Behavior modeling method and its application in combat simulation

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Abstract. Behavior Modeling and Simulation is an important method to analyze macro-and micro-behaviors of groups and individuals. It can predict and analyze the law of crowd activity under a certain density and provide important support for the study of social and economic activities and war and military activities. It has been widely used in emergency response, combat simulation and many other fields. This paper reviews behavioral modeling and simulation, mainly from the current situation of behavioral simulation applications, the main methods of behavioral modeling and the needs of future development direction. Firstly, the application status of behavior simulation is analyzed from both military and social aspects. In the aspect of social behavior simulation, it mainly analyses several aspects, such as safe evacuation, automatic driving, road traffic planning, intelligent robots and so on. In the aspect of military behavior simulation, it mainly analyses individual combat behavior simulation, battlefield element model construction, combat action combination model, multi-agent coupling simulation and so on. Secondly, the method of behavior modeling is deeply analyzed, and the main models of behavior modeling are summarized, including social force model, cellular automata model, agent model, etc. At the same time, the behavior model of individual's multiple forces in a certain environment and the emergence effect model of group are deeply analyzed. Finally, based on the above two aspects of research and analysis results, this paper aims at the simulation of multi-person cooperative attack and defense, which is a military behavior simulation problem. From the four aspects of dynamic environmental factors, operational rules constraints, enemy threat factors and multi-agent cooperative control, this paper puts forward several problems that need to be further improved in cooperative attack and defense.

Key words: Individual Behavior, Crowd Behavior, Behavior Modeling, Combat Simulation
1. Introduction

Behavior is an activity produced by an organism under the influence of various internal and external stimuli [1]. In the process of social life and war, behavior plays an extremely important role. Therefore, it is of great significance to study behavior model and conduct behavior simulation for understanding complex social behavior events and fighting the game between the enemy and us. Behavior model is a model to describe various behaviors of people, including many kinds of behaviors, such as traffic behavior, network behavior, financial behavior, etc. different behaviors have different emphases. This paper focuses on human behavior modeling.

Behavior modeling and simulation is an important means to analyze various behaviors or phenomena in nature and society, and also one of the main methods to verify the feasibility of theory. Human behavior is a very complex process. How to restore the process of human behavior as real as possible and simulate it is of great significance to evaluate various schemes and decisions. The higher the degree of computer restoration, the more the real experimental resources are saved. In the real scene, data collection is expensive and dangerous, and can only be collected after the event, with low efficiency. While simulation can provide unpredictable and special environment quickly and efficiently.

At present, behavior modeling and simulation are widely studied, and different behavior models are developed for different application scenarios. Generally speaking, there are many achievements in the field of social behavior modeling on the simulation of natural environment and the emergence of crowd behavior; there are few reports on the research results of military behavior. Although there is some progress in the performance experiment and the demonstration of using method of equipment simulation, there are few researches on the simulation method of warfighter, the main reason is that human being is an intelligent individual. It has the characteristics of complex thought, diverse behavior, strong individuality and so on. The current combat models are mostly based on static terrain, but due to the strong destructive power and change ability of weapons and equipment to the terrain, the scene reconstruction of the current combat simulation to the battlefield is still not realistic, and the interaction between combat behavior and dynamic terrain is more difficult to realize. Overall, the current behavior modeling and simulation has a certain research basis and application direction, but there are still some unsolved problems and more complex application requirements.

This paper first summarizes the application status and modeling methods of behavior modeling, and then analyzes the new requirements of behavior modeling proposed by combat simulation, so as to provide reference for future research.

2. Application status of behavior model

2.1 Application status of social behavior model

Social behavior is human behavior caused by social stimulation [2]. At present, social behavior simulation is mainly used in complex activities such as safe evacuation [3-8], traffic engineering [9-14], robot motion control [15-17].

In terms of safe evacuation, China, as the country with the largest population density, is in urgent need of solving the problems of dense population and space shortage. With the development of architecture, building safety and evacuation strategies under special conditions have gradually become a research hotspot. The research of safe evacuation is mostly based on the method of model simulation. The evacuation model was first proposed by Japanese scholar Togawa in 1955. The Togawa model regards the crowd as an indivisible fluid, and the model is relatively simple [3]. In the fruit model, edge effect is introduced to distinguish horizontal, upward and downward evacuation modes, which improves the problem that Togawa model can only analyze horizontal single-layer scenes [4]. Paul built a data-based evacuation model by using real data fitting [5], and created a new method of data-oriented model building. Helbing put forward the social force model [6] in 1995, which has become a classic model in the field of evacuation model. Up to now, there are still a lot of models based on social force model. Jiang Xinyu improved the social force model, increased the small group division
[7], and realized the small group evacuation path planning under the emergency. Zhang Limao and others simulated the subway fire through the fire simulator and Pathfinder [8], evaluated the three main parameters of temperature, carbon dioxide concentration and visibility, carried out the subway evacuation scenario simulation, and provided effective reference data for the design of subway safe passage and the formulation of evacuation guidance scheme.

In traffic engineering, it first appeared in the British road research laboratory [9], which completed the intersection simulation model. After that, the traffic simulation gradually transits to the stage of software design, and the traffic simulation software is generally divided into two categories: macro and micro. Macro software is mainly used for road network simulation. In 1965, the Federal Highway Administration of the United States developed a SIGOP system based on a macro model to study the design and structure of traffic lights in the road network [10]. The microscopic model is usually used to describe the motion of a single vehicle. Lieberman developed UCTS-1 based on random time scanning, and then developed Netsim system [11]. With the deepening of research, hybrid model and comprehensive large-scale model begin to appear. Van Aerde developed integration and successfully combined micro and macro models to build a quasi micro model. TSIs developed by the Federal Highway Administration of the United States has shown good results in model accuracy, scene breadth and effectiveness, and is a representative system of large-scale integrated model.

Domestic road traffic research started relatively late, initially mainly by domestic institutions of higher learning. Shanghai Jiaotong University has designed the macro traffic flow model [12]; Xi'an Jiaotong University has designed the signal intersection model [13]; Tsinghua University's traffic research institute has developed Trasimul software to simulate the urban level crossing situation. With the development of urban modernization, the demand of traffic engineering for model is more refined, and the development and test of unmanned vehicle also depends on the construction of traffic model to some extent. Zhao Jin and others have designed a simulation platform based on urban road traffic[14], which can provide a realistic experimental environment for the operation and test of autopilot, which not only saves development costs, but also enhances safety.

In the aspect of robot motion control, because the research of robot includes many fields such as physics, machinery, computer and so on, and the research time is late, its system and technology have not formed a relatively fixed method. The initial purpose of robot motion control is to solve the problem of unmanned space exploration robot. After that, there are explosive disposal robots, fighting machine dogs, robot vacuum cleaners and so on. In the early days, robot motion control was mainly based on the principle of dynamics and programmed control [15]. In the control of quadruped or bipedal humanoid robots, Boston power company always represents the most cutting-edge research technology [16]. Boston power company has been developing research and application of intelligent robots for ten years, with relatively significant results, but its high cost has made Boston power close to bankruptcy for many times. Recently, Zurich Federal Institute of technology published a paper on how to use artificial intelligence and deep learning for robot training in science robotics [17], and showed the outstanding performance of robot ANYmal. By means of simulation training, the virtual version of ANYmal can be made in the computer, and many of them can be trained at the same time, reaching more than a thousand times of the training and learning speed in reality, and then downloading the results to the real robot, the effect is very significant, and its moving speed and balance recovery after falling show great progress.

2.2 Application status of military behavior model

Behavior modeling is also a very important field in military science research. Operational behavior modeling can provide scheme evaluation, data test and Tactics Research for military training. Lenoir T analyzes the relationship between real war and military entertainment projects, and war games can also be regarded as a simulation way of war behavior [18]. Although the game is very different from the real war, it is still a method to study the war behavior. Kincaid JP built a disaster exercise model [19] and applied it to the public security personnel response training system. Then the US military improved the model to a war model and developed simulation games to conduct soldier training and
medical rescue training. In 1997, a research report of RAND Corporation of the United States proposed that the training cost of single personnel in the United States Army could be reduced to one fifth of the original by using virtual training system. In 2011, the US army launched the US Army Infantry Training System, which constructed a simple environment and enemy situation model for individual simulation training.

The combat model not only plays an important role in training soldiers, but also has its application value in the research of Tactics. The combat model can simulate the combat process, and Lanchester equation is an important formula to calculate the combat forces [20]. However, Lanchester's equation is more rigorous, which has strict requirements on the structure and lethality of both sides of the battle. However, with the diversification of the combat forces and the complexity of the tactical methods of war, the combat structure and lethality may change greatly in a battle. The model building method based on artificial life came into being. In fact, artificial life is to build combat units into agents, and construct complex battlefield systems by distributed artificial intelligence. With the development of artificial intelligence, the research on the behavior simulation of individual soldiers has a new trend. Du Jun and others put forward the simulation model of individual combat based on three modules of perception modeling, action modeling and action control [21], and initially established the basic model of individual combat. With the emergence of object-oriented concept and agent technology, the elements on the battlefield are unified as the combat entity to build the model. Aiming at the problem of coupling the military concept model and the engineering technology model in the process of combat, Pu Wei puts forward the combat modeling method based on agent action diagram [22], and takes the typical combat action modeling of armored unit as an example to verify the feasibility and effectiveness of the method. In recent two years, the computer computing power has been greatly improved, which makes the realization of more complex model system possible. Hao Xiaoxiong proposed an agent-based on-the-spot first aid modeling of the army synthetic army war [23], which constructed models of warfighters, health personnel, health vehicles, etc. and coupled them to the simulated battlefield environment in the way of multi-agent, simulated and calculated the process of battlefield first aid, which provided a reference for the design of real battlefield medical service scheme.

2.3 Application Status Analysis

The behavior model in the social field has a strong commercial and safety value, which provides an important reference and test platform for architectural design, traffic planning, machine training and other aspects. But there are also some problems such as the model is not precise enough and the individual characteristics are not obvious enough.

Behavior model in military field plays an important role in auxiliary training, simulation of combat process and so on. However, there is still a lack of model construction of variable complex environment and elements connection between combat behavior and battlefield environment.

3. Application status of behavior model

3.1 Social force model method

Social force model [6] is a very classic character behavior model proposed by Heibing.

\[
m_i \frac{dv_i}{dt} = m_i \left( v_i^0(t)e_i^0(t) - v_i(t) \right) + \sum_{j\neq i} f_{ij} + \sum_{u} f_{iu}.
\]

The classic social force model contains three "forces": the first is self driving force, which is determined by pedestrian quality \(m_i\), expected speed \(v_i^0(t)e_i^0(t)\), current speed \(v_i(t)\) and step length \(\tau_i\); the second is the resultant force given by the recipient; the third is the resultant force given by the obstacle. The classical social force model can simulate the arch effect and well reflect the phenomenon of "fast is slow" in practice.

Because people often have different reactions and decisions in different environments, most people make similar decisions in the same environment [24]. The model is based on the hypothesis that pedestrian speed is affected by social force field. The "force" in social force is not a force in physics,
but a driving factor for the evolution of individual behavior in the model [25,26]. At first, the classical social force model ignores the differences between individuals and gives them a certain quality as a particle for simulation. The advantages are convenient calculation and implementation, while the disadvantage is too simple. The consistency between simulation effect and real situation needs to be improved. Generally, when the crowd reaches a certain level and panic psychology reaches the threshold (the threshold can be randomly floating between people), there will be a dependence on the public, that is, herd phenomenon. Subsequently, in the continuous improvement, additional parameters such as panic coefficient and conformity coefficient are introduced to reflect the panic psychology and conformity effect of the crowd in the real situation [27]. The classic model only considers that when two strangers are close due to random movement, they will produce psychological "repulsion force" away from each other. Due to the neglect of volume, the collision of body cannot be realized at first. With the introduction of individual volume, the force in social force is expanded, the repulsion force generated by individual body collision is proposed, and the model of collision and avoidance between people is improved. In recent years, the improvement of social force model is more comprehensive. Deng Yujing introduced anxiety psychological factors and random movement of characters into the crowd evacuation process, and further improved the social force model [28]. Ma analyzed the typical expected speed distribution strategy, and obtained that the pedestrian flow density is an effective index to reflect the complexity of human behavior dynamics through experiments, and gave the strategy suggestions for speed distribution according to different application backgrounds [29]. Kang proposed a dynamic framework model of shipwreck evacuation based on the beach scene based on the social force model, and introduced a small number of "villain" models, which increased the complexity and fidelity of the model, providing an important reference for shipwreck accident rescue [30]. Kretz improved the parameter relationship of the social force model to avoid oscillation under the specific parameter selection [31].

3.2 Cellular automata model method

The cellular automata model is a kind of spatiotemporal discrete model. The construction methods of cellular automata are diverse. As long as certain laws or rules are satisfied, it can be regarded as a cellular automata model. Therefore, its application fields are very wide, including information transmission, system order, chaos theory, etc. [32]. This paper only analyzes and discusses the research of cellular automata in crowd movement simulation. Cellular automata can be divided into one-dimensional cellular automata, two-dimensional cellular automata and three-dimensional cellular automata.

One dimensional cellular automata determine the neighborhood according to the unique parameter distance, and its rules are the simplest and intuitionistic. Since its research started the earliest, the research on one-dimensional cellular automata is also the most in-depth [33]. Huang Pinghua et al. Decoupled the steady-state time-dependent function based on probability theory, and constructed a one-dimensional cellular automata stochastic traffic flow model [34]. Xue Yu et al. Improved the single lane cellular automatot to regulate traffic flow through deceleration probability and vehicle density [35].

Two dimensional cellular automata can distinguish cells from geometric figures, such as triangular cellular automata, quadrilateral cellular automata and hexagon cellular automata. The application of two-dimensional cellular automata is more extensive, and its quadrilateral mesh mode can fully fit in terrain gridding. Xie Mei and others realized crowd evacuation simulation using Python language and two-dimensional cellular automata [36]. There are many methods of neighborhood setting in two-dimensional cellular automata, which are usually von Neumann type (4 neighborhood type), Moore type (8 neighborhood type) and extended Moore type. Among them, the extended Moore type expands the neighborhood of the Moore type to twice the radius, which can improve the calculation accuracy and increase the complexity. Ji proposed a logistic regression model based on stochastic utility and cellular automata of ground field [37]. Ye Ruifang et al. Used Moore's nearest neighbor model to carry out edge detection and image restoration processing on the image, improving the processing speed and quality [38].
Three-dimensional cellular automata are often used to simulate the evolution of crystal structure, such as the process of liquefaction, vaporization and solidification during welding and solidification. It can also be used to simulate group behavior in 3D environment. The complexity and calculation of 3D model are large. In some cases, 2D model can be applied to 3D space for processing. Although it can restore the real process to a certain extent, there are still large errors. Hu Jun and others proposed a three-dimensional cellular automata model based on location gravity and collision to simulate crowd evacuation [39], which greatly improved the evacuation strategy of the three-dimensional environment of the ladder type. Zhou Guoxiong et al. Used three-dimensional spherical cellular automata to simulate forest fires, and introduced genetic algorithm to reduce the number of iterations, which improved the operation efficiency [40]

3.3 agent model method

Agent model can realize the simulation closest to human on single individual model, and can couple human understanding, behavior, decision-making and psychological model into an agent. Then the complex system formed by multi-agent is embedded in the environment, and multi-agent system is the hot issue of this year. The behavior of fish, birds and people can be simulated by agent model. Through simulating the behavior of natural biological groups, the Boids model [41] explores the rules from the collective behaviors of birds, fish, etc., and finds that there are mainly three main behaviors: aggregation, dispersion and alignment, in which individuals in the group do random movement to a certain extent while receiving group constraints. Pan Xinxin et al. Used the similarity between fluid movement and crowd movement, simulated crowd movement with the help of FLOW3D model, and compared it with the macro motion image of crowd, and got a better model [42].

Dynamic model is a simplified model based on artificial rules. In application, it is impossible to set all elements of nature as rules and write them into the model. With the continuous development of the model, the simulation method based on data-driven is proposed. By introducing real data into the simulation of the agent, and decomposing and splicing the motion process, the simulation authenticity is further improved. Li et al. Used a copy and paste technology to realize the animation of a large number of people, and solved the problem of continuity of time and space [43]. Qiao et al. Proposed a strategy to optimize the difference of trajectory. The framework composed of prior data can effectively reduce the computational complexity [44]. Ren Jiaping combines the two and proposes a group behavior simulation algorithm based on data-driven and mechanics [45].

Using neural network and reinforcement learning to train agents to achieve autonomous generation of behavior decision-making is the leading direction in the field of behavior simulation. The main method of reinforcement learning is to design reward strategy, and make AI try and error continuously based on the way of maximizing reward, and finally form AI's own judgment strategy. Reinforcement learning problem is usually modeled as Markov decision-making process, whose goal is to find a strategy that can make us obtain the maximum cumulative reward [46]. In recent years, deep reinforcement learning, which combines reinforcement learning process with deep neural network, has become a hot new direction in the field of artificial intelligence. Heess and Nicolas train a series of simple tasks from simple reward signals through reinforcement learning mode, and then carry out complex behavior learning through gradient reinforcement learning of mutation strategy to complete a variety of complex terrain obstacles such as crossing, detour, jumping [47].

3.4 model method analysis

The above model methods are three common methods of current behavior simulation.

Although social force model has been widely and deeply applied in the research of group behavior, it has obvious shortcomings in the following aspects: social force model usually regards environment boundary as static rigid entity, which can not meet the dynamic change of people to environment and the secondary behavior effect caused by it; the model focuses on individual behavior details, but on the whole. In some cases, it is necessary to introduce a global control assistant model to achieve the overall order; the model does not consider the real-time decision-making factors of individuals.

There are several problems in the simulation of group behavior with the cellular automata model: the behavior of pedestrians is limited to a two-dimensional plane, and the simulation of behavior in
three-dimensional space needs to be strengthened; the typical cellular automata model only has eight forward directions, while the real moving direction of pedestrians is arbitrary and random, so the cellular automata model is precise in the simulation of crowd behavior. Degree is limited greatly.

In behavior modeling and pattern, although agent model has many advantages, there are still some challenges to be overcome. First of all, the lack of coupling of psychological and physiological factors in the model affects the authenticity and effectiveness of behavior simulation results and individual behavior decision-making support effect; second, because the conditions required for behavior decision-making are too complex, there is still a big gap between the current agent behavior model and the goal of achieving a reasonable decision; third, human behavior is extremely complex, and a single mathematical formula is very complex. It is difficult to express perfectly, but it needs to be solved by the cooperation of multi-disciplines.

4. Analysis and design of behavior model for military simulation

4.1 analysis of the particularity of the warfighter's behaviour

As an important form of combat research, combat simulation needs to construct the relationship among the three elements of "equipment environment human". Compared with the social behavior model, the behavior modeling and Simulation of people are quite different, which are mainly shown in the following points.

Because of the complexity and variability of the battlefield environment, battle simulation is usually accompanied by great changes in the terrain, such as the destruction of craters, walls and bridges caused by shelling. Whether the algorithm and strategy based on the static environment can deal with the real-time changing dynamic environment on the spot is an important problem that needs to be improved in the team cooperation model.

The complexity and constraint of operational rules. The rules of group evacuation model or fish bird group model are relatively simple, and the behavior is only limited to movement. The motion parameters are usually speed, direction, distance from other individuals and so on. But the operation is more complex. The time required by the superior mission, the communication distance of the team members, the safety range to avoid the killing, the influence of complex terrain on the speed and so on all need to be analyzed and designed.

Intelligent elements of enemy operations. The most obvious difference between combat behavior simulation and social behavior simulation is that there is an enemy agent with self-judgment in combat action. In the environment, the agents of both sides constantly judge and interpret the decision-making behavior of the other side, and make targeted measures to make the whole simulation process more complex and difficult to predict. However, due to the reasons of combat purpose, national culture, psychology, etc., the two sides The same event will produce different responses, and the complexity of the system will further increase.

Cooperation of multiple individuals. The behavior of social individuals is often driven by their own interests to maximize, so they tend to show the majority of group emergence and competition, while team cooperation highlights the cooperation among teammates, such as task division and cooperation, the use of battle formation, information sharing and decision-making, and how to reflect the algorithm strategy of coordination and control in heterogeneous multi-agent is the future development. The important research direction of the exhibition.

4.2 basic requirements for behavior modeling of warfighter

(1) perception model

In the attack and defense model, the threat of the enemy is one of the key factors that have an important impact on the path selection and the action behavior of the attack and defense. The enemy threat mainly considers the position, killing radius and obstruction of direct fire. Environmental awareness is the first and important part of behavior model construction. Individual local path planning and behavior selection are based on current environmental information. In this paper, target perception and threat perception are considered. The perception of obstacles, people and terrain in the environment. The sensing range and mode are modeled based on the real line of sight. The maximum
horizontal visual angle of human monocular is 156 degrees, the maximum horizontal visual angle of binocular is 188 degrees, and the overlapping visual field is 124 degrees. Only objects in the overlapping visual field have a sense of stereo and distance, so the default visual angle is 124 degrees when modeling. Other angles, commonly known as residual light, are not sensitive areas of human eye. Based on the target perception distance, environmental transparency and human visual difference are introduced. It is set as perception distance \( r \), visual distance \( \text{Dis}_{\text{eye}} \), random variable \( \text{Dis}_{\text{ran}} \), environmental transparency \( \delta \), which is mainly affected by the environment, such as heavy fog weather or smoke zone made by the enemy. The larger the range, the greater the concentration. 

\[
(1)\quad \text{Dis}_{\text{eye}} = (\text{Dis}_{\text{eye}} + \text{Dis}_{\text{ran}}) \times (1 - \delta)
\]

(2) behavioral reasoning 

The path planning algorithm and behavior selection model need to be considered when the environment information is obtained through the perception model. In this paper, we mainly study the single individual local path planning algorithm, mainly based on grid data, through the principle of cellular automata, using the 8-neighborhood algorithm, to get a relatively accurate algorithm. However, considering the overall constraints of formation control, we need to set the scope. When the path exceeds the scope of formation control, we need to choose a new reasonable path. The global path search will be discussed in the team cooperative control. When there is a segment in the middle of the path that is in the threat area, behaviors such as breaking barriers and building fortifications will be initiated for this segment, which will lead to changes in the environment and then provide a more reasonable new path, so it is necessary to re-plan the path. Dynamic path planning will first build a new channel based on two-dimensional space. When facing the three-dimensional entities such as houses that must be crossed, the three-dimensional path will be generated based on the destructible attributes of the entities and the individual special operations of the special combat team members to determine whether they can cross the houses.

The global path planning will consider the geographical environment and the threat of the enemy comprehensively, and determine a variety of route schemes by means of the shortest path, the shortest time and the least threat, respectively. The global path planning involves the complex environment of large terrain, and the convergence of the precise algorithm is poor. The path planning strategy based on graph search and artificial potential field method can effectively reduce the complexity. The transformation of complex terrain from grid data to connected graph data will greatly reduce its complexity. Combined with the artificial potential field method, the gravity field is set at the task target point, and the repulsion field is set at the obstacle, which makes the spanning tree change from random direction to target orientation, so as to reduce the vibration or slow convergence caused by narrow space. Considering the threat of enemy situation, we add time cost and threat cost to the path length for overlay analysis. Because the dynamic change of terrain will be completed by local single individual path planning, the accuracy can be reduced properly when global planning, and the details can be handled by individuals.

(3) multi individual collaboration 

The path planning in the individual behavior modeling is limited by the formation and has a relatively small range, so the more accurate algorithm can be used to achieve the requirements of accuracy and detail reduction. Local path planning can use intelligent algorithm, combined with reinforcement learning method to train AI, so that virtual soldiers can judge the enemy's strategy, choose the path and attack and defense behavior flexibly. First, set the boundary conditions or punishment functions for virtual soldiers. If they exceed the boundary, they will be deducted points. If they enter the enemy's fire area for more than 5 seconds, they will be judged dead directly (deduct enough points). If they complete the given tasks within the constraints (such as every 100 meters of the route, eliminate the enemy, and blast obstacles), they will be given points. Through training, they will get the highest final score. Through many times of simulation training, the virtual soldier AI can finally reach a relatively mature behavior choice.
Through the combination of decision-making core and formation control to complete the whole attack and defense behavior, a "leader" is needed, which is not necessarily the actual soldier model, but also a concept "leader" to judge the decision-making. The decision-making and route are made by it, but the model and behavior state can not be set. The central point of the formation can be set as the fixed position of the "leader". In fact, in combat operations, individual soldiers are often required to be responsible for a certain distance away from the planned route, and return after completing the mission. At this time, a real or virtual leadership center is required to continue the formation control and path planning.

Formation control can take robot group as a whole dynamic area through region based robot control method, and region can be dynamically transformed through algorithm design, so that robot formation can form different graphics in various environments, which will have better adaptability in the face of complex environment.

5. Concluding remarks
Character behavior modeling and simulation have certain application and broad prospects in the current social and military fields. According to the current application situation of behavior modeling and simulation, this paper distinguishes the military field and social field, analyzes their application and compares their similarities and differences. This paper analyzes and discusses the main methods in the field of current behavior simulation, summarizes the prospects and technical difficulties of its application in the military field, and makes a preliminary framework design for the behavior modeling of the warfighter.

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