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Automatic Generation of Haptic Motion Effects from Audiovisual Content

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***Abstract*—We present haptic motion generation algorithms that automatically create motion waveforms from a video's audiovisual streams to enrich user experiences. A total of eight algorithms are developed, each focusing on a different aspect of motion expression—ranging from first-person camera movement, third-person dynamics of rigid and articulated bodies, and stylized human movement to sound-driven impacts and combinations of multiple motion effects. These approaches generate convincing motion effects in a fraction of the time it would take manually. Within a single system, users can watch a video accompanied by these effects and compare the outputs of different algorithms.**

***Index Terms*—multimedia creation, vestibular sensation.**

In this demo, we present haptic motion generation algorithms that automatically create motion waveforms from a video's audiovisual streams. All generated effects can be played back within a single system, where users can switch between algorithm outputs without reconfiguration.

We develop eight algorithms inspired by authoring practices commonly used by designers of motion effects in multisensory content. These typically involve extracting visual or auditory features and adapting them to a motion platform's limited workspace (Fig. 1). Each algorithm focuses on a different aspect of motion expression. Three target first-person videos: extracting gross camera motion [1], generating fine-grained motion from visual surface cues [2], and producing gun recoil motion in real time by detecting sound events [3]. Others address third-person videos, including rigid and articulated object motion using 3D spatial data [4]–[6], and stylized movement such as dancing or walking through body part segmentation and real motion data [7], [8]. One also merges multiple motion effects seamlessly with minimal interference between them [9]. Together, they cover a wide range of motion scenarios found in videos. See individual papers for details.

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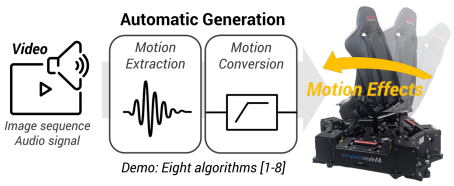

Fig. 1. A user watches a video accompanied by automatically generated haptic motion effects. The user can select and experience one of eight algorithms.

References

[1] J. Lee, B. Han, and S. Choi, "Motion effects synthesis for 4d films," *IEEE Transactions on Visualization and Computer Graphics*, vol. 22, no. 10, pp. 2300–2314, 2015.

[2] B. Lim, S. Han, and S. Choi, "Image-based texture styling for motion effect rendering," in *Proceedings of the 27th ACM Symposium on Virtual Reality Software and Technology*, pp. 1–10, 2021.

[3] G. Yun, H. Lee, S. Han, and S. Choi, "Improving viewing experiences of first-person shooter gameplays with automatically-generated motion effects," in *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, pp. 1–14, 2021.

[4] S. Han, G. Yun, and S. Choi, "Camera space synthesis of motion effects emphasizing a moving object in 4d films," in *2021 IEEE Virtual Reality and 3D User Interfaces*, pp. 670–678, IEEE, 2021.

[5] S. Han, J. Park, and S. Choi, "Generating haptic motion effects for multiple articulated bodies for improved 4d experiences: A camera space approach," in *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, pp. 1–17, 2023.

[6] S. Han, J. Ahn, and S. Choi, "Generating haptic motion effects for general scenes to improve 4d experiences," in *2024 IEEE International Symposium on Mixed and Augmented Reality*, pp. 51–60, IEEE, 2024.

[7] J. Ahn and S. Choi, "Automatic generation of haptic motion effects expressing human dance," in *2025 IEEE Conference Virtual Reality and 3D User Interfaces*, pp. 340–350, IEEE, 2025.

[8] H. Lee, S. Oh, and S. Choi, "Data-driven rendering of motion effects for walking sensations in different gaits," *IEEE Transactions on Haptics*, vol. 15, no. 3, pp. 547–559, 2022.

[9] J. Park, S. Han, and S. Choi, "Merging camera and object haptic motion effects for improved 4d experiences," in *2023 IEEE International Symposium on Mixed and Augmented Reality*, pp. 1036–1044, IEEE, 2023.