fit(t)_{arg1} - fit(t)_{\min}} \in (0,1)$, so w_1 gradually becomes smaller with the increase of t, which meets the weight requirement for the location update of the high quality population. Because $w_2 - w_1 > 0$, so there is $w_2 > w_1$, the whales of the common population are a little farther from the optimal position and need larger inertia weights to speed up their search for superiority, so w_2 is applicable to the location update of the common population.

Similarly, there is $w_3 > w_2 > w_1$, the inferior population needs a larger weight to approach the optimal position quickly, and this weight calculation method is applicable to perturb the whale population position update. Proof Bi.

The improved equation for the whale position update is given in the following equation:

$$\vec{X}(t+1) = w * \overrightarrow{X^*}(t) - A \cdot \vec{D} \qquad if \;\; p < 0.5 \quad (5)$$

$$\vec{X}(t+1) = w * \overrightarrow{X_{rand}} - A \cdot \vec{D} \quad (6)$$

$$\vec{X}(t+1) = w * \vec{D} \cdot e^{bl} \cdot \cos(2\pi l) + \overrightarrow{X^*}(t) \qquad if \;\; p \ge 0.5 \quad (7)$$

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$$A = 2\hat{a} \cdot r - \hat{a} \quad (8)$$

W-BNAW algorithm

The SVM parameters are optimized using the improved whale optimization method, and the IW-BNAW algorithm's particular steps are as follows:

Step 1: Define the parameters.

Set the minimum and maximum inertia weights $w_{\min}$ and $w_{\max}$, as well as the range of values $[C_{\min}, C_{\max}]$ for the penalty parameter C of the parallel SVM and the range of values $[C_{\min}, C_{\max}]$ for the RBF parameter σ. Also, provide the size of the whale population at N.

Step 2: Set the whale population to zero.

The parallel SVM's parameter pair (C, σ) is represented by each whale, which is started at random within the parameter range.

Step 3: Calculate the whales' fitness.

The cost function $J = \sum_{i=1}^{n} \left(h(x_i) - y_i \right)^2$ of the current classification result of the parallel SVM is used to determine the fitness value of each whale position, where $h(x_i)$ is the predicted value of the SVM and y_i is the actual value. The lower value of J denotes the better effectiveness of the sought parameters.

Step 4: Classify the populations into classes.

The adaptation degree is sorted in ascending order, and based on the sorting results, the populations are classified into three classes, namely, poor quality populations, normal populations and high quality populations.

Step 5: Refresh the whale's location.

To assist the whale in leaving the local optimum, determine the adaptive nonlinear convergence factor $\hat{a}$ and perturb the coefficients in the position update A. Calculate adaptive inertia weights w, and give different weights to the positions of whales of different classes to update the whale positions according to equation (5)(7).

Step 6: Choose the ideal position right now.

The ideal position for the current generation is determined by comparing the fitness values of the

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updated locations of the whale population, and if the optimal position changes, the new optimal position replaces the previous optimal position.

Step 7: Check to see if the iteration termination condition has been met.

Determine if the whale population's maximum allowed number of iterations, $T_{\max}$, has been reached. If so, output the parameter pair associated with the whale's ideal position to get the SVM's and the support vector subset's optimal parameters. If not, add one more iteration and go back to step 4 to continue the loop iteration. Figure 2 depicts the overall IW-BNAW algorithm's framework architecture.

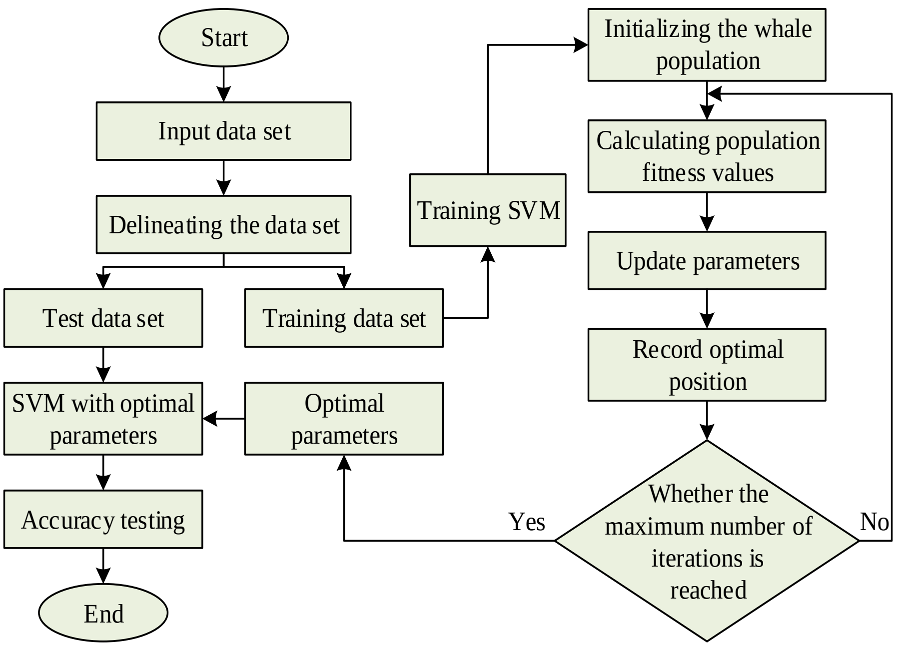

Figure 2: IW-BNAW algorithm flow

Building a Global Parallel SVM

We suggest the "TFB" technique, the phases of which are as follows, to address the load imbalance issue that arises when creating parallel SVMs.

Step 1: Identify the reduce nodes' burden.

Calculate the amount of time reduction will need to finish the task $rtime$, sort the keys according to their $rtime$, and save the results in queue $Ktime$ in $< key, rtime >$ form.

Step 2: Processing massive load nodes

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Consider the first item in the queue; if the key is $rtime > rtime_{avg} = (1/n)\sum rtime$, the load on the reduce node processing the key is seen to be excessive. We suggest migrating the data volume DM, calculating the data volume to be migrated for the large load node, and assigning DM to the small load node at the end of the queue in order to balance the load on the decrease node. The term "migrated data volume DM" is defined as follows:

The amount of data that needs to be migrated is determined in the following situations, assuming that the node's time for data transmission is R_dt_i and its speed is rv_j:

(1) When $rtime_i - rtime_{avg} > rtime_{avg}$,

$$DM = \left(rtime_{avg} - rtime_j - R\_dt_i\right) * rv_j \quad i \neq j \tag{9}$$

(2) When $rtime_i - rtime_{avg} < rtime_{avg} - rtime_j$,

$$DM = \left(rtime_i - rtime_{avg} - R\_dt_i\right) * rv_j \tag{10}$$

(3) When $rtime_i - rtime_{avg} > rtime_{avg} - rtime_j$,

$$DM = \left(rtimee_{avg} - rtime_j - R\_dt_i\right) * rv_j \tag{11}$$

Step 3: Update $rtime$.

The updated $rtime$ for a small load node is equal to the sum of $rtime$ and the time needed to process the migrated data, while the updated $rtime$ for a large load node is equal to $rtime \leftarrow rtime - n * rime_{avg}, n \in 1, 2, \cdots$.

Step 4: Update the queue $Ktime$.

Judge whether $rtime$ after the little load node's upgrade to the original version is satisfactory. judge whether $rtime$ after the little load node's upgrade to the original version is satisfactory $rtime - rtime_{avg} \leq R\_dt$, if it satisfies then consider that the node no longer needs to migrate the data volume, and delete this node in the queue. If not, keep calculating DM and moving the data to the node at the end of the queue until the big load's $rtime$ fulfills

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$rtime - rtime_{avg} \leq R\_dt$, at which point you should remove the node's information from the queue.

Step 5: Till there are no more nodes in the queue larger than $rtime_{avg}$, repeat steps 2 through 4.

The reduction function is then used to combine the local optimum $< key, ((C, \sigma), SV, fitness) >$ of each node to create a global parallel SVM model as the MapReduce cluster environment now has a load-balanced state.

BBT-SVM parallel construction of local multiclassification

To partition the sample sets of non-leaf nodes, the BSD technique based on the balanced binomial trees and sample set divisibility is presented. By dividing the relevant sample set for each non-leaf node, the technique seeks to create a balanced binomial tree structure for multiclassified SVMs.

The specific steps of the BSD are:

Step 1: Identify how many SVM subclassifiers will be built using BBT-SVM. Following the censoring of the redundant data, the procedure is carried out on the dataset. Let C represent the dataset's total number of categories. Therefore, $L = \lfloor \log_2 C \rfloor + 1$ is the binomial tree's layer count. The binomial tree has $C - 1$ subclassifiers in total. The subclassifiers should be identified as $SVM_k, k \in 1, 2, \cdots, C-1$ for each tier.

Step 2: Get the new data cluster centers O_i, cluster density ρ_i, samples in each cluster X_i, and the average distance of the samples to the cluster centers S_i for the sample set X with the redundant data eliminated.

Step 3: Create a matrix representing the sample set's divisibility. The sample set must be split into the root node's left and right subtrees in accordance with its divisibility properties in order to build a balanced BBT-SVM classifier. The calculation formula needed for this purpose is provided below in Eq. A sample set divisibility (SIS) computation approach is suggested for this.

(1) Standard distance of samples within a cluster SDD_i:

$$SDD_i = \sqrt{\frac{1}{n-1} \sum_{l=1}^{n} \left\| X_{il} - S_i \right\|} \qquad (12)$$

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where S_i stands for the sample's average distance from the cluster's center.

(2) Relative distance between clusters RDI :

$$RDI_{ij} = \frac{\left\| O_i - O_j \right\|}{S_i + S_j}, i \neq j \tag{13}$$

(3) Sample set divisibility SIS :

$$SIS_{ij} = \rho_i^* \left(SDD_i + SDD_j \right) + RDI_{ij} \tag{14}$$

Whereas if the value of SIS_{ij} is higher, it indicates that the two classes of data clusters are more easily subdivided into smaller groups, denoting i, j . The SIS values of each class of data cluster with regard to the other classes of data clusters are computed and stored in the divisibility matrix R, which is expressed as follows:

$$R = \begin{bmatrix} 0 & SIS_{12} & \cdots & SIS_{1C} \\ SIS_{21} & 0 & \cdots & SIS_{2C} \\ \vdots & & & \\ SIS_{C1} & \cdots & \cdots & 0 \end{bmatrix} \tag{15}$$

Step 4: Develop the non-leaf nodes' SVM_k subclassifier model. Determine if there are C' sample classes at node SVM_k, and if $C' = 2$, train the binary SVM subclassifier on the dataset. If the answer is $C' > 2$, add up each row of the matrix R, sort the results by decreasing row size, divide the dataset X_i of the largest category into the left subtree of the node SVM_k and the dataset X_j of the next largest category into the right subtree, and then count how many categories are currently left in the dataset of the non-leaf node C''. If $C'' = 1$, compare whether this dataset X_m exists $SIS_{im} \geq SIS_{jm}$, if yes, divide the dataset X_m into the right subtree. Otherwise, divide it into the left subtree. If $C'' > 1$, the SIS values in the column where the i category is located except SIS_j are sorted in ascending order, and the data set corresponding to the first $\left\lfloor \frac{C''}{2} \right\rfloor$ smallest value is divided into the left subtree, and the remaining data set is

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divided into the right subtree. The IW-BNAW technique suggested in the preceding chapter is used to train the SVM subclassifier placed at the non-leaf nodes. At this point, the sample set on the nodes on the left subtree is deemed to be a positive class and the nodes on the right subtree as a negative class.

Step 5: Create the regional BBT-SVM model. For the training of SVM_k through $k = C - 1$, repeat Steps 2 and 3. Next, combine the sub-classifiers to create a multi-classifier model, and then output the local BBT-SVM model via map.

International legal basis of energy cooperation between Eurasian Economic Union countries and China

Legal prerequisites for cooperation between China and the Eurasian Economic Union

The Agreement between the People's Republic of China and the Eurasian Economic Union was signed by Sargsyan, the chairman of the executive committee of the Eurasian Economic Commission, Fu Ziyoung, and representatives of the member states of the Eurasian Economic Union (the "Union") on May 17, 2018, at the Astana Economic Forum in Kazakhstan.

The Chairman of the Executive Committee of the Eurasian Economic Commission Sargsyan and officials from the member nations of the Union signed the Agreement on Economic and Trade Cooperation between the People's Republic of China and the Eurasian Economic Union (the "Agreement"). The Agreement's coverage spans 13 chapters on themes like e-commerce and competition, as well as new ones like intellectual property rights and trade facilitation. It also addresses sectoral cooperation and government procurement. By enhancing their mutual collaboration, exchanging more information, and sharing their collective knowledge, both parties committed to further streamline the customs clearance process and lower the cost of trade in commodities. The Agreement seeks to further reduce non-tariff trade barriers, enhance trade facilitation, foster the growth of the industrial sector, advance the deepening of economic and trade ties between China and the Union and its member states, benefit businesses and individuals on both sides, and establish institutional safeguards for bilateral trade and economic cooperation.

Russia, Kazakhstan, Belarus, Kyrgyzstan, and Armenia are all significant stakeholders in the development of the "Belt and Road," and the Eurasian Economic Union was founded in 2015. Strong economic complementarities exist between China and the Union and its member states, and there is great potential for commercial cooperation. In 2017, trade between China and the Union member states totaled US$109.4 billion.The Agreement, which is the first significant institutional agreement on economic and trade between China and the Union, ushers in a new era of project-driven economic and trade cooperation between China and the Union and its member states. It also serves as a significant step forward in advancing the docking of cooperation between the Belt and Road Initiative and the Eurasian Economic Union.

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Energy Law of the People's Republic of China

Energy law is an important part of China's legal system, and its main role is to regulate all kinds of social relations in the field of energy. This includes regulating the distribution of power and obligations between individuals, between individuals and the government, between governments, and between countries in the process of energy exploitation. From the above concept, we can see that: first, the scope of energy law includes not only the domestic energy laws and regulations of a country, but also the international energy relations as the object of regulation. Secondly, energy law involves many fields and multiple aspects related to energy, which means that energy law should take into account the balance of various interests when adjusting energy legal relations.

Energy law is often considered to be a branch of public administration law, a branch of law that lacks basic principles and an integrated system. When it was first developed, its core purpose and primary task was simply to ensure an adequate supply of energy. Its basic policy and value norms include the following: first, energy security, which is manifested by the important role of energy for securing economic order and economic development: second, in times of war or other emergencies, it is crucial for a country to have adequate strategic reserves of energy. In addition, a country should reduce the dependence of its economy on imported energy. Little consideration has been given to other energy-related topics such as improving energy efficiency, preserving ecological balance, and ensuring equal access for developing and developed countries, which are now gaining attention. As economic globalization continues to expand, energy law needs to be integrated and harmonized with related sectoral laws, while being given more missions. One obvious trend is that as the concept of sustainable development permeates various areas of common concern to the international community, energy law is increasingly required to integrate with environmental law and to consider the possible environmental impacts of energy issues. This requires the energy legal system to rethink and reorient its values and basic principles so that they are consistent with the interests of the common development of human society while maintaining national security and promoting economic growth.

International Energy Law

The legal regime of energy in the context of international energy cooperation includes both those at the international multilateral level as well as the domestic legal provisions of a country that involve energy cooperation with foreign countries.

International energy law at the multilateral level is an integral part of energy law, and its formulation has appeared in some foreign writings only in recent years, and there is no work in China that specifically studies "international energy law", nor is there a general definition of its regulatory scope. Some scholars, in conjunction with foreign writings, believe that international energy law should guide the legal rules and institutions that regulate transnational relations arising from international energy, and that the objects of regulation are not limited to relations at the national level, but also include relations formed by the state through other subjects, including

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international organizations, regional organizations, non-governmental organizations, multinational corporations, etc. On the other hand, the foreign energy cooperation and energy diplomacy involved in domestic energy law should also be the focus of study in the international energy cooperation mechanism. Since the distribution of rights and obligations in the energy sector is ultimately adjusted through a country's domestic law, it is a question worth considering how to apply the relevant principles of international law in the energy sector. Thus, on the premise of balancing national interests and the common interests of the international community, how to integrate the provisions of domestic law with the principles of international law is also a major issue to be addressed in the international energy cooperation mechanism (Zampetti, Low, & Mavroidis, 2022) (Zedalis, 2021).

Study on international law of energy cooperation under the convergence of big data

Feasibility of international law identification based on IW-BNAW algorithm

International energy cooperation involves not only international energy law, but also international public law, international private law, and international economic law, thus it is necessary to accurately locate the legal categories and their applicability when applying legal provisions. To investigate the feasibility of the algorithm in this paper, the performance of the algorithm for screening needs to be measured first, so the algorithm dataset is constructed to facilitate the comparison of the performance of the IW-BNAW algorithm with other SVM algorithms. The datasets used in this paper are web8a, covtype.binary, adult8 and skin, which are derived from the real datasets of libsvm database.

Table 1 Dataset Information

Data set	Data length	Characteristic number	Number of categories
web8a	48653	305	3
covtype.binary	582014	58	3
adult8	20703	124	3
skin	234967	5	3

To validate the IW-BNAW algorithm, the feasibility of training SVM with MR-CSVM, MR-CS-SVMS and MR-NPP-SVM algorithms in a big data environment is compared, and the acceleration ratio is used as an evaluation index for the 2 datasets, web8a and skin. To further ensure the accuracy of the experiments, the acceleration ratio is calculated by averaging the results after 10 runs.

The web8a speedup example is shown in Figure 3, and the skin speedup example is shown in Figure 4. The IW-BNAW method presented in this research has the highest speedup ratio in both the web8 and skin datasets, according to a comparison of the speedup ratios of the two datasets. In the line graph trend, the IW-BNAW speedup ratio has been steadily climbing, and with the increase of the number of nodes, the speedup ratio in the web8a dataset grows to 1.61 at the sixth node, which is 0.16 and 0.21 higher than the 1.45 and 1.40 of MR-CS-SVM and MR-NPP-SVM on the same node, respectively. In the skin dataset MR-C- SVM, MR-NPP-SVM, and MR-CS-SVM, the acceleration ratios climb less, while IW-BNAW still maintains a higher climbing trend and grows to 2.35 at the sixth node. Overall it seems that the algorithm in this paper operates better and the algorithm is feasible to be applied to the identification of international law with advantages such as efficient identification.

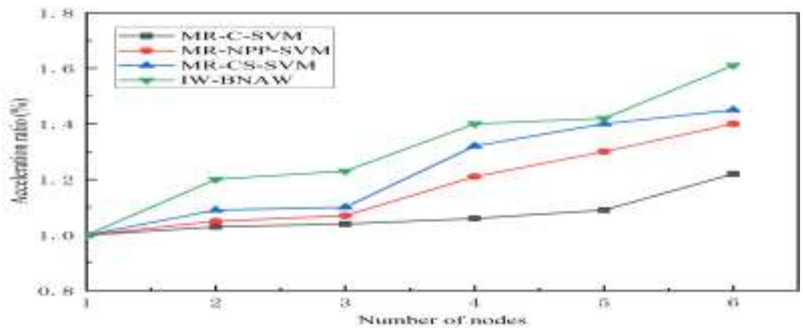

Figure 3: Acceleration ratio of web8a

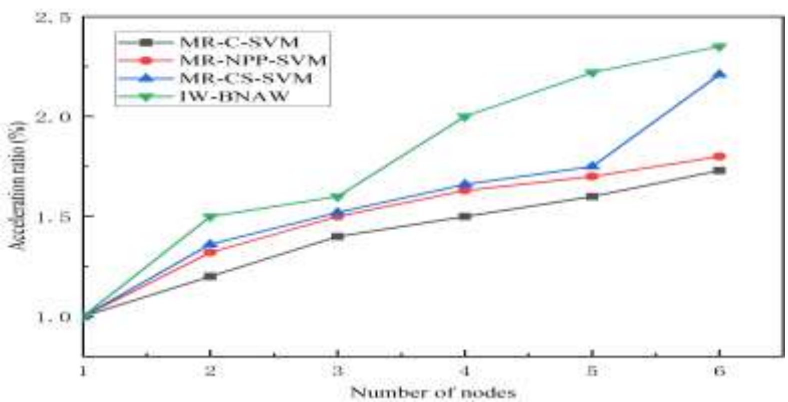

Figure 4: Acceleration ratio of skin

International legal classification accuracy based on BBT-SVM algorithm

International cooperation involves not only the economic interests between two countries, but also the political interactions between two countries, so it is necessary to scrutinize the contract between two parties one by one before cooperation to avoid contract loopholes. In this paper, the BBT-SVM algorithm is used as a means to check the efficiency and accuracy of the algorithm in dealing with international laws by examining discriminatory systems, institutional traps, and disputed clauses in international laws one by one.

The accuracy of international legal issues judgment is shown in Table 2. The discrimination

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system identification rate is 94%, and the accuracy rate is 95%. The recognition rate of regime traps is up to 99%, and the accuracy rate is 96%, and the applicability rate is 97%, which shows that the algorithm in this paper has high efficiency and accuracy when applied to the classification of international legal law articles, especially in the finding of regime traps. The validation of disputed clauses is often the most difficult to define, and its recognition rate in BBT-SVM algorithm is as high as 98% and its accuracy rate is 90%, which indicates that the algorithm in this paper can assist international law in locating the disputed content, improving the rigor of contracts, and maximizing the protection of national interests.

Table 2 Judgment accuracy of international legal issues

Problem classification	Recognition rate	Accuracy	Applicability
Discriminatory system	94%	95%	93%
Institutional trap	99%	96%	97%
Dispute clause	98%	90%	89%

The accuracy rates of the four datasets web8a, covtype.binary, adult8, and skin in Table 1 were compared to derive the classification accuracy of the BBT-SVM algorithm with the three algorithms MR-C-SVM, MR-NPP-SVM, and MR-CS-SVM.

The accuracy values of each algorithm on the datasets are shown in Figure 5. From the results BBT-SVM has higher accuracy overall than MR-C-SVM, MR-NPP-SVM, and MR-CS-SVM in all four datasets. The average accuracy of MR-C-SVM is 87%, the mean accuracy of MR-NPP-SVM is 89%, and the mean accuracy of MR-CS-SVM is 87.75%. The average accuracy of BBT-SVM in skin is 99%, in adult8 is 86%, in covtype.binary is 85%, and in web8a is 91%, overall in 90.25%, in comparison the algorithm of this paper has a high accuracy to assist in identifying international legal classification.

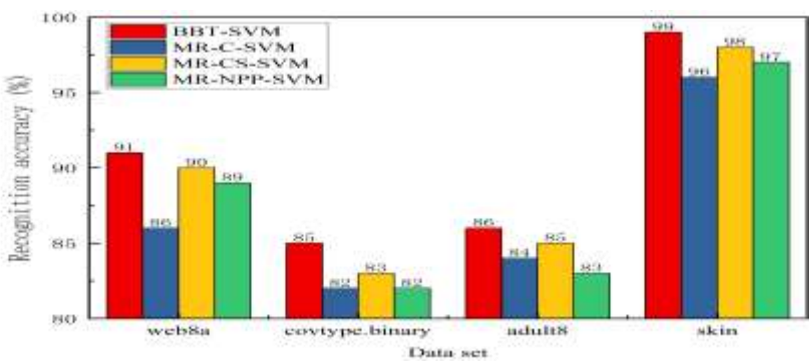

Figure 5: The exact value of each algorithm on the dataset

Conclusion

This study proposed a big data parallel SVM algorithm and constructs a global parallel SVM based on the study of applicable international laws of energy cooperation between Eurasian

Economic Union countries and China in the context of big data fusion. The IW-BNAW and BBT-SVM algorithms are used as the main research validation tools to test their functions and verify their feasibility in international law identification and their accuracy in international law classification.

(1) According to the IW-BNAW algorithm, the acceleration ratio in the web8a dataset is 0.16 and 0.21 higher than the other algorithms on the same node, respectively. Skin dataset IW-BNAW algorithm performance than the other three performance to maintain a higher climbing trend, indicating that in general, the algorithm in this paper operates better and has the advantages of efficiency and accuracy when applied to the identification of international law.

(2) International cooperation involves a large number of legal codes, so it is necessary to check each aspect involved in its cooperation to ensure smooth and fair cooperation. According to BBT-SVM algorithm, discriminatory system identification rate is 94% and accuracy rate is 95%. The recognition rate of system traps is up to 99%, and the accuracy rate is 96%, and the applicability rate is 97%, which shows that the algorithm of this paper can assist international law to locate the disputed content in international cooperation, improve the rigor of contracts, and maintain the fairness of cooperation between two countries to the maximum extent.

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