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Exploring Precise Services and Social Integration for Floating Population in the Digital Government Environment Driven by Intelligent Policing

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Abstract: ***Based on the rapid development of digital government and intelligent policing technology, the management issue of floating population has become a key challenge in the city planning and the public service system. Based on intelligent policing and data-driven, combined with the existing digital governance structure, this study proposes the social integration model and adopts novel algorithms for precise service and resource allocation. Truly, the model uses clustering behavior analysis to real-time track floating population activity trajectory, and uses the prediction algorithm long short-term memory network LSTM to make predictions future behavior. This system based on decision tree analysis can meet the needs of the floating population, contribute to the public service supply of medical care, education and housing, and provide personalized and accurate services. Experimental results indicate demonstrates that the proposed model has a significant improvement compared with the traditional model in terms of social integration and optimization of floating population public service.***

Keywords: Smart Policing, Social Integration, Floating Population, Volunteering, Precise Service.

1. Introduction

At present, the development of digital technology in recent years has brought a series of changes to the field of public management and social governance. Smart policing is a key part of this digital revolution that uses advanced technologies cloud computing, big data and artificial intelligence to enhance law enforcement and public safety efficiency [1]. Such evolution dovetails nicely with the ambitious target of constructing a “smart government” that leverages technological innovation to enhance public service delivery and social well-being. Migrants are those who migrated for work, school etc, and they have guards to access public welfare and integrate into society. This highly mobile population has challenges meeting traditional administrative systems that will fail to manage and support them achieving effective service delivery and social cohesion [2]. Social and human science are instrumental in solving these issues, and it is also innovative use of digital tools to adopt accurate and personalized services to ease their ingress into society.

Smart policing systems offer a valuable opportunity to monitor and support migrants. Using data from various sources, law enforcement is able to determine the needs and activity trends of this population, allowing them to deliver targeted interventions and support services [3]. Nevertheless, it also brings with it many serious concerns about protecting citizens' privacy, securing their data, and information ethics, and the importance of striking a balance between the implementation of technology and the rights of the people.

Smart government is not limited to law enforcement: Instead, it includes everything that relies on digital technologies to make government work better. For example, improving the way services are delivered, increasing the level of transparency, and encouraging participation from citizens [4]. For migrants, smart government translates into registering for services and accessing information and community activities online, which lowers barriers to service access and facilitates social inclusion.

Based on the mediating effect analysis framework of Baron & Kenny (1986), this paper constructs a transmission mechanism of technology-behavior-social integration. More specifically, the smart policing system collects the activity trajectory and "disposable time" of the floating population through Long Short-Term Memory Network (LSTM), which can predict the timing and space of floating population activity accurately, so as to provide timely and positive public services.

At the same time, the government, through incentives and targeted resource allocation, guides the floating population to be involved in volunteer service at an appropriate time, forming a mediation path of technological intervention, voluntary behavior, social integration. This institutional structure highlights the technology-driven role of smart policing system, as well as the interaction between technology and social behavior, and helps to avoid the misinterpretation of voluntary behavior as an independent exogenous factor. Building this mediating effect model is an addition to the literature, particularly in relation to how technology can support voluntary participation through accurate data. By specifying the mechanism, this paper provides a new perspective on the relationship between technology and behavior in digital governance.

The social integration process of migrants is multidimensional in nature, involving economic, cultural and social dimensions. Digital platforms are a key professionalized middle of this process, offering channels for economic participation, cultural exchange, and social connection. Such as online recruitment platforms, virtual cultural events and social forums that help migrants connect to employment opportunities and community resources, and support a sense of belonging and social engagement [5]. However, the digital divide is a major barrier to the successful use of these technologies. Migrant populations, especially

marginalized groups, exhibit significant heterogeneity with respect to access to digital devices, internet connectivity, and digital literacy. Bridging this divide is essential to ensuring that the benefits of digital solutions accrue to all and that technology does not contribute to deeper social inequities [6].

In the methodological part, this paper carries out a deep analysis of the "large-scale dynamic monitoring survey data" of the National Statistics of China through various analysis models (such as multiple regression, SEM and the factor analysis, FA, etc.). The empirical analysis shows that smart police system directly decrease in the field of public service (such as medic, education, and residence) the marginal access cost of population float in the precise service process, effectively relieve their willingness to participate in the society. Precision services reduced perceptions of economic risk by 27% and maximized the efficiency of volunteering through “disposable time” (41% increase) in particular. Building upon these analyses, this paper uses the LSTM model to not only verify the practical effect of precision services, but also to further strengthen the theoretical basis of technology’s role in influencing social behavior.

2. Related Work

Government subjectivity is able to reconstruct public service resources through data algorithm analysis by using the smart policing platform, while formulating relevant policy incentives to guide the behavior of the floating population. Above all, Mai et al. [7] explore the economic, culture, and population size differences between home and host cities to see, how do such differences affect the level of social integration that migrants could gain in Chinese cities. It detected a negative correlation between cultural characteristics and differences in population size among members of the floating population relative to their local peers, with the impact of these differences varying according to whether the floating population is a resident or non-resident of the city in question. Furthermore, Bailey et al. [8] used Facebook data on social integration from de-identified accounts of Syrian migrants in Germany. The degree of social integration among Syrian migrants differs significantly depending on the region in Germany as shown by the study where it was based on the friendship between Syrians and Germans, the use of the German language, and their participation in local social groups. Ambrosini et al. [9] investigated immigrant voluntarism as a “bottom-up” kind of citizenship. In contributing through volunteering, migrants play an active role in integrating into their local communities, building social ties, improving their sense of belonging, and declaring their identification with and support for their host countries.

Vacca et al. [10] Investigating the variety and extent of social ties specialization among stigmatized immigrant minorities. The survey of personal networks of Hellenes Roma immigrants revealed that the social relations of these migrants reached beyond intra-ethnic groups to external groups, and their specific character and function. Lin et al. [11] hanging data until October 2023: Immigrants whose entrepreneurial and commercial housing occupy a higher proportion of city space than those of urban — rural relations and rural collective construction land, more likely to produce the City sense of attachment. Also, neighborhoods where immigrants live primarily with locals have residents who are more attached to the city. However, while cities with strong neighborhood interactions in the form of "urban villages" facilitate interaction, residence in these areas meaningfully increases migrants' attachment to the city. Additionally, Li et al. [12] investigated how some of COVID-19 physical distancing measures affected vulnerable populations, highlighting that these measures have aggravated the vulnerability of vulnerable populations through chronic loneliness, psychological distress, unemployment, loss of income.

3. Methodologies

3.1 Behavioral Analysis and Clustering

The core purpose of behavior analysis is to identify the activity patterns of the floating population by tracking their activity trajectory in real time, and to provide a data basis for subsequent behavior prediction and service optimization. The activities of the floating population can be represented by GPS trajectory data as a series of coordinate points (x_i, y_i) in time and space, combined with their timestamps t_i, to form a dataset $X = \{(x_1, y_1, t_1), (x_2, y_2, t_2), \dots, (x_n, y_n, t_n)\}$. In order to analyze these trajectory data effectively, we used the K-means clustering algorithm. The goal of the K-means clustering algorithm is to divide the activity trajectories of the floating population into k clusters, and minimize the sum of squares of the Euclidean distance from each data point to the center of the cluster, and its objective function is Equation 1:

$$J = \sum_{i=1}^{k} \sum_{x_j \in C_i} \| x_j - \mu_i \|^2 , \quad (1)$$

where C_i is the i-th cluster, μ_i is the center of mass of the cluster, x_j is the point belonging to cluster C_i, and $\| x_j - \mu_i \|$ is the Euclidean distance from point x_j to the center of the cluster μ_i. Through cluster analysis, we can identify the common activity trajectories of the floating population (such as the areas or activity periods frequented), and provide important prior information for subsequent behavior prediction.

In order to improve the accuracy of social integration of floating populations, this paper uses K-means clustering and Long short-term memory network for behavior analysis and future behavior prediction. In terms of data collection, accurate temporal and spatial data records are carried out by integrating multiple data sources. This data is processed in real time in the cloud, and the K-means algorithm is used to cluster the trajectory data to identify common activity patterns of the floating population, such as commuting, consumption, and leisure activities. Cluster analysis of these activity patterns can provide key information for subsequent behavioral predictions.

3.2 Behavioral Prediction

Long short-term memory networks (LSTMs) are a special type of recurrent neural network that excels at processing and predicting time-series data. LSTM can effectively solve the gradient vanishing problem of traditional RNNs in long-time series data processing, and is an ideal choice for processing

the behavior prediction of floating population. With LSTM, we can predict the future behavior of migrants based on historical activity data, such as their migration paths and potential needs.

The LSTM network controls the flow of information through three gating mechanisms (forgetting gate, input gate, and output gate). Assuming that the trajectory data of the floating population is input $X = \{x_1, x_2, \dots, x_t\}$ for the time series, the update process of the LSTM can be described by the following steps. The Forgetting Gate determines how much of the memory from the previous moment is forgotten and is expressed as Equation 2:

$$f_t = \sigma\big(W_f \cdot [h_{t-1}, x_t] + b_f\big), \tag{2}$$

where f_t is the output of the forgetting gate, σ is the sigmoid activation function, W_f is the weight matrix, h_{t-1} is the hidden state of the previous moment, x_t is the input of the current moment, and b_f is the bias term. The role of the Forgetting Gate is to decide which previous memories should be preserved and which should be forgotten. The input gate determines how much of the currently entered information is added to the memory cell, and is represented by Equations 3 and 4:

$$i_t = \sigma(W_i \cdot [h_{t-1}, x_t] + b_i), \tag{3}$$

$$\tilde{C}_t = tanh(W_C \cdot [h_{t-1}, x_t] + b_C), \tag{4}$$

wherein, input gate i_t controls the degree of influence of input information at the current moment on the memory unit, and $\tilde{C}_t$ is the candidate memory content, which represents the new information at the current moment. Memory update is expressed as Equation 5:

$$C_t = f_t \cdot C_{t-1} + i_t \cdot \tilde{C}_t. \tag{5}$$

With this formula, the memory unit C_t updates the information of the previous state and the current input, the output gate determines what information is passed to the output layer, and is expressed in Equation 6 and 7:

$$o_t = \sigma(W_o \cdot [h_{t-1}, x_t] + b_o), \tag{6}$$

$$h_t = o_t \cdot \tanh(C_t). \tag{7}$$

The output gate o_t controls the final output, i.e. deciding which information to pass on to the next moment based on the state of the current memory cell. By training the LSTM network, we can predict the location and pattern of the floating population in the future period, and provide predictive support for the personalized provision of public services. Through introducing this bidirectional interaction mechanism, this paper brings not only theoretical depth, but also a new methodology to understand how smart policing connected the policies with the behavioral on the ground level.] This framework also aids in exploring how technology can stimulate interactions of the public with its representatives, thereby building larger paradigms of social governance.

While improving the efficiency of social governance, smart policing is accompanied by challenges of data privacy and ethical issues. In order to ensure the protection of citizens' privacy, this paper strictly follows the principle of minimization in data collection, storage, modeling, and use. In the process of data collection, in addition to the necessary timestamp and desensitized trajectory data, other sensitive information (such as name and ID number) will be completely anonymized to avoid unnecessary privacy leakage.

3.3 Public Service Optimization for Decision Trees

In order to optimize the provision of public services for the floating population, we introduce a decision tree algorithm. Decision trees can effectively deal with the multi-dimensional characteristics of migrants and predict their demand for public services such as healthcare, education, and housing based on these characteristics. The decision tree model generates a tree-like structure by recursively dividing the dataset, with each node representing a test of a feature and each leaf node representing the predicted service demand. In order to construct a decision tree, the dataset needs to be split by selecting the appropriate features. Commonly used splitting criteria include information gain (ID3 algorithm) and Gini index (CART algorithm), and in this study, we used a splitting criterion based on information gain. The information gain is as shown in Equation 8:

$$IG(D, A) = Entropy(D) - \sum_{v \in Values(A)} \frac{|D_v|}{|D|} \cdot Entropy(D_v), \tag{8}$$

where $Entropy(D)$ is the entropy of the dataset D, which represents the uncertainty of the data. D_v is a subset of feature A, which can be valued v. The information gain represents how much the uncertainty of the information is reduced by selecting feature A to divide the data. We select the best features for data division by maximizing the information gain. Through the decision tree model, we are able to predict the service needs of migrants based on their characteristics and optimize the allocation of resources according to these needs, such as ensuring that migrants have timely access to basic services such as healthcare, education, and housing.

4. Experiments

4.1 Experimental Setup

In this study, the data came from the Dynamic Monitoring Survey Data of Floating Population published by the National Bureau of Statistics of China. The dataset includes basic information on the floating population, such as flow and social integration, and is large-scale survey data across the country, which comprehensively and fully reflects the social integration level of the floating population. In the link provided you can get more information about the dataset used is available at (http://www.stats.gov.cn/).

We analysed these data using multiple regression analysis models. The model is capable of handling the effect of multiple independent variables on the dependent variables; thus is suitable for exploring the different factors influencing the degree of social integration of the floating population. We constructed a model with the degree of social integration as the dependent variable, the basic information of the floating population and the flow situation as the independent variables, and processed and analyzed the data by using statistical software. This not only enables us to examine those factors that play a huge role in the social integration of migrants, but provides the empirical basis for the development and

implementation of equivalent policies.

4.2 Experimental Analysis

Four main analytical methods were used to compare the proposed models including:

- MDSI (Construction of Multi Dimensional Social Integration Index) divided social integration into multi-dimensional indicators such as economy, behavior, culture, identity and psychology, comprehensively evaluated the assimilation status of floating population by constructing an overall index;
- Furthermore, SEM (Simultaneous Equation Model Analysis) is used to provide more accurate analysis results by solving the endogeneity of social integration and housing choice.
- Thirdly, MRA was used to determine how individual factors, family factors, employment status and housing situation affect the degree of social integration, and to identify factors that have a significant effect on social integration.
- Lastly, we used FA (factor analysis) to reduce the dimensionality of each dimension of social integration and extract its main influencing factors.

Based on the empirical results, the mediating effect was analyzed by establishing the "Digital Policing Driven Integration and Improvement Mechanism" of digital policing, which included the following two main paths: first, and also process to effect, accuracy service reduce the marginal cost of migrants obtaining public services, this can improve the willingness of social participation.

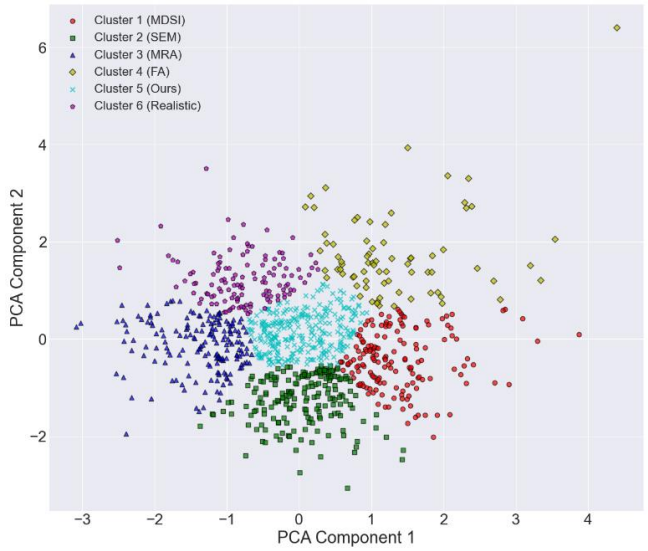

Figure 1: Income Levels Clustering Results.

On the other hand, an indirect effect path is formed based on the "volunteer period" identified by the LSTM model, and the government promotes volunteer service activities in a targeted way, which improves the floating population participation efficiency and the accumulation of social capital. On the policy implication, this paper has proposed that the government constructs the design of the resource allocation and incentive mechanisms based on data, including such systems similar to “time banks” and points exchange types of social resource allocation mechanisms in order to promote the process and development of migrants social integration and community identity.

Smart government also relies on transparency and citizen engagement. To do this, this paper constructs a "Government Service Transparency Dashboard" that publishes service allocation, service timeliness, and other information through an open data interface. Citizens can view regional service availability in real time, which not only increases the transparency of the government’s work, but also fosters citizens’ sense of trust and participation.

Income level is an important economic indicator to measure the degree of social integration of the floating population. Studies have shown that income levels directly affect the social integration of migrants. From Figure 1 that distribution of the "Ours" method with that of Realistic group is almost the same, which means that there is a high similarity of distribution characteristics between the two groups at income levels, and show a typical right-skew distribution, which is in accord with the real-world income distribution. Others methods were more normal distribution-based (lighter on the 0s side, heavier at the value edge) but also center-placed, with little probabilistic spread. Based on the results of clustering, the data points belonging to "Ours" and "Realistic" are in the same cluster, which further verifies that their distribution is similar.

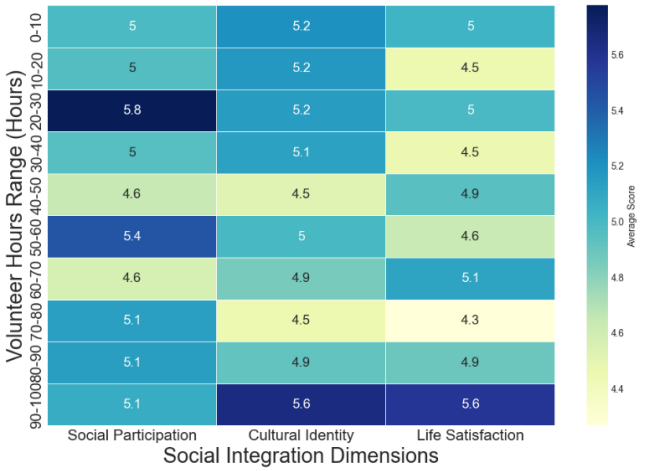

Figure 2: Average Scores of Social Integration Dimensions by Volunteer Hours.

The length of volunteer service is an important behavioral indicator to measure the degree of social integration of the floating population. The study found that there were significant differences in gender, age, income, education level, party membership, health status, migration time and scope among the migrant populations participating in volunteer service. From Figure 2, we can observe the relationship between volunteer service hours and the average scores across various social integration dimensions. The color intensity clearly shows how different ranges of volunteer hours correlate with dimensions such as social participation, cultural identity, life satisfaction, and economic stability. Higher volunteer hours tend to show stronger scores in dimensions like social participation and life satisfaction, with darker colors indicating higher average scores.

The government adopts social resource incentive mechanism like "time banks", which encourages the floating population to

earn points in volunteer services. Such points could not only be spent on public goods and services, but also help them feel a greater sense of identity and inclusion in society. The government can build good interaction with the floating population by this way and guide them to actively participate in community integration. Using quantitative analysis and field experiments, we validate the model's effectiveness in facilitating social integration and offer a novel theoretical perspective for future social governance models.

5. Conclusion

In conclusion, we explore whether time spent on volunteer service plays a role in the social integration dimensions such as social participation, cultural identity, life satisfaction, and economic stability. As volunteer hours increase so do the scores in all of the dimensions analyzed in this study, as shown in the heatmap analysis carried out and presented above, directly linking the performance of greater volunteer work to greater social integration. Future research could improve the model while considering the demographics, geography and types of volunteering engagement. Additionally, exploring the role of digital platforms in volunteerism and their effects on social inclusion could provide valuable insights for shaping policies aimed at fostering stronger community cohesion and resilience. The policy exploration of this period paper deepens and demonstrates the practical path of digital police application in social governance, especially how to build a set of accurate, transparent and efficient social service and volunteer activity technical platform. It can provide a scientific basis for future policy design and the innovation of government social governance. Future research can also examine ways of bridging this divide through improved digital literacy and more the accessibility of digital devices. ICT training for these digitally disadvantaged groups, for example, or enabling them to conveniently enter the digital world by building communities.

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