Research Article

Regional Economy Using Hybrid Sequence-to-Sequence-Based Deep Learning Approach

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In recent times, the role of the regional economy changed significantly under certain conditions of globalization and structural adjustment. The process of changing must be crucial to analyse regional economy and develop the planning of regional economy. Developing economies depend often on industries and country policies. Modern studies tend to participate in important factors in this field such as energy intensity, labour skills, local industries, resources, and local expertise. Furthermore, in this study, to start developing the regional economy and make the revolution in this field to connect it with new technology, we train the deep learning algorithm of gathering factors to manage them perfectly and make a good prediction for the future economy. Hybrid sequence to sequence (seq2seq) algorithms of deep learning fed with previous information from past years and run the system to compare the predicted result data with current information to evaluate the method to be certified for the coming years.

1. Introduction

Many economic activities have marked geographical concentration. Thus, the agglomeration process has started with differences that take shape and become quite rigid. The regional and environment system is considered as one of the most important economically produced systems within an institutional framework conducive to the formation of the innovative capacity for specific regional contexts, which allows for the assimilation and use of knowledge produced externally. The resulting innovations and economic development are mostly related to the regional level in addition to the systematic and frequent interactions between relevant local actors [1].

Nevertheless, the local economic development depends on the regional competitive advantage and the site-specific capabilities and competencies that are fostered by the social, institutional, and cultural structures. Since such circumstances are context specific, it is extremely difficult to replicate them in different settings, and each site must shape its competitive advantage based on functional and effective interactions between agents of the local economy and socio-institutional forces. Moreover, the presence of formal (community) and informal (community) institutions promotes collective action and works on coordination between local actors that provide the appropriate environment to stimulate regional economic development [2].

The process of supporting economic development and for institutions that do not differ from the institutional and social “approaches” needed to disseminate knowledge and innovation provides economic agents with context-specific arrangements or instructions for collective order, problem solving, and improved predictability on market behaviour, especially learning and understanding competencies [3]. Despite this, the controversy surrounding the role of informal institutions versus formal institutions, referring to the support of official and unofficial institutions and finding points of interaction between them, society is an essential element in shaping the development potential of regions of learning [1]. Indeed, formal and informal organisations balance each other and equally counter the other possible negative externalities, which can occur, for instance, in terms of lack of confidence, more expensive dispute resolution, lack of coordination, reduced network range, etc. [4].

The mechanisms of regional economic growth are supported by social and structural factors unique to the context. Via a complex collection of interactions, protocols, and traditional behaviours, these factors form the
local capacity to convert information into economic resources. In addition, geographically differentiated economic growth capacity across regions can be defined by spatial variation inefficiency, leading to greater differences between different locations. Regional development plans must also provide steps to deal with structural vulnerabilities. For a variety of factors, ranging from a lack of consensus on "optimal" institutions, this is not an easy job for policymakers [5].

Arrangements for the close integration of institutions in unique contexts, and being highly path dependent and especially flexible for evolving contexts [1] are impossible, for example, for one area to reproduce effective institutional forms in various contexts as well as to intervene in institutional failures within a limited time. However, recognizing that innovation and economic growth are primary regional phenomena and that local social and structural factors are important to them, it contributes to the consideration of a middle-level viewpoint as a relevant objective of the investigation in both theory and policy [1].

Nonetheless, regional economic integration agreements (EIAs) emerge and have been defined by many in light of the continuing proliferation of environmental impact assessment around the world, and it seems that governments, companies, and customers can all benefit from a clearer EIA map that deals with the EIA option. A friendly environment is secured in order to obtain integrated agreements. With few exceptions, there is a hypothetical lack of analysis of the sequence of economic integration agreements [6].

In addition, these hypotheses or theories that accept economics as driving forces help to explain, for example, the "hierarchy" of the European Union, especially concerning successive expansions. However, the process of European integration seems to have recognised what the terms such as an "institutional plateau" for which "constitutional settlement" seems to be the only rational balance [6].

The advent of the sequencing of sequential learning (Seq2Seq), in recent years, offers a more versatile and extensible temporal modelling system. The seq2seq model, however, suffers from the possible issue of the need to compact all historical data into an internal constant length vector [7]. This may restrict the seq2seq model’s ability to manage long sequences. Methods for resolving basic Seq2Seq shortcomings and skills in modelling long-range dependencies, such as regional economic structures of long-range processes in the general environment, are therefore proposed for attention mechanisms [7].

Deep learning models, which are a type of machine learning, are based on artificial neural networks with complex structures. Algorithms have advanced rapidly in recent years and are commonly used in machine optimization problems, such as genetic algorithms, neural network algorithms, annealing algorithm simulation, algorithms for optimising chaos, particle swarm algorithms, and hybrid sequencing approaches [8].

Such intelligent algorithms can provide more effective solutions for practical solutions, and undifferentiated and multiple constraints that are nonlinear or discrete. Machine learning algorithms can solve complex improvement problems, unlike conventional mathematical methods, and intelligent conduct is simulated by some classes in nature [9].

Thus, the structure of regional industry lies in the main challenge of regional economic development within the formation and continuous improvement. When solving problems, intelligent algorithms are essentially parallel, due to rivalry and choice between people, with high precision and rapid convergence [10].

The subparameters are arranged in detail as follows: Section 2 provides method and discussion with different algorithms such as main weighting algorithm for component distance, distance analysis for regional economic development, global component hybrid Seq2seq algorithm, and temporal and spatial change analysis; Section 3 shows results and discussion; Section 4 is the conclusion.

The most important existing studies in literature can be listed in Table 1.

### 2. Method and Discussion

Several methods were used in this study. The condemnation will be explained in the equation and utilized to obtain the best results.

#### 2.1. Main Weighting Algorithm for Component Distance

The target of treatment area, which is expressed by the value \(n\), is assumed to be \(x\) which form a particle of its combination, where the element \((i)\) is represented as a vector \((n)\) dimension, \(x_i = \{x_i(1, 2, \ldots, n)\}\). However, place and speed notifications, a few customizable parameters, and nonscalable information will constantly evolve into a globally optimal solution, so convergence can often be made to the global optimum. The particle will then depend on the following formula to change the velocity and location when the global maximum value and the individual maximum value are found:

\[
y_i = ax_i + b(z_i - x_i) + c(z_i - x_i),
\]

where \(y_i\) is the variance of the colony of particles or elements, and \(a\) is the coefficient of inertia; \(b\) is referred to as the learning factor; \(c\) is the difference factor, \(z_i\) is called a "uniform random number." However, these particles work to predict regional economic development levels, and production should be made by a hybrid sequence-to-sequence algorithm with one output layer that can be expressed as follows:

\[
a_{t+1} = \frac{\exp(e_{t+1})}{\sum_{t=1}^{T} \exp(e_{t+1})},
\]

\[
e_{t+1} = v_{t} \tanh(W_{\text{seq}}x_{t-1} + W_{\text{hcht}}),
\]

where \(T_x\) denotes the length of the input sequence \(a_{t+1}\), and others are an alignment function to measure the degree of irregular conformity in the encoder, \(v_{t}\), \(W_{\text{seq}}\) and \(W_{\text{hcht}}\) learnable parameters to the most recent \(s\) - 1 hidden state in...
the decoder and currently hidden state $h_t$. Then, $a_{jt_i}$ normalized by the softmax function to establish $a_{jt_i}$ attention weights.

Thus, time series $f(t)$ of which the local mean $f(t)$ can be expressed as follows, if there is only one in the neighborhood $(t_0-\sigma, t_0+\sigma)$ scale fluctuation, it is to be represented with a certain point, that is, $t_0$.

$$H_{\sigma} = \sum_{t_0-\sigma}^{t_0+\sigma} \left[ f(t) \frac{g_{ta}}{c_{ta}} - q\sigma \right],$$

where the decision variable is $g_{ta}$, and the random order is $q\sigma$. The area around the time axis in an oscillation phase. Therefore, the area around the time axis in an oscillation period is equal to zero, which is the time axis symmetry [17]. The principle of classification is to decrease objective value function and increase the resemblance among objects in the same group:

$$K_i = \sqrt{w(m_i - j_i)(n_i - e_i)},$$

where $I$ is the classification matrix of similarity; block category for different points; $m_i$ is the number of spliced classes; $j_i$ is the distance between the sample data $i$; the sample class $I$ is the centre point $m_i$, and $ei$ is the sample $i$ weighting parameter.

In light of the constraints of equity and inequality, the study of disparities in regional economic growth poses a range of nonlinear progress problems [18]. To find the benefits of a worst-point replacement, the following distortion methods are therefore used:

$$J_i(x) = \lambda i p(x) + \varepsilon F(x)i.$$ (5)

The architecture of the neural network's secret layer is mainly by determining the number of hidden layers and the number, and the basic point of designing the layout of the hidden layer is the design number of nodes for the hidden layer in each hidden layer as follows:

$$A_j = B_j[\xi B_j(x) + \pi C_j + (x)\tau D_j(x)].$$ (6)

Assuming that $A_j$ is the number of layer nodes hidden within the framework; $\xi$ is the number of input with particle input nodes; $\pi$ is the number of output nodes and is the result; $r$ is the fixed or adjustable factor [19]. $\tau$ is a formula that can estimate the number of nodes of the hidden layer, so the specified value needs several experiments to ensure its correctness.

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2.2. Difference Analysis for Regional Economic Development.

In general, the framework of comprehensive indicators is based on the concept of the selection of indicators for regional economic differences; i.e., a series of indicators is the general term for the form of convergence that comprehensively assesses and compares the level of economic development for the different regions. This group of statistical measures is interrelated, and thus involves an evaluation of the state of regional economic development for several reasons. The widely used method for assessing the state of regional economic development consists primarily of one-factor assessment and systematic assessment techniques.

Quantitative research on comprehensive assessment metrics is also focused on qualitative analysis; energy-intensive skills, business skills, local industries, resources, local expertise, and the degree of regional transparency are then evaluated as the essential and assistive components of the population. Based on the Seq2Seq algorithm package, Figure 1 shows the regional assessment methodology for economic development (RED).

Considering the general relationship of economic indicators as clustering metadata, the main component distance weighting algorithm will eradicate association and get new major components. In order to analyze the weight, we use the main algorithm in such a way that all the variables can be involved so that the result is a high weight. Thus, the effect will be stronger and the first participant will have a higher weight. Thus, the importance of weights plays a role in the classification process.

Any classification shift is triggered by direct replacement to achieve the objective of adaptive sample data; however, the distance between samples by the key component of the original knowledge must be determined by different weights. Image detection and motion mode are two kinds of movement techniques. Place motion is a motion along a line of two adjacent detection points in the downward direction, whereas motion for electronic detection is a motion in a series along each coordinate axis. At the same time, the global search capacity of the entire population can be improved with the use of the non-optimal particle aggregation and diffusion technique for global search. In addition, to use the contrast ratio strategy and the corrective ratio strategy in this algorithm, thus, the effectiveness of the local search for the optimization algorithm is increased for the sum of the particles. The clustering strategy and diffusion strategy were used as a random movement strategy to boost the global economy and the group optimization algorithm’s search power.

Direct and indirect variables can be distinguished from economic growth factors, despite the impact on economic...
growth. Resources, labour, and the efficiency of capital and labour inputs and outputs are direct factors; technological development, natural resources, natural environments, and indirect variables are socioeconomic systems and economic policy amount of capital and the productivity of labour inputs. Inputs and outputs are indirect factors that eventually influence economic growth. Moreover, the regional variations are due to shifts in regional economic growth levels in staffing and spending, and the relationship between regional differences and input differences between different variables is more complex.

Over time, variations in the degree of regional economic growth have influenced variances in job levels, regional differences, and investment levels. In addition, when analysing the correlation between variances in the input factor and regional differences, regional growth variations should be considered not only because of input factor level differences but also because of environment input factor differences resulting from regional input factor level differences. At the same time, because of the long-term cumulative impact, regional disparities in jobs and investment levels on a small scale are decreasing. Therefore, regional variations have shown an increasing pattern in the medium and long ranges, so in the formulation of relevant policies, attention should be paid to the long-term effects of employment and investment differentials.

Deep learning based on vector updated used in the proposed method as a novel technique that is used for updated weights of extracted features and changing the layers and nodes accordingly, the computational vector allows the system to respond with the sensitive data changed and update the sequence of data that is related with other sequences in different vectors.

2.3. Global Component Hybrid Seq2seq Algorithm. It was achieved by analyzing many spreadsheet sequences over a while as the main classic component analysis, which included the time-series principle. First, a global spreadsheet is obtained, multiple spreadsheets are merged, and then, a main component of the study is conducted. However, the cumulative effects of the regional economy that use regional resources and the regional climate are focused primarily on panel calculation and analytical hierarchy models for quantitative analysis or using different statistical approaches, data processing regression theory, and findings for structural analysis of energy consumption.

Indeed, the economic difference between the two regions does not directly affect the final result or increase production. The production in these two countries is related to the scale of the regional economic power of both regions, and the flow of the commercial economy to the target location, as shown in Figure 2, is just a price for the goods of the two regions.

Factors that need to be taken into account in the target region in order to achieve the full economic benefits are the difference and true demand of the consumer market. These nonregional economic factors will remain at the initial point of departure and become poor outside the ring. Therefore, nonregional economic influences originate from the small area into the economic zone of agglomeration. The cost of inflows or startups was also higher, or the proportion of investment was equal to the benefits that cannot be recognised through capital investment.

There are not very broad regional economic disparities in general. In addition to the acceleration of the country’s overall economic growth, there will be increasing economic disparities between regions. Consequently, the slowdown in the countries of economic growth, as well as the slowdown in
the spread of economic changes between regions, will stop at a relatively high level [20]. However, the differences between regions would show a distinct trend as the growth of the national economy increases. In addition, the industrial structure refers to the establishment of different departments of industry, within each department of industry, and between different industries and institutions. For the economic growth of a specific area, the industrial establishment is a very important structure. However, the continuous growth and upgrading of the regional manufacturing sector are at the centre of regional economic development. Therefore, in implementing the openness strategy and the market economy, the eastern region has adopted a positive indicator. Indicators such as the total regional production, the total amount of imports and exports of foreign investment enterprises, and the level of rural population consumption, domestic financing are influenced by the amount of urban population consumption, per capita urban population wages, per capita net rural household income, education expenditure, and all tax revenues.

2.4. Temporal and Spatial Change Analysis. One of the most significant reasons for supporting vectors is that, since they can cope with the dynamic nonlinearity of economic systems, machines can be used in the economic sphere. The most significant characteristic of economic systems is the complexity of nonlinearity. And the sample can be divided into the nearest group by measuring the aggregation, in addition to calculating the distance from the pole to the centre point and substituting for the centre point. The initial point is measured, and the new centre point is iteratively calculated.

The downside is that it only looks at the distance which might not be ideal for the distance formula and does not take the density between the distributions of the points into account. Through nonlinear transformation, the supportive vector machine (SVM) is translated into a separate high-dimensional field in order to differentiate as much as possible between two types for a perfect curve in a high-dimensional space.

There are two forms of growth of the regional economy, namely, system integration and interactor cohesion, because of many variables. They are organically linked to these factors and have an effect on economic development in the region, and any mechanical division would result in job losses in the system. Moreover, the cumulative impact of these components is greater than the mere addition of individual components. The growth of the regional economy is therefore a structural issue, as shown in Figure 3.

An economic system developed in a particular region is a regional economy; this structure consists of many factors, including natural, environmental, or economic. The organic connection with the environment also has an organic relationship with society during the transition period: production, trade, distribution, and consumption. Thus, the development of a gigantic complex structure combining on a larger scale of the three divisions of the economy, culture, and climate.

The growth momentum focuses on the innovative leading economy and industrial entities in regional economic growth cycles differently. Growth is also affected by three factors between the growth pole and the remote areas, and the effect of polarization, spread, and turning back to other economic bodies. This leads to the creation of multiple points that push the arteries between the points.

In this paper, the influencing factors are the factors affecting the growth of the regional economy, where capital expenditure, structural shifts, industrial structure, etc. are considered. In the meantime, the unemployment rate is also a significant factor that, in recent years, has
attracted great attention. As for the experimental research techniques, the data models are analyzed in a hierarchical manner and according to the distribution of weights on the variables.

In addition, the main driving force behind the acceleration of economic growth and the main driving force behind the change in economic growth trends are the technical factors. A broad range of material is included in the elements of science and technology; these important three factors are addressed by all the representative indicators: the basic conditions for regional science and technology, the state of the inputs, and the status of the outputs for a comprehensive assessment. In addition, variations in the degree of economic growth, industrial structure, and planning were the product of the different regions’ geological, social, and cultural environments.

3. Results and Discussion

This paper defines model areas based on the hybrid Seq2seq algorithm to examine regional economic development differences. Therefore, four indicators are selected in three categories, representing the state of economic growth of the simulation target area; furthermore, the structural indicators include the ratio between the value added of the secondary industry and the value added of the service industry; per capita GDP, retail consumer goods sales per capita, and population conflicts are quality metrics.; to a large extent, these four metrics include important aspects of the target simulation areas, such as the main weighting algorithm for component distance, difference analysis for regional economic development, capacity development for innovation, and social progress. The system, therefore, applies to a complicated group of interacting elements. Besides, the system is an entire organism with specific functions that are synthesised by the interaction of interconnected components, and, as mentioned earlier, the complementarity and cohesion between the elements are the basic characteristics of the system.

The interconnection between the components relates to honesty. That makes up the method, and consistency refers to the nonadditive nature of the components’ effects. Furthermore, several factors in this field, all of which are organically related, affect economic growth, and any mechanical division would lead to the breakdown of the system.

Therefore, the growth pole will be relocated from one position to another in taking into account political decisions and other factors contributing to market environment upheavals, technological cooperation between industry companies, and the redistribution of the product’s competitiveness as a result of business innovation. At the same time, due to interconnected and centralised economic institutions, a relatively stable dynamic regional economic structure is developed over a given period of time. The growth of the regional economy is a structural issue, and it can be seen that the regional economy is an economic structure developed in a specific region. As all are organic, the structure consists of natural components, environmental components, economic components, and human elements. However, it is believed that a regional economic entity is a profit-driven corporation searching for ways to raise its profits; that is, as a regional economic entity, a position within a certain scope is treated as a whole.

However, a country’s economic strength is seen as the centre of the overall social and economic strength of the region, where it is first important to select a measure of the degree of regional economic growth. Metrics can then be chosen from various aspects, such as economic totality, to measure the degree of economic growth of a country, individual tenure, economic structure, the efficiency of the economic process, and economic benefits. Resource factors thus play a pivotal role in the region’s economic development. The resource gain is a tangible reflection of the capacity for regional economic growth and is a prerequisite and cornerstone for rapid economic development [21] so that resource disparities between regions need to be completely taken into account. Several factors may be selected, such as natural resources and social resources, where metrics reflect and quantify the conditions of resources between regions. Also, in designing the indicator system, the infrastructure level is a significant factor that cannot be overlooked, since infrastructure levels are closely linked to the country’s economy and social development. In addition, it is possible to select metrics that represent and calculate the level of regional infrastructure from a variety of aspects.
such as transportation, post, and telecommunications, for instance. In several fields, such as education, health, the living conditions of citizens, the economy, family planning, and social security, the level of social growth is also included, as shown in Figure 4.

There is a great parallel property to this whole algorithm. Moreover, in each quest, the optimum solution obtained will be used to direct the next study. The social knowledge exchange mechanism is considered such that the randomness of it does allow the search to shift in the direction of convergence of algorithms. This algorithm is a restricted search technique that, by documenting search history and using it to figure out the next search path, can obtain information in the search process to avoid an optimal local solution. Nevertheless, it effectively solves the problems of combinatorial optimization. It addresses undifferentiated objective functions. The nonlinear approach to the inner point has the benefits of strong convergence, high-speed enhancement, and solid durability. It is also ideal for the resolution of problems of continuous optimisation of differential functions as separate variables that are difficult to solve. To solve several separate optimisation problems, a global optimisation solution is therefore optimal, but the speed of optimization of the genetic algorithm is slow and easy to slip below any mutual value to the local optimum value [22].

However, the experience of central growth indicates that the central city is the leading force in the central period, and the urban structure is extracted from the central cities. Differences in regional economic evolution rates result from the unequal distribution of the entire activity of space innovation. As the economic gap between the undeveloped regions continues to expand, according to the hypothesis of the technological gap, it contributed to making the innovation differences already in the region’s rapid economic development. The explanation for this is that there is a very wide innovation distance between underdeveloped and developed regions, and there is no corresponding educational ability, which makes relatively backward areas generally less capable of absorbing and absorbing the advanced technology, impacting the adoption and imitation of new technologies.

4. Conclusion

In this paper, the role of regional economy changed significantly under certain conditions of globalisation and structural adjustment. The process of changing must be crucial to analyse the regional economy and develop the planning of the regional economy. Developing economies depend often on industries and country policies. Modern studies tend to participate in important factors in this field such as energy intensity, labour skills, local industries, resources, and local expertise. Furthermore, to start developing the regional economy and make the revolution in this field to connect it with the Seq2seq algorithm, the contribution of this study can extract the factors to manage them perfectly and make a good prediction for future economy by using hybrid sequence to sequence (seq2seq) algorithms of deep learning fed with previous information from past years and run the system to compare the predicted result data with current information to when evaluating the disparities in regional economic growth; it is parallel and has high precision and speed of convergence.

Data Availability

The dataset (Russian Federation regions and OECD Regional Database) used in the proposed approach may be available by the corresponding author upon request.
Conflicts of Interest

The author declares that there are no conflicts of interest regarding the study of this paper.

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