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A Case Study on AI-Driven <DEEPMOTION> Motion Capture Technology

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Abstract

The rapid development of artificial intelligence technology in recent years is evident, from the emergence of ChatGPT to innovations like Midjourney, Stable Diffution, and the upcoming SORA text-to-video technology by OPENai. Animation capture technology, driven by the AI technology trend, is undergoing significant advancements, accelerating the progress of the animation industry. Through an analysis of the current application of DEEPMOTION, this paper explores the development direction of AI motion capture technology, analyzes issues such as errors in multi-person object motion capture, and examines the vast prospects. With the continuous advancement of AI technology, the ability to recognize and track complex movements and expressions faster and more accurately, reduce human errors, enhance processing speed and efficiency. This advancement lowers technological barriers and accelerates the fusion of virtual and real worlds.

Keywords: *AI,Motion Capture, 3D Animation, Human-like Character Animation, DEEPMOTION*

1. Introduction

Motion Capture (MoCap) is a technique that involves attaching sensors or markers to actors to capture their motion data, which is then applied to computer-generated 3D models to create realistic animations. Motion capture technology can capture subtle body movements, facial expressions, and even eye movements, transforming actual human or animal movements and expressions into digital form for use in various applications such as film, television, video games, sports science, and medical research.

1.1 Overview of Development

Since the early 1970s, motion capture technology has evolved from simple mechanical sensors to using highly precise optical, electromagnetic, and inertial sensor systems. Initially, this technology was primarily used for biomechanical research and motion analysis, helping scientists and doctors better understand human

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movements and improve rehabilitation strategies.

Over time, motion capture technology has found widespread applications in entertainment (particularly in film and video games), sports analysis, virtual reality, and more. It enables creators to capture precise human movements, convert them into animations, or apply them to 3D models, creating realistic animations and virtual characters. Especially since the 20th century, with the flourishing development of 3D films and animations, particularly after the release of the film "Avatar" in 2009, the literature on motion capture technology has entered a period of rapid growth. In recent years, with the advancement of artificial intelligence and machine learning, motion capture technology has seen new developments. The application of AI in processing and analyzing large amounts of capture data has made motion capture more efficient and precise, opening up new possibilities in animation production, game development, virtual reality, and other fields.

Figure 1. Motion capture in film and Television Production Involves Identifying Joint Positioning Points for Motion Tracking.

1.2 The Outlook of AI Technology in Motion Capture

The application prospects of AI technology in the field of motion capture are extremely promising, expected to revolutionize the way animations and 3D models are created. Through deep learning and computer vision, AI can automate the recognition and tracking of complex movements, significantly enhancing the speed and accuracy of data processing. This will streamline the animation production process, making motion capture more precise and efficient, while lowering costs, enabling more creators to access and utilize this technology. Combined with virtual reality (VR) and augmented reality (AR), AI-enhanced motion capture technology will offer users more immersive and interactive experiences, ushering in a new era of innovative applications.

2. Research purposes

This study aims to explore and deepen the practical application of artificial intelligence technology in 3D scenes through the AI motion capture technology developed by DeepMotion. The study seeks to achieve the following core objectives:

2.1 Enhancing the precision and efficiency of motion capture

By introducing deep learning and machine learning algorithms, this study aims to enhance the accuracy of motion capture technology in recognizing and recording human movements, especially complex and subtle

movements. Additionally, the study aims to optimize data processing workflows to reduce delays from motion capture to animation generation, thereby increasing overall production efficiency.

2.2 Reducing the cost and technical barriers of motion capture technology

Taking DeepMotion as an example, performing motion capture and generating 3D humanoid characters through videos is one of the solutions for developing more economical and convenient motion capture techniques. Particularly, it reduces the reliance on expensive equipment, making motion capture technology more accessible and user-friendly for small to medium-sized creative teams and individual users.

2.3 Promoting the development of human-computer interaction technology

After releasing "animate 3D," DeepMotion introduced "SAYMATION," a 3D animation generation through prompts, currently in the testing phase. By enhancing the real-time and interactive nature of AI-based motion capture technology, similar to the generation methods in platforms like Midjourney, it aims to enhance the generation of 3D dynamic models. This advancement promotes the development of more natural and immersive human-computer interaction methods, especially in applications within virtual reality and augmented reality environments.

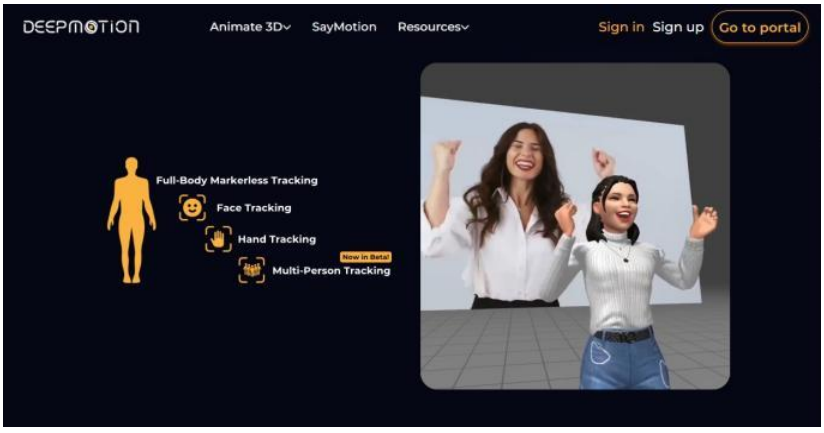

Figure 2. Homepage for DEEPMOTION's video-to-3D animation platform

3. Research Methods

3.1 Experiment Design and Implementation

Training the AI model to accurately recognize and capture human movements using a processed dataset. Evaluate the selected AI model's accuracy and generalization ability through cross-validation and other methods. Assess the performance and effectiveness of the AI motion capture system under real conditions.

3.2 Experiment Design and Implementation

Training the AI model by importing single and multiple video objects to generate 3D animations. Validating the model's accuracy and generalization ability through methods like cross-validation.

3.3 Model Training

As shown in the diagram, the first step involves adjusting and editing the basic data of the video, such as frame rate and length, to meet the generation requirements. This is followed by selecting a predefined human model and adjusting basic parameters by choosing details like finger movements, facial expressions, and setting options like the physics engine to fine-tune the generated model.

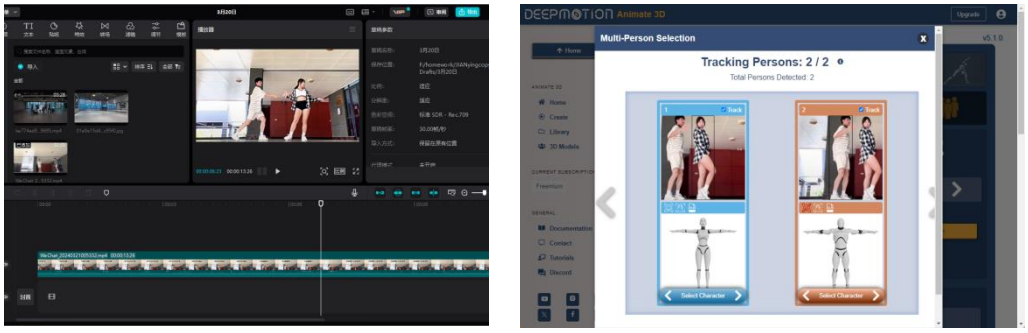

Figure 3. The video generation process in DEEPMOTION

4. Results and Analysis

4.1 Process Presentation of Motion Capture Results

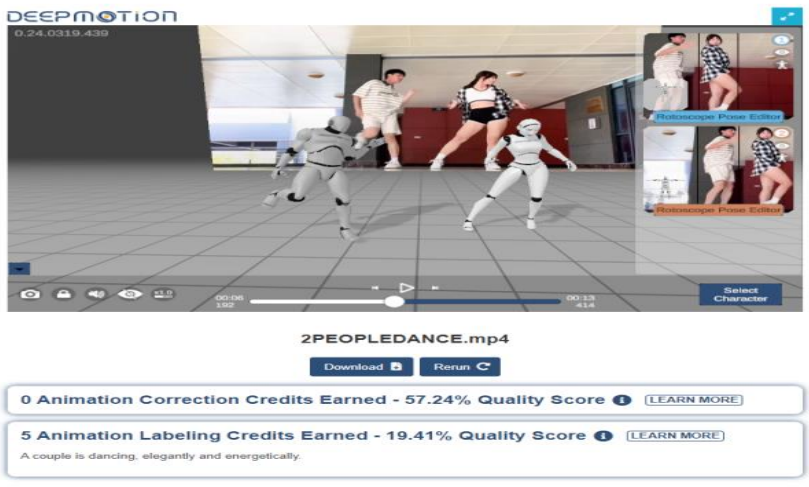

Figure 4. Video Generation Results from DEEPMOTION

4.2 Application Effect Analysis of Motion Capture under AI Technology in 3D Scenes Compared to Traditional Methods

Increased motion capture and animation efficiency compared to traditional methods is significantly faster. For basic 3D animation generation, there is a qualitative leap in efficiency. Taking DEEPMOTION as an example, a short 38-second video only takes 3 to 4 minutes to generate. In contrast, traditional manual motion capture techniques typically require several days to weeks to produce a 30-second 3D dance animation video. Additionally, AI technology helps lower the cost and technical barriers of motion capture by adjusting the key

points of the generated results to make them closer to natural movements.

4.3 Current technical problems

In video-to-3D animation technologies like DeepMotion, there are some common issues that can impact the application and development of the technology:

Accuracy and Realism:

Despite advancements in technology, there are still challenges in extracting accurate motion or human models from video data. In some cases, there may be issues with misinterpretation or results lacking realism, affecting the quality of animations or models.

Data Dependency:

These technologies typically require a large amount of data for training, and the quality and diversity of data can impact the model's performance. Effective data collection and processing are crucial for the successful application of these technologies.

Computational Resource Requirements:

Deep learning technologies often require significant computational resources for training models, especially when dealing with large-scale data such as videos and images. This can pose a challenge for enterprises or individuals using these technologies, particularly for small teams or creators.

5. Advantages of Artificial Intelligence in Motion Capture

Efficiency and Speed: AI can significantly improve the processing speed of motion capture data, enabling quick conversion and application to virtual characters, thereby enhancing production efficiency.

Reduced Hardware Requirements: Traditional motion capture systems rely on a large number of sensors and specialized equipment, whereas AI technology has the potential to capture motions by analyzing standard video inputs. This can dramatically reduce equipment costs and setup time.

Increased Accuracy and Naturalness: AI algorithms can learn from vast amounts of data, capturing finer movements and expressions, making it possible to create more natural and fluid animations.

Ease of Modification and Iteration: Modifying captured motions can be challenging and time-consuming with traditional motion capture techniques. AI allows for easier adjustment and optimization of motion data.

Challenges Data Quality and Complexity: High-quality motion capture requires abundant and high-quality training data. Ensuring that AI systems understand and accurately reproduce complex movements and interactions can be a challenge.

Technological Limitations: Despite the theoretical advantages of AI motion capture, practical applications, particularly in handling complex environments and motions, still face technological barriers and limitations.

Limitations in Expression: While AI can capture motions themselves, the captured motions may lack the subtle performance details and emotional depth that human actors can bring.l venue.

6. Conclusion

Given the current state of development and future directions, bidding farewell to green screens seems

imminent. Artificial intelligence technology, relying on big data computation, can comprehensively understand and execute the separation of characters or target objects from the surrounding environment, allowing for more accurate capture of movements and expressions. AI motion capture is a highly promising field that might revolutionize the way motion capture is performed, reducing costs, improving efficiency, and naturalness. However, to overcome its challenges, further technological innovation and improvements are needed. With the progress of AI technology, we can expect to see more precise and natural motion capture solutions in the future.

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