Development and Research of a New Model of Smart Community Management Based on the Background of Big Data

Qin Li(✉)

College of Economics and Management, Mianyang Teachers' College, Mianyang 621000, Sichuan, China
xiguahaotian2023@163.com

Abstract. With the advent of big data and network era, modern high technology has been gradually integrated into the community to continuously meet people's requirements for high quality of life, and the era of smart community has come. Smart community is the foundation of smart city, and Hangzhou is the first city in China to build a smart city, which not only has a solid foundation in building a smart city, but also has successful experience in building a smart community. With the development strategy of building a smart city and focusing on the development of digital economy and high technology, Hangzhou is leading the direction of smart city construction. Therefore, Hangzhou, as a pioneer in the construction of smart cities, is actively exploring the path of smart community development, which has both technical, policy as well as financial support, also the role of early and pilot implementation. Along with the rapid development of the national economy, the scale of the city is constantly expanding, the number of people and the flow of vehicles is increasing, and the traffic problems are becoming more and more prominent. In urban intersections, people use traffic lights to control the movement of vehicles, and the use of fixed traffic light duration can cause long average waiting times for vehicles in different vehicle flow situations, leading to congestion and affecting the overall road traffic situation. Therefore, how to choose a reasonable way to control traffic lights is crucial to reduce congestion at intersections.

Keywords: Big data · Smart communities · A new model of management

1 Introduction

Since the beginning of the emergence of communities in China and their development over the years, communities have had a great impact on society and the way of life of their inhabitants, and in parallel with the standardization of communities, we have upgraded and reorganized the provision of public services for sports in communities [1]. In 2014, the State Council issued several opinions on accelerating the development of sports industry to promote sports consumption, which mentioned that: enriching market supply, using social capital to diversify sports venues and fitness equipment, and government

P. Qi and Z. Chen (Eds.): ICBDIE 2023, AISR 178, pp. 859–865, 2024.
https://doi.org/10.2991/978-94-6463-238-5_110

support by purchasing services; supporting capital and individuals to enter the field of sports industry and develop diverse sports products and sports services [2]. It can be said that strengthening the supply system of community-based sports public services is a fundamental issue for the healthy development and well-being of our community residents. However, with the development of time and technology and the extension of community functions, the traditional public service system of community sports can no longer meet the high requirements of community residents for life nowadays [3].

2 Q-Learning Algorithm

In reinforcement learning, an intelligent body selects the appropriate action through a strategy. The goodness of the strategy will directly determine the action and the goodness of what follows, but it would be inappropriate to view the strategy only by virtue of the reward obtained in this step, but rather it needs to be judged based on the current reward value together with the reward value that follows, which is caused by the delayed reward of reinforcement learning [4]. The long-term reward value is needed to measure the goodness of adopting a certain strategy in the current state, where the value function is introduced to represent:

$$V^{\pi}(s) = E_{\pi}[\sum_{i=0}^{h} \gamma^{i} r_i | s_0 = s]$$

The value function $V^{\pi}(s)$ represents the expectation of the cumulative reward value obtained by using the strategy π with state s and after many steps. The discount factor, denoted by γ, is meant to account for the fact that the more distant the moment generates the reward value has less impact on the current choice.

The well-known Bellman equation was later obtained based on the Markov property and the iteration of the value function as follows:

$$V^{\pi}(s) = \pi(s) \sum_{s' o \backslash S} p\left(s', s\right)[r_0 + \gamma V^{\pi}\left(s'\right)]$$

$\pi(s)$ represents all strategies in the case of the current state s. $p\left(s', s\right)$ represents the transfer probability from state s to state s'. The Bellman equation describes the linkage establishing one state s to another state s', and the value function in the current states is related to the reward value to the next state, the value function of the next state, the transfer probability, etc. The strategy that always chooses the largest value function gives better results when the transfer probability is known. Here, it is also necessary to add the action a. The cumulative reward value obtained under a certain state s and action a of the policy π is noted as the action value function $Q^{\pi}(s, a)$, as follows:

$$Q^{\pi}(s, a) = E_{\pi} \gamma^{i} r_i | s_0 = s, a_0 = a]$$

The foundation of Q-Learning is built on how to iterate the Q-value function, which can be obtained by building a two-dimensional Q-table with indexes as state values and

Table 1. Q Table

Action	a_1	a_2	···	a_{m-1}	a_m
s_1	$Q(s_1, a_1)$	$Q(s_1, a_2)$	···	$Q(s_1, a_{m-1})$	$Q(s_1, a_m)$
s_2	$Q(s_2, a_1)$	$Q(s_2, a_2)$	···	$Q(s_2, a_{m-1})$	$Q(s_2, a_m)$
...	...	...	...	...	...
s_{n-1}	$Q(s_{n-1}, a_1)$	$Q(s_{n-1}, a_2)$	···	$Q(s_{n-1}, a_{m-1})$	$Q(s_{n-1}, a_m)$
s_n	$Q(s_n, a_1)$	$Q(s_n, a_2)$	···	$Q(s_n, a_{m-1})$	$Q(s_n, a_m)$

column names as action values, with each state value and each action corresponding to a Q-value (Table 1).

The Q-Learning algorithm is constantly updated according to the iterative formula, which is as follows:

$$Q(s, a) = Q(s, a) + \mu(r + \gamma^* \max_{a'} Q(s', a') - Q(s, a)$$

μ represents the step size, too large tends to cause the Q table to fail to converge, too small slows down the learning. It can be seen in equation that each Q value is iterated by constantly updating until the entire Q table no longer changes or stops when the maximum number of iterations is reached.

2.1 AC Algorithm for Reinforcement Learning

Brief Introduction of AC Algorithm

Model-free algorithms for reinforcement learning can be divided into two main categories, one is based on the policy gradient, the main representative is the policy gradient algorithm, and on this basis the REINFORCE algorithm and the DDPG algorithm can be derived, the REINFORCE algorithm is to solve the shortcomings of high variance and too slow convergence in the policy gradient algorithm [5]. The main feature of the DDPG algorithm is a deterministic policy gradient combined with deep learning [5] (Fig. 1).

Actor in the Actor-Critic algorithm is based on the policy gradient and Critic is based on the value function [6]. Actor can be trained to give the probability of selecting each action in a continuous action space, while Critic can learn the reward and punishment information by using the form of a value function [7].

For the Actor network, it is trained by a strategy gradient. The payoff function is first determined:

$$J(\theta) = V^{\pi}(s) = E_{\pi}[V]$$

The gradient of the gain function is obtained and the gradient is updated according to the gradient descent method as follows:

$$\nabla_{\theta} J(\theta) = E_{\pi}[\nabla_{\theta} log\pi(s, a) V^{\pi}(s)$$

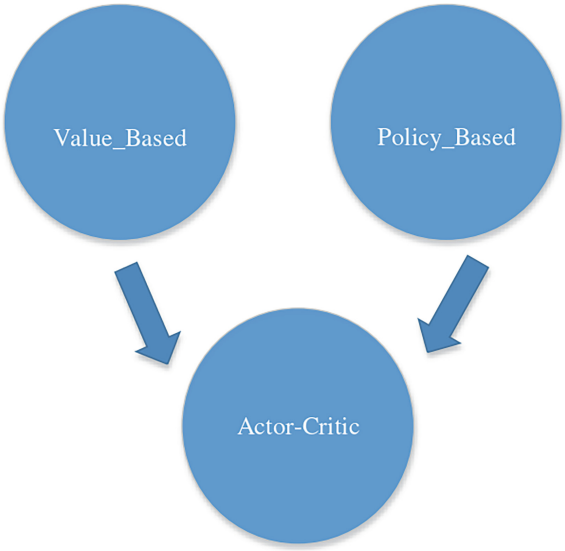

Fig. 1. Actor-Critic algorithm

Here V is the value function, which is required to be fitted according to the Critic network. Then in a Critic network with parameter w, only the following needs to be satisfied:

$$V_w(s) \approx V^{\pi}(s)$$

3 Research Results and Analysis

3.1 The Main Body of Public Service Supply of Sports in Hangzhou Under the Background of Smart Community Construction

According to the survey, both traditional sports public service providers and sports public service providers under smart community construction are composed of government, social organizations, and volunteers [8]. According to Fig. 2, it can be seen the percentage of each subject in Hangzhou for the supply of sports public services under the construction of smart communities. Among them, the government supplies the most, accounting for 95.23%; other supply bodies supply a relatively small percentage, accounting for 3.42%, 1.35% and 1.41% respectively. This also reflects that the supply of sports public services under the smart community construction in Hangzhou is still dominated by the government, and the participation of other subjects in the supply is relatively low [9].

Those who receive the certificate must sign a pledge to guarantee a minimum of 60 h of pro bono fitness instruction per person per year.

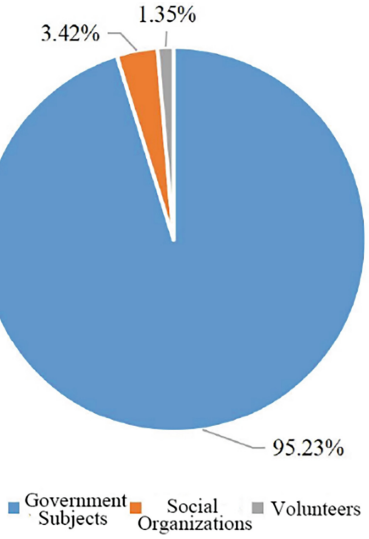

Fig. 2. Percentage of the main supply of sports public services in Hangzhou in the context of smart community construction

Table 2. Construction of public sports facilities in Hangzhou

Location	Number
Fitness Path for All	9233
Basketball Court	6193
Table tennis court	4816
Badminton Court	1459
Soccer field	913
Volleyball Court	683

4 The Current Situation of Sports Public Service Supply Content in Hangzhou Under the Background of Smart Community Construction

4.1 Field Equipment Facilities Service Supply

See Table 2.

4.2 Analysis of Community Residents' Perception of Sports Public Services

The sports feedback platform is a solid bridge for communication between residents and the government, and an important reference for the government to adjust the content of sports public service provision. The construction of a sports feedback platform is the first

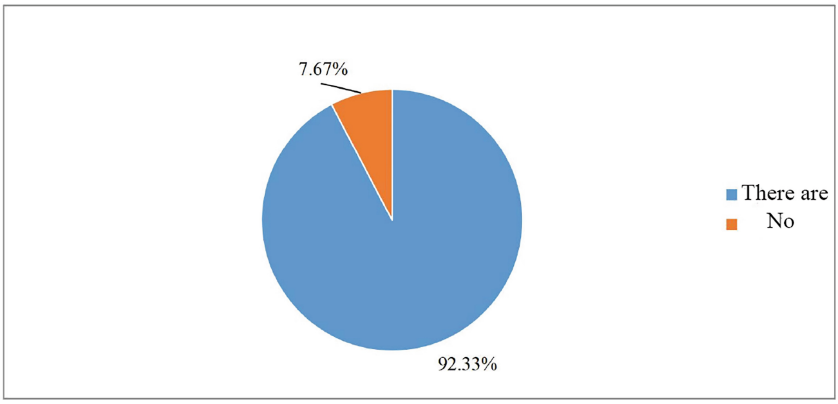

Fig. 3. Sports feedback platform construction

step in bringing the government and community residents closer together, strengthening the communication between the government and community residents and helping to match the supply and demand for sports public services. From Fig. 3, we know that 818 people, or 92.33%, chose communities that had established a sports feedback platform, while 68 people, or 7.67%, did not have a sports feedback platform in their communities. This shows that most of the smart communities in Hangzhou have established sports opinion feedback platforms, which are conducive to community residents reflecting their opinions and demands.

5 Conclusion

The supply body of Hangzhou sports public services under the construction of smart community is single, and the government as the supply body grasps the development direction of smart community sports public services, while social organizations and volunteers play an important role in the supply process with little participation. The current situation of sports public service supply content in Hangzhou under the background of smart community construction: the most constructed national fitness paths in Hangzhou meet the fitness needs around the community, but it is difficult to meet the community residents' pursuit of personalized, modernized and lifelike sports programs; the number of social sports instructors is unevenly distributed, mainly the third-level social sports instructors, and the number of national and first-level social sports instructors is relatively The number of national and first-level social sports instructors is relatively small; there are 17 physical fitness monitoring points all connected to the online network platform; the new media software commonly used by people has become a channel for information publication; Hangzhou's financial expenditure is the main source of special funds for intelligent community sports public services, but the special funds invested are small. In this paper, road scenes and vehicle flow forms are established by SUMO, and reinforcement learning is introduced to traffic signal scheduling. The state space related to vehicle information is established with SUMO as the environment, including roads, vehicles, and other things. The traffic light is used as the intelligent body to establish

the action space of four phases. The functional form of the average waiting time of the vehicle is used as a reward function. The environment and the intelligent body are constantly interacting for model training and learning.

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