Development of serious game which use full body interaction and accumulated motion

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Abstract

This article reports a new method and tools for exaggerated real-time character animation control method for full-body gesture interaction systems. Game Action Motion Interaction Controller (GAMIC) is a motion interaction design tool that can be used by motion interaction designer with KINECT, WiiRemote, it comprises a generic evaluation function with thresholds and does not require any additional programmings.

1 CartooNect

CartooNect is a serious game system that used KINECT by the motion of whole body interactions. In our plan of experiment, children or adult draw a picture by hand drawing on paper that background and properties. When a player stand in front of the system, the player's whole body is displayed to player in a real time with the drawn picture as a background and they can move free to play as an actor in virtual world. The player can walk around in radioactive pollution field freely. When the player emulates a motion of avatar that stands up and crouches down, sunflowers are bloom on the polluted field. This project told a message to show and share Japanese disaster in a casual way. Especially, it could tell a function of agriculture in radioactive pollution using full body interaction serious game.

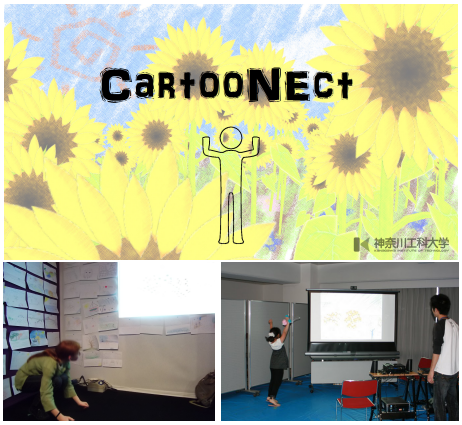

Figure 1: *players action of CartooNect*

2 Motivation: intuitive animation control method and tool for KINECT generation

Real-time animation in-game avatars driven by full-body gesture interaction systems using real-time motion capture data are extremely appealing. Further, it is becoming more popular since researchers and developers can easily access consumer-priced depth sensors in Microsoft KINECT and OpenNI frameworks.

However, a system that can realize suitable real-time animations for each player actions is required. This article describes a new method and a tool for exaggerated but sophisticated interactive animation control systems for real-time animation playback timings. Our method can improve best player experiences without programming by offline/online GUI's for current video games and interactive systems.

Figure 2: *A scene of motion design in a game project*

3 GAMIC: Game Action Motion Interaction Controller

Game Action Motion Interaction Controller (GAMIC) is a tool that can link the timings between KINECT recognition and avatar animation playback by GUI, WiiRemote, and actual motions. GAMIC requires linking between physical players action and real-time avatar animation playback timings for the development of game systems that assume full-body gesture interactions using KINECT.

GAMIC defines a recognition timing of KINECT for animation playback timing by GUI. MID stores two target gestures-for the start and end ($T1$, T_2)-using WiiRemote in front of KINECT on the GAMIC GUI.

This recognition can be expressed as an evaluation function of the current posture and its threshold is a target frame. The evaluation function expresses a similarity between the current player's kinematics and target postures from KINECT inputs, and it can be obtained as a summation of the inner products of target and current bones.

If a current posture V fits a target posture T, the evaluation function $f(T, V)$ outputs 1. Its threshold P1 can control the recognition difficulty by $f(S, V)$ as a starting target frame S.

The trigger frame (TF) is an intermediate posture, and it exists between SF(T_1) and EF(T_2) as a result of the continuity of human motions. TF is an indescribable and dynamic posture but it can be expressed by an evaluation function $f(E, V)$ with its threshold P_2.

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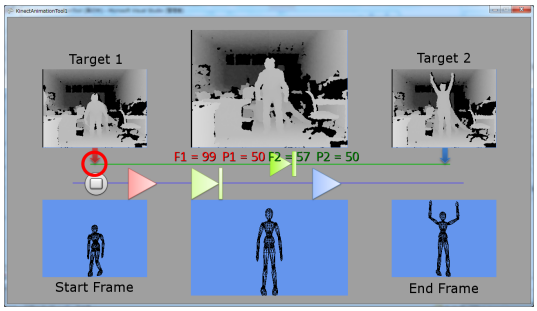
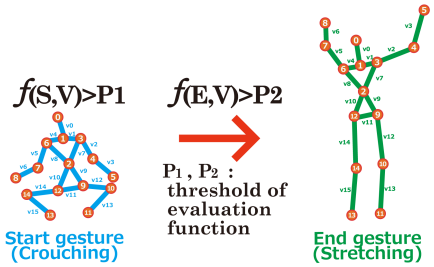


Figure 3: *Screenshot of GAMIC*

TF must be set correctly it can generate togetherness if the posterior half-animation is synchronous with the recognition.

GAMIC can control the recognition sensitivity, timing, and animation impressions simultaneously by adjusting P_2.



$$f_{\mathrm{Target}} = \sum_{i=0}^{k} \left(\frac{\mathrm{Ti} \cdot \mathrm{Vi}}{\|\mathrm{Ti}\| \|\mathrm{Vi}\|} \right) \quad (\mathrm{k}=15)$$

$$\mathrm{V} = \text{Current Kinematics}$$

$$f_{(\mathrm{T,V})} = \sum_{i=0}^{k} \left(\frac{\mathrm{Ti} \cdot \mathrm{Vi}}{\|\mathrm{Ti}\| \|\mathrm{Vi}\|} \right) \quad (\mathrm{k}=15)$$

$$= \left\{ \begin{array}{l} 1\text{: perfect match} \\ -1\text{: completely different} \end{array} \right\} \quad (-1 \sim +1)$$

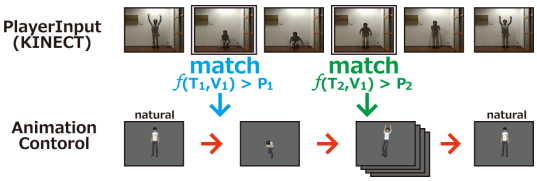


Figure 4: *Evaluation function*

4 Conclusion

By using GAMIC, we realized a higher quality of animation-timing implementations with resource effective tools by non-programming methods. This process requires some personnel (MIA, Programmers, Actors) to create the core of the interaction sense from past projects.

It will be also integrated with physics and/or machine-learning-based posture estimations and animation blending to create effective interaction experiments in the near future. Template matching and physics- and learning- based approaches can improve player gesture recognitions and dynamic animation however, these techniques also require human decisions and large trial-and-error periods for improvement.

In contrast, GAMIC has the advantage that intuitive player actions can be explored for real-time animations by MID instead of machine-learning methods. Hence, assignment and linkage between player actions and predefined animations can be improved, especially for special actions that are otherwise impossible by physical motions.

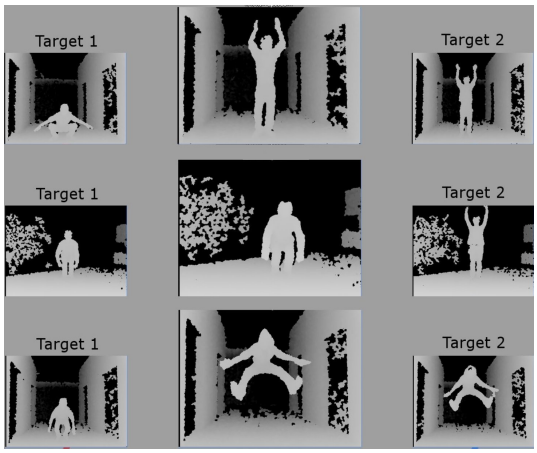


Figure 5: *Depth images from KINECT and target motions by motion interaction designer (MID)*

5 References

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