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INTELLECTUAL ANALYSIS OF LARGE DATA STORES

Chernyashchuk N., Koval I., Gaiduchyk M., Kushko I., Kachko V. Intellectual analysis of large data stores. An intelligent system for processing big data. The paper classified and considered the further development of the PHI accelerator in modern processors for computing artificial intelligence in games. Based on the approach, an intelligent system was developed that increases efficiency and speed in game projects using artificial intelligence. The practical significance of the obtained results is that the obtained results can be used to improve the efficiency of using machine learning in the development of computer games.
Keywords: processor, intellectualized system, machine learning, computer game, artificial intelligence Keywords: processor, intellectualized system, machine learning, computer game, artificial intelligence.

Чернящук Н.Л., Коваль І.М., Гайдучик М.С., Кушко І.М., Качко В.О. Інтелектуальний аналіз великих сховищ даних. У роботі класифіковано та розглянуто подальший розвиток прискорювача PHI в сучасних процесорах для обчислень штучного інтелекту в іграх. На основі підходу була розроблена інтелектуальна система, яка підвищує ефективність і швидкість в ігрових проектах з використанням штучного інтелекту. Практичне значення отриманих результатів полягає в тому, що отримані результати можуть бути використані для підвищення ефективності використання машинного навчання при розробці комп'ютерних ігор.
Ключові слова: процесор, інтелектуалізована система, машинне навчання, комп'ютерна гра, штучний інтелект

Statement of a scientific problem. The functioning of an intelligent system is based on the use of various algorithms and methods that allow the system to understand, make decisions and interact with the environment. Some key algorithms for the functioning of intellectualized systems are considered in our work [1, 2].

Research analysis. Machine learning is an approach that allows an intelligent system to learn from data and make predictions or make decisions without explicit programming [2]. Machine learning algorithms include supervised learning (eg neural networks), unsupervised learning (clustering, dimensionality reduction) and reinforcement learning (Q-learning, REINFORCE).

Intelligent systems use rules and logical inference systems to make decisions based on facts and rules. This approach is widely used in expert systems [2, 7].

Optimization algorithms are used to find optimal solutions under constraints. This can be important in problems where you need to choose the best alternative among many.

To work with voice commands and audio data in intelligent systems, voice recognition algorithms are used, which convert audio signals into text information [5].

In intelligent systems that provide recommendations (for example, recommendations to buyers in an online store), collaborative and content filtering algorithms are used.

These algorithms can be used individually or in combination to develop a variety of intelligent systems and applications that solve different tasks. The choice of algorithms depends on the specific task and resources available for the implementation of the intelligent system [7, 8].

The goal of the work. Research on an intellectualized approach using hardware based on machine learning methods for the development of computer games.

Presentation of the main material and substantiation of the obtained research results. If the agent did not perform the action or for other reasons the action did not take place, then we return to the repeated step of training the agent on the selected set of values.

The functioning of an intelligent system is based on the use of various algorithms and methods that allow the system to interact with data and the environment, as well as to make decisions and react to events. Here are some basic algorithms for the functioning of intellectualized systems:

Signal processing techniques are used to analyze and process signals such as images and audio.

Machine learning algorithms include methods of classification, regression, clustering, and others that allow the system to learn patterns in data.

Logic techniques and rules are used to develop rules and logic algorithms that determine how a system makes decisions based on input data.

Knowledge-based decision-making techniques use expert knowledge and databases to make decisions.

Systems modeling methods are used to create models that simulate real processes or phenomena.

Simulation and virtual reality are used to create simulated environments where the system can test solutions without actual intervention.

Optimization algorithms are used to find optimal solutions under constraints.

Search algorithms are used to find the best solutions in problems with a large space of possible options.

Process automation algorithms are used to automate routine operations and tasks.

Control and regulation systems are used to control physical processes or devices.

Motion and navigation algorithms are used to control the movement of robots and navigate in space.

Natural language processing (NLP) algorithms are used to understand and generate textual information.

User interaction algorithms are used to create user interfaces and interactions.

Algorithms of the functioning of intellectualized systems can be combined into complex complexes for solving specific tasks and tasks. They can be implemented in different programming languages and use different approaches to data processing and user interaction.

The function of starting the action of the agent is presented in Figure 1, for its visualization the environment for creating computer games was used directly.

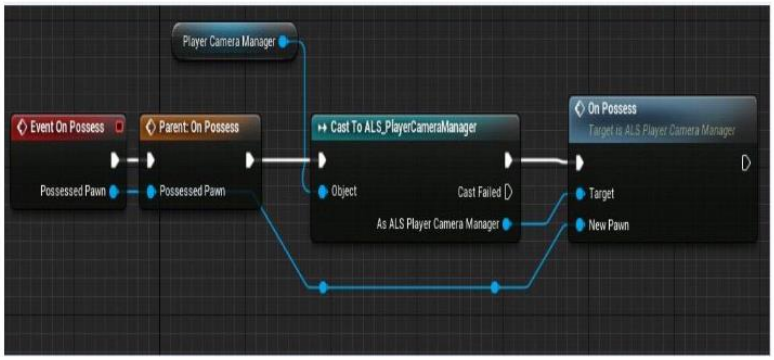

Fig.1. The start of the action of the agent

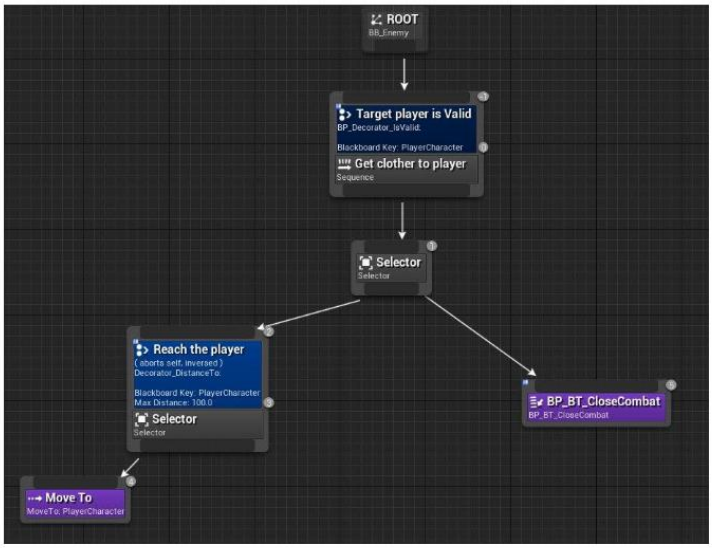

Fig.2. Agent behavior

The algorithms of the functioning of intelligent systems determine the way in which these systems make decisions and interact with the environment. These algorithms include various methods and approaches based on artificial intelligence and data processing. Here are some of the most common algorithms for the functioning of intelligent systems:

Methods of machine learning (Machine Learning) machine learning uses statistical algorithms to teach an intelligent system to recognize patterns in data and make decisions based on this knowledge. Machine learning methods include: neural networks, decision trees, support vector method, clustering, Bayesian networks and others.

Natural Language Processing (NLP) NLP techniques are used to understand and generate natural language, such as text analytics, machine translation, speech recognition, and sentiment analysis.

Genetic algorithms (Genetic Algorithms) genetic algorithms model natural selection for solving optimization problems and finding optimal solutions.

Decision Support Algorithms (Decision Support Algorithms) these algorithms help to make decisions based on input data and established rules. They are used, for example, in management systems, finance and medicine.

Simulation Systems (Simulation Systems) simulation systems allow you to simulate processes and interaction in systems to analyze and solve complex problems.

Planning and Optimization Algorithms (Planning and Optimization Algorithms) These algorithms are used to select the best actions or routes in limited time and resources.

Combining these algorithms and approaches allows you to create a variety of intelligent systems that can solve various tasks in different areas, from production automation to the development of smart mobile applications.

A standard behavior tree for an NPC is presented in Figure 3.

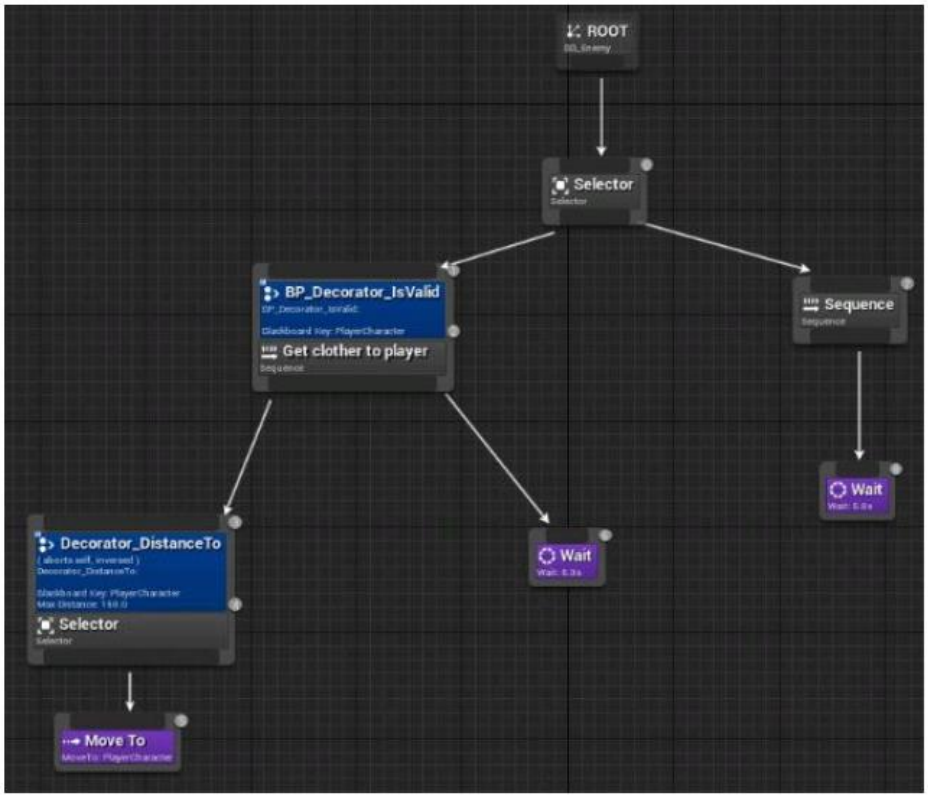

Figure 3 – NPC behavior algorithm

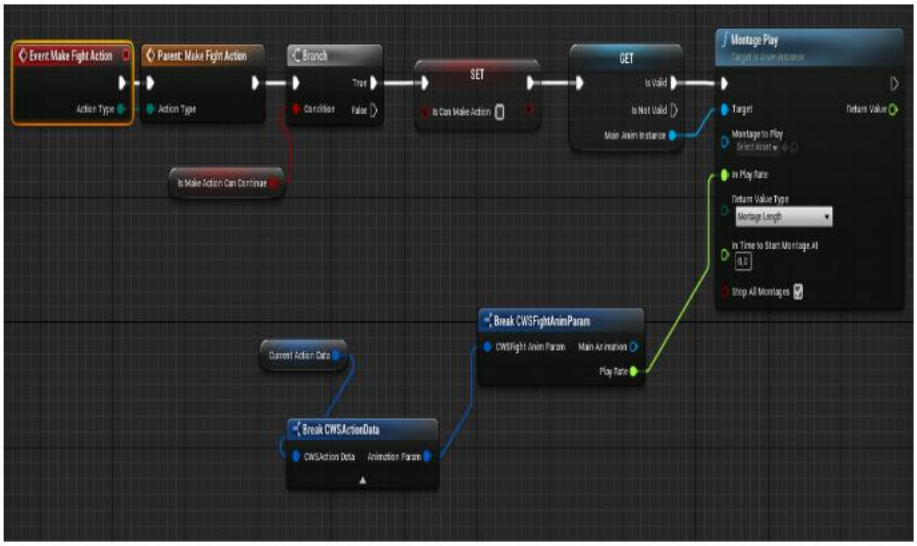

Figure 4 – Striking

The functional diagram of the operation of artificial intelligence during the battle is shown in Figure 5. The agent's counteraction algorithm is presented in Figure 6.

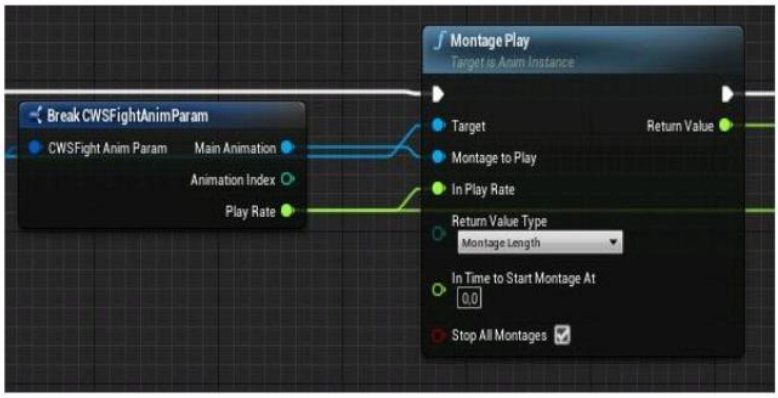

Figure 5 - Scheme of countermeasures

For each action there is a counteraction, for example, if the player hits with his left hand, the AI must place a block with his right, then he will not get hit.

Algorithms for the functioning of an intelligent system determine the way in which the system makes decisions, processes information and performs tasks. Depending on the specific system and its tasks, different algorithms and methods can be used. Here are some common algorithms that can be used in intelligent systems:

Machine learning uses algorithms to train models that can predict outcomes or classify data based on training data. This includes algorithms such as linear regression, decision trees, support vector method, neural networks and many others.

To understand and process text information, intelligent systems can use natural language processing algorithms (Natural Language Processing, NLP), including tokenization, lemmatization, tonality analysis, and others.

For image and video analysis, systems can use computer vision algorithms such as convolutional neural networks (CNNs) for object recognition and visual information processing. Some systems use formal logic and rules for decision-making. This is especially useful in expert systems, where the expertise of experts is taken into account in the form of logical rules.

Genetic algorithms use natural selection and genetic operations to optimize decisions. They are used to solve complex optimization tasks. Search algorithms help to find optimal solutions among a large

number of possible options. This may include left-right search algorithms (linear search), binary search, A* algorithms, and others.

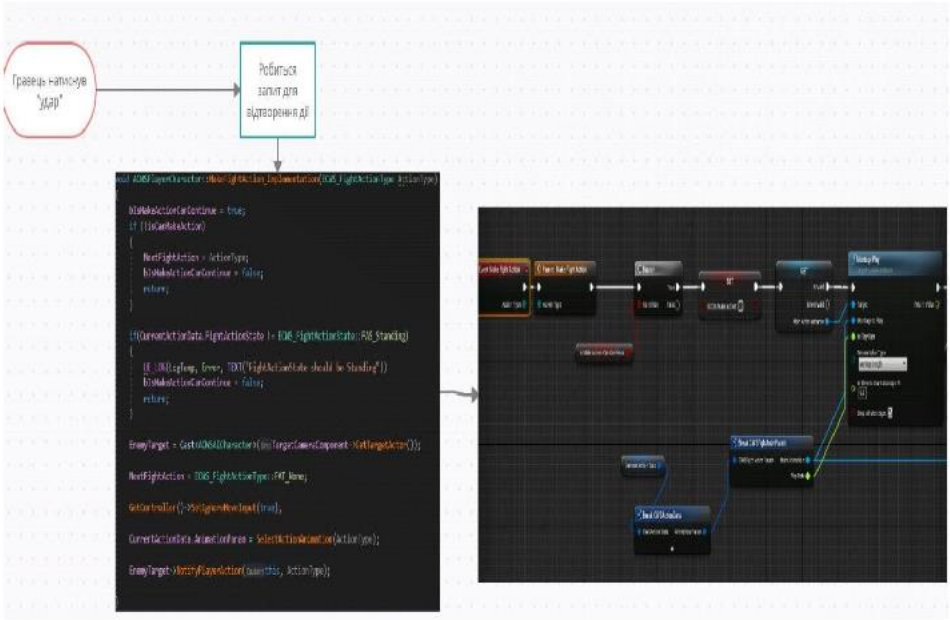

Figure 6 – Scheme of the agent during the impact

Recommender systems use different algorithms, including collaborative filtering, content-based filtering, and deep learning to make recommendations.

For systems that have to make decisions and develop action plans, planning algorithms such as path-finding algorithms, decision trees, Q-learning, and others are used.

Algorithms for the operation of intelligent systems can be selected depending on the specific tasks and characteristics of the system, and they are often used in combination to achieve better results.

```
void UCWSMachineLearningComponent::UpdateQTable(FCWSFightActionResultData ResultData)
{
	OldAction = CurrentAction;
	OldState = CurrentState;
	CurrentState = 0;
	float DeltaError = GetReward(ResultData) + gamma * GetMaxQAction(CurrentState) -
QTable[OldState][OldAction];
	QTable[OldState][OldAction] = QTable[OldState][OldAction] + (alpha* DeltaError);
	SaveToDataTable();
}
```

Figure 7 - Action scoring code

Conclusions. A formalization of the decision-making process using Markov chains and an agent model is presented, and an improved agent-based method is presented to improve agent performance by considering reward weights that satisfy the functional and game design system. An analysis of existing learning algorithms was conducted and the advantages of the machine learning method with reinforcement were substantiated; it is advisable to use it for training agents in the system. Problems that arise in the learning process and ways to eliminate them are also investigated.

In accordance with the developed formalized agent model and agent method, a program structure was developed and an algorithm for the operation of an intelligent system based on machine learning methods for the development of computer games was developed. The analysis showed that for the specific task considered in this work, it is advisable to accelerate AI learning using an artificial intelligence accelerator model using an Intel I9 11900 processor (11th generation), which had a new architecture for artificial intelligence - Intel Deep Learning. promotion. In the process of designing the software structure,

the necessary clarifications were made in the structure of the machine learning subsystem described in the formalized model, and the analysis and selection of the artificial intelligence hardware accelerator was also carried out.

Using the proposed solutions, software for an intelligent system was developed based on machine learning methods for developing computer games using artificial intelligence hardware accelerators. A preliminary analysis of existing software development tools and existing hardware solutions was conducted. The choice of software development tools and hardware solutions, the most effective for the implementation of an intelligent system based on machine learning methods for the development of computer games, is substantiated.

With the use of intelligent system software based on machine learning methods for the development of computer games, the possibilities of practical use of the improved agent method and the artificial intelligence accelerator model were investigated. The effectiveness of using the proposed solutions has been confirmed experimentally. The use of the artificial intelligence accelerator model made it possible to accelerate the study of the computer game character by 2.14 times compared to classical methods.

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