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Type Accounting: A Mechanism for Growing Implicit Geo-Number Chains for Multi-Objective Evolutionary Geometry

Ziyang Weng*, Shuhao Wang, and Yang Ming
School of Information Management, Wuhan University, Wuhan, China
weng_ziyang@whu.edu.cn, wangshuhao@whu.edu.cn, yangming@whu.edu.cn
*corresponding author

Abstract—Empirical evidence from studies linking geographic factors such as topography and natural resources to map artifacts is often weak, and procedural management of different samples or codes is unreliable. We found a general weakness in these investigations: Although most map products are limited in their historical conception to the functional validity study component, the analysis of implicit geo-data therein relies almost exclusively on national-level data. Based on algorithmic interventions, We extrapolated the use of GIS to accurately measure spatial variation factors in conflicting map products. A comparison of several relevant variables measured at the national and conflict scale showed that national statistics were found to be poor approximations of conflict areas (areas where civilizations meet). The computational analysis further shows that some of the survey results do depend on the scale of measurement, and that a suture mechanism for the implicit geo-number chain can be identified. Finally, we discuss how multi-objective optimization algorithms can be applied in future research for rapid ranking and improvement of GIS and space to increase our understanding of conflict regions, durations, and biased outcomes during the multi-objective evolution of this type of map products.

Keywords-multi-objective optimization; geometry; implicit data; growth mechanism

1. INTRODUCTION

The multi-objective evolutionary path of geodesy is inseparable from the state, regime, civilization, trade, and society. The diversity and complexity of service objectives have caused the overlap of encryption, deviation, and deciphering calculation methods in the collection, processing, and use of geo-data in map products, resulting in complex problems including rapid iteration of local information, slow updating of methods, and repeated use of data proofreading. And today's research mostly compares directly with GIS data sources in terms of geo-name and location extraction for location deviation validity calculation. There is no escaping the fact that map products have deep roots in the growth of geo-knowledge and the connection between geographic exploration and civilizational interactions, whether by means of warfare patterns or trade [1]. Likewise, topographic features, land assets, population distribution, and ethnic diversity are aspects that deserve special attention. Generally, people ignore the regime in remote border areas, ongoing war activities and regions that are maintained for a short period of time, for example: these areas are inhabited by ethnic or religious minorities, have rugged terrain, are covered by mountains or forests, and have harsh climates that are not conducive to the traditional regime's investment of resources in governance, resulting in a relatively lagging state of development. However, to date, empirical studies have been unsuccessful in identifying explicit links between map productions techniques and human factors in geographic distribution and civilizational interactions, it is still unknown how the hidden geo-political chains [2] are formed and functioning.

Theoretical frameworks on empirical studies are often driven by decontextualizing factors, such as the historical process of short-term expansion gaining access to easily accessible information on the geographic geo-resources of the associated region and road networks in rugged terrain, thus increasing the viability of expansionary behavior. However, our review of the empirical literature suggests that most studies ignore local conditions and instead use national aggregates for their analysis.

To address the above issues, we propose to place this type of activity in a wide range of historical scenarios and consider it in the context of dealer's law behavior. Unlike the above studies, the aspects of this paper's research that seek to innovate are: (1) the introduction of map artifacts and survival environments into the semantic saturated annotation [3] work to expand the computable semantic capacity; (2) the introduction of multi-objective genetic algorithms to transform images into computable data experiments based on GIS environments and spatial-temporal constraints [4-6]; (3) the improvement of multi-objective genetic algorithms to analyze the results of computational experiments to aid the new output of the conclusion.

The second part of the paper, in conjunction with a sample set of research cases, suggests that while it may be appropriate to focus on country size and use country-level geographic variables when exploring conflict risk, this research strategy is less appropriate when the conflict is the unit of observation. This is particularly true for spatially limited conflicts and when several conflicts occur simultaneously within the same country; In the third part, we propose that geographic information systems (GIS) can be used to generate geographic measurements specific to each conflict zone; in the fourth part, to explore the impact of measurement scale, we compare

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sample means for several indicators of terrain and road network resources; and in the fifth part, we conclude.

2. BEHAVIORAL ABSTRACTION

Empirical evidence from studies linking geographic factors such as topography and natural resources to map artifacts is often weak, and procedural management of different samples or codes is unreliable. We found a general weakness in these investigations: although most map products are limited in historical concept to a functional validity study component, analysis of the implicit geo-data therein almost exclusively relies on national-level data. Collecting, processing, drawing preparation, proofreading, and cartography are the goals of national governance from which successive regimes traditional practice from which important geographical lessons were learned. Participants included brief literature studies of specific geographic knowledge, culminating in hands-on work by junior and senior leaders of mapping organizations. Leaders guide their subordinates through the data sequence under their study, prompting integrated decisions that result from analyzing multiple pieces of geographic information over the same geographic area. The density, quality, and adoption effectiveness of these data sources in planning and implementation are very useful in understanding the geographic importance of surveying techniques and mapping purposes, as well as other aspects. This paper explores how we can use GIS to enrich

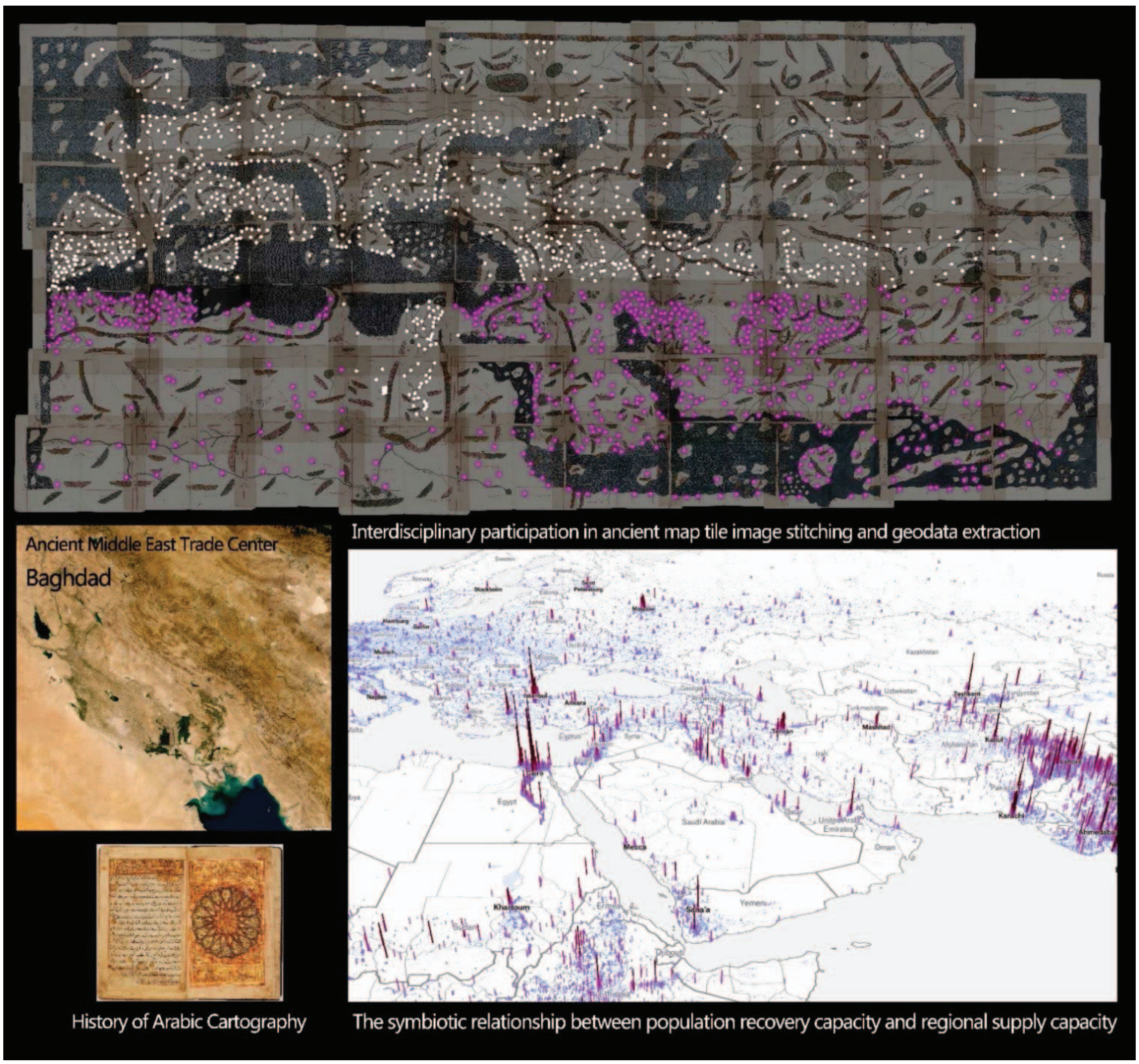

Figure 1. Diversity of information mining driven by mixed objectives: (a) Interdisciplinary participation in ancient map tile image stitching and geodata extraction; (b) The symbiotic relationship between population recovery capacity and regional supply capacity.

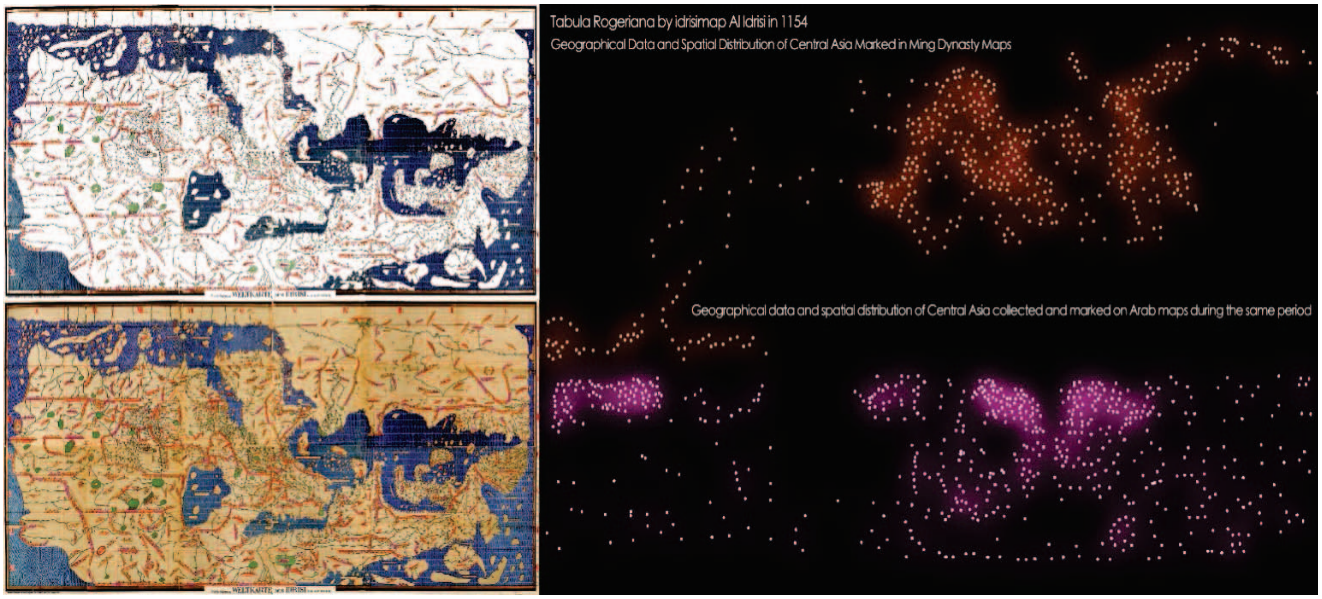

Figure 2. Implicit similarity discovery for spatially typed data: (a) Geographical Data and Spatial Distribution of Central Asia Marked in Ming Dynasty Maps; (b) Geographical data and spatial distribution of Central Asia collected and marked on Arab maps during the same period.

the experience of enhanced domain experts in deciphering the growth of implicit geo-number chains therein.

In the process of convergent behavior from a single, long-standing regime realizing war and trade across a large territory, the total amount of geo-data is rapidly or steadily enriched. In the Chinese Yuan and Ming dynasties, after the military expansion across Asia, Europe, and Africa destroyed the stable map boundaries in a short period of time, the geo-information of North Africa, West Africa, the Middle East, and India was accompanied by the intensified military behavior, and a large amount of information on routes, towns, and water systems was set into a new map with the intervention of cartography and geo-calculation data in the Arabian Peninsula, and then into East Asia. Prior to this, the "aggregation" of geometric and implicit information was accelerated. The purpose was to provide an integrated geographic experience for the top leaders of the central authority. Since the act is integrated, it combines all the geographic skills and knowledge learned in the respective regions. Therefore, we can easily incorporate the analysis of this type of behavior into several cartographic geography case studies, more notably, the typical "banker" concept of this type of behavior. Any one of these technical breakthroughs or any regional geo-data obeys the notion of the law of the banker.

Examination of the map products for the period showed that when point marking and GIS conversion were implemented, typical distributional thermal characteristics emerged and all conflict-specific variables were significantly different from the corresponding variables measured at the usual national level. We then analyzed the duration of short-term external regimes (e.g., Khorezm, Ilkhanate, etc.) in the sample cases. The results show that some findings do depend on the measurement scale. In particular, the recovery and presence of data from conflict areas damaged in the course of warfare into relatively stable governance periods time periods significantly increases the duration of outer-edge geo-information searches, while their impact is small when measured at the national level.

In addition, the use of precise conflict location data allows us to add a new variable to the duration analysis for measuring conflict-distance. The relative location of the conflict matters: the further the conflict is from the capital, the longer the duration. This is a powerful effect that dramatically changes estimates of country size, incompatibility type, and effectiveness. The results suggest that local conditions and the relative location (distance) of the region should be taken into account in conflict research, and that the study of its median chain growth mechanisms could greatly benefit from the use of GIS and spatial methods.

3. MATHEMATICAL DESCRIPTION

Recent developments in GIS and research GIS have led to an increasing use of spatial methods by users of traditional mapping software. Tools that facilitate exploratory spatial data analysis include global and local indicators of spatial associations, variance pattern exploration, and distance analysis. Spatial analysis has existed in the social sciences for decades, but is still rare in studies of the validity of deciphering ancient map products. This paper uses GIS interventions to obtain a history of cross-regional geographic measurements to generate indicators of interaction opportunities and border area salience [7]. A relative location indicator was constructed using GIS to measure the distance between the conflict zone and the capital city, while the same conflict location data was used to account for the spatial overlap between conflict and lack of development, i.e., the effectiveness of achieving "banker" goals.

In addition, studies of the diffusion model have used spatial econometrics to try to explain the value of the behavioral element in geopolitics from a sociological perspective, logically giving a possibility to explore the calculation of the spatial distribution with human access to data, behavioral extrapolation of data, and a domain of changing values [8]. Despite the apparent surge in the number of quantitative studies in this area, we believe that some of them have serious flaws in the data used. This may have a significant impact on the validity of inferences.

Most importantly, our concern involves how the measurement scales of various geographic indicators and geo-numerical chains can be stitched together for evolution, and can be fully informed by the banker's law approach to constructing non-dominated sets, where we extract and classify the above behaviors with features that meet the need for multi-objective evolutionary search, while conforming to the following six basic rules: (1) Map artifacts are treated as geometric populations, and the artifacts are divided into subpopulations for each degree of data fusion; (2) Sub-populations each select geo-data growth search goals and achieve them; (3) The artifacts need to be supplemented with extraterritorial geo-data during processing to replenish mapping needs; (4) The geo-data collection process of the artifacts is influenced by historical events, with high fusion efficiency resulting in fast collection and low fusion efficiency resulting in slow collection; (5) The process of geo-data collection by the production is affected by geo-constraints, with fast collection speed if there are no constraints and slow collection speed if there are constraints; (6) The return of the fleet after reaching the threshold of the voyage time is considered as the completion of a voyage.

For convenient description, the following definitions are given first:

Definition 3.1, $\forall x, y \in P$, if there is no dominance relationship between x and y, then it is said that x and y are unrelated or irrelevant.

Definition 3.2, for a given individual $x \in P$, if $\nexists y \in P$,let $y \succ x$, then x is said to be a non-dominated individual of set P. The set consisting of all non-dominated individuals of P is called the non-dominated set of P.

Definition 3.3, let $NDSet$ be the non-dominated set of P, $NDSet \subset P, \forall x \in P$, If x is a non-dominated individual of P , there must be $x \in NDSet$. Then we say that $NDSet$ is the largest non-dominated set of P.

Definition 3.4, If there does not exist any other x in P smaller than x^*,i.e., $\nexists x \in P$, let $x \succ x^*$, then x^* is said to be the smallest element in the partial order set $(P, \succ)$. The set of all smallest elements is denoted as $M(P, \succ)$. Let $x \in M(P, \succ)$,Cluster$(x) = \{y \mid x \succ y, y \in P\}$ be the family with x as the smallest element.

Let P be the evolutionary population of the mapping product, Q be the construction set, initially $Q = P$, and $NDSet$ be the non-dominated set, initially empty. Take any individual from Q, compare it with all other individuals in turn, and remove the individual dominated by that individual from Q. If the individual is not dominated by any other individual, it is non-dominated and will be incorporated into the non-dominated set $NDSet$. Otherwise, the individual will also be removed from Q; and so on until Q is empty.

The method of constructing an undominated set of P can be described as follows:

(1) Let Q be the constructed set, initially $Q = P$; $NDSet$ be the undominated set of P, initially $NDSet = \emptyset$.

(2) Take a body x from Q, and let $Q = Q - \{x\}, D = \emptyset$;

(3)Let $D = D \cup \{y \mid x \succ y, \forall y \in Q\}$;

(4)Let $Q = Q - D$; if $\nexists z \in Q$, let $z \succ x$,then let $NDSet = NDSet \cup \{x\}$;

(5) Repeat steps (2) to (4) until Q is empty.

To facilitate understanding, the specific procedure for constructing the non-dominated set using the dealer's rule is given below, and the pseudo-code is shown in Table 1.

Table 1. Pseudo-code for Algorithm 1

Algorithm 1: Construct the evolutionary population using the banker's rule*P* of the non-dominated set

Function call: Function Nds (Pop: population)

Q = Pop;
while ($Q \neq \emptyset$) do
{$x \in Q$, 令 $Q = Q - \{x\}$;
x-is-undominated =. T. ;
fo r($y \in Q$)
{ if ($x \succ y$) then $Q = Q - \{y\}$
else if ($y \succ x$) then x-is-undominated =. F. } end for y
if (x-is-undominated) then $Nds = Nds \cup \{x\}$;

4. Case Studies

From more than forty geographic survey products such as "Zheng He Navigation Map", "Mixed One Frontier Map", "Selden China Map", "Public Opinion Map of Yuan Jing Shi Da Dian", "European Copy of al-Idrisi World Map", "Islamic World Map by Abu Zaid Ahmed Ibn Sal Balki", etc., 2,023 geographic marker data were manually identified and read, combined with the translation of Chinese and foreign ancient and modern place names against each other. Obtain the latitude and longitude information of the place names, realize the mapping topology of the GIS environment, and manually assign the key exploration areas. The experimental GIS data is obtained from China National Geographic Information Public Service Platform. The code flow chart is as Figure 3.

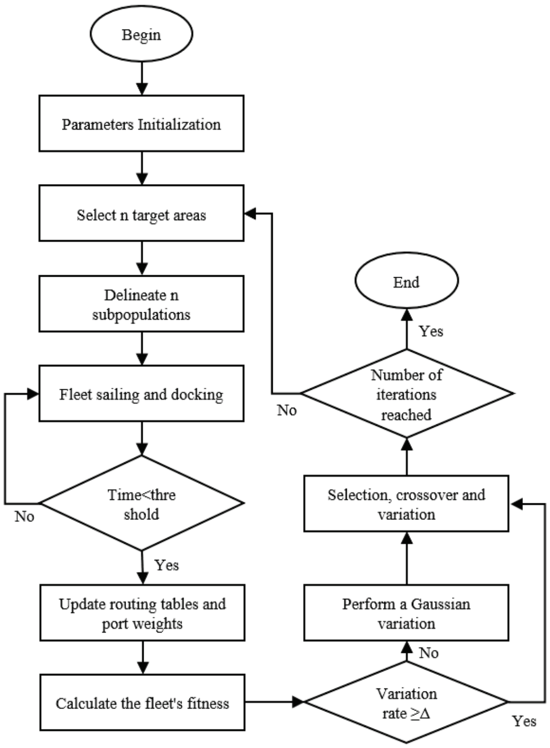

Figure 3. The code flow chart

The computational results characterize effectively provide a new logic of interpretation that enlightens the depth of knowledge of the interactive behavior between geography and civilizational interactions, where typical findings are facts that most literature studies and basic empirical research cannot explain.

Programming with Python 3.11. Factors such as distance of locations, level of economic development, and exploration value were considered. The dealer's rule was used to construct the non-dominated solution set and rank all solutions. The experimental results are shown in Figure 4 and Table 2.

From the calculation results, it can be seen that the regions with the largest data load on the map are Central, West, and South Asia. The Central and West Asia regions play a pivotal role in civilization exchange as the land corridor connecting Asia and Europe. At the same time, the South Asia region is also a necessary route for civilizational exchanges between Asia, Europe, and Africa. The computational results characterize and effectively provide a new logic of interpretation that enlightens the depth of knowledge of the interactive behavior between geography and civilizational interactions, where typical findings are facts that cannot be explained by most literature studies and basic empirical research:

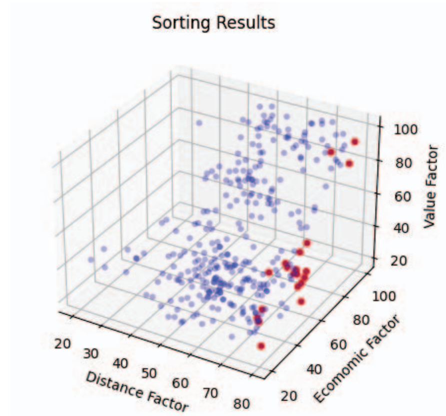

Figure 4. Distribution of solution sets

Table 2. Top 20 Non-dominated Solutions

Rank	Region	Location	Latitude (N)	Longitude (E)
1	Central Asia	Tashkent	41.2995	69.2401
2	Central Asia	Chorbot	40.8121	69.6275
3	Central Asia	Samarkand	40.3025	69.6909
4	Western Asia	Fergana	40.3834	71.7833
5	Western Asia	Ashkelon	38.2869	68.7802
6	Central Asia	Samarkand	39.6456	66.9756
7	Central Asia	Osh	40.5314	72.7864
8	Central Asia	Aral	40.5069	72.7944
9	Western Asia	Riyadhan	40.6533	72.8681
10	Central Asia	Zhanaozen	37.4831	69.7067
11	Central Asia	Görksmayr	39.0274	66.8309
12	Central Asia	Bukhara	39.7717	64.4220
13	South Asia	Gilgit City	35.9188	74.3078
14	Central Asia	Suleiman	34.8487	68.6309
15	Central Asia	Kabul	34.5553	69.2075
16	Western Asia	Amritsar	36.7666	3.4775
17	Central Asia	Kyrgyzstan	42.8746	74.5698
18	Central Asia	Kyzylorda	42.8654	74.586
19	Western Asia	Almaty	43.2565	76.9285
20	Central Asia	Tashkent	41.2995	69.2401

By definition, civilizational interactions are events above the national level, often leaving trajectories that span several countries. If we want to estimate spatial spillover effects on adjacent regions (e.g., conflict risk or impact on the economy), ignoring the relative location of conflicts may lead to biased conclusions [9]. Adjacent conflicts have a negative impact on economic growth, and the impact increases with the length of the common border. While this finding sounds reasonable, given the instantaneous establishment of the Mongol Empire as a military act spanning Europe and Asia and the subsequent resulting cultural conflicts and exchanges civilizational conflicts and exchanges that followed, the expanding common borders and the short-term and a severely damaged economy in the short term would seem to explain this. The effect of distance between actual conflict areas and neighboring countries can be completely ignored when using geo-data aggregates that go beyond the national level.

5. CONCLUSION

Integrated multivariate heterogeneous geo-information and cartographic resources can be the main source of geo-number chain growth. However, in order to sustain access to effective geo-resources, rights holders must control geo-resource coverage areas or transportation corridors. If the rights holder does not have access to stable governance, there is no reason to expect effective geo-data resource uptake in the adjacent area, which is substantially different from areas with less effective geo-resource collection. Similarly, the rugged and complex terrain and harsh natural climate argument assumes that mountainous and forested terrain is not conducive to geo-data collection and does not provide effective geo-information for military forces. However, it does not matter that the area is mountainous or swampy unless both parties to the conflict are operating over the terrain of the region. Thus, if there is no general probabilistic relationship between terrain statistics according to the national level and the risk or duration of conflict in the region, the proposition of growing chains of rough terrain geopolitical numbers may be fully valid.

The experiments show that the multi-objective optimization method proposed in this paper is able to drive the interpretation through manual empowerment with the intervention of domain experts in the presence of a large amount of missing data, and it is clear that the proofs in the literature have some influence on the derivation of experimental results. However, with more complex historical conditions and comprehensive data involvement, computational derivation can better model the process of system movement and improve the accuracy of the simulation runs. Many of the factors often suggested to precipitate conflict, such as topography, natural resources, population distribution, and ethnic composition, vary considerably among sub-nations, but are not significant in this paper's experiments.

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