

P-10 Kinematic Analysis of Normal Walking and Slipping: A Pilot Study using AI-based Pose Estimation

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Introduction

- Falls are common among the elderly and patients with central nervous system damage due to muscle weakness.
- These falls can result in serious injuries, increased medical costs, and a decreased quality of life. In previous studies on falls, sensor data was primarily collected using IMUs and surface electromyography, or kinematic data was obtained by attaching markers to the subjects.
- However, with advancements in artificial intelligence technology, research has increasingly focused on collecting data solely from walking videos of subjects.
- Therefore, in this study, kinematic data was collected from walking videos and analyzed using an AI-based Pose Estimation program.

Data collection

- A healthy adult male subject (height: 173 cm, weight: 78 kg) was videotaped during normal walking and walking with a fall.
- During normal walking, the subject walked at his usual pace on a flat surface.
- For walking with a fall, a slip was induced by applying a polyethylene film and surfactant to a flat surface.
- To prevent injury, the subject wore a harness.

Video data analysis

- Video data was collected for each condition, and the images were analyzed using the REMO Body-S program.
- Kinematic data, such as the 3D angles of each joint, were then extracted.

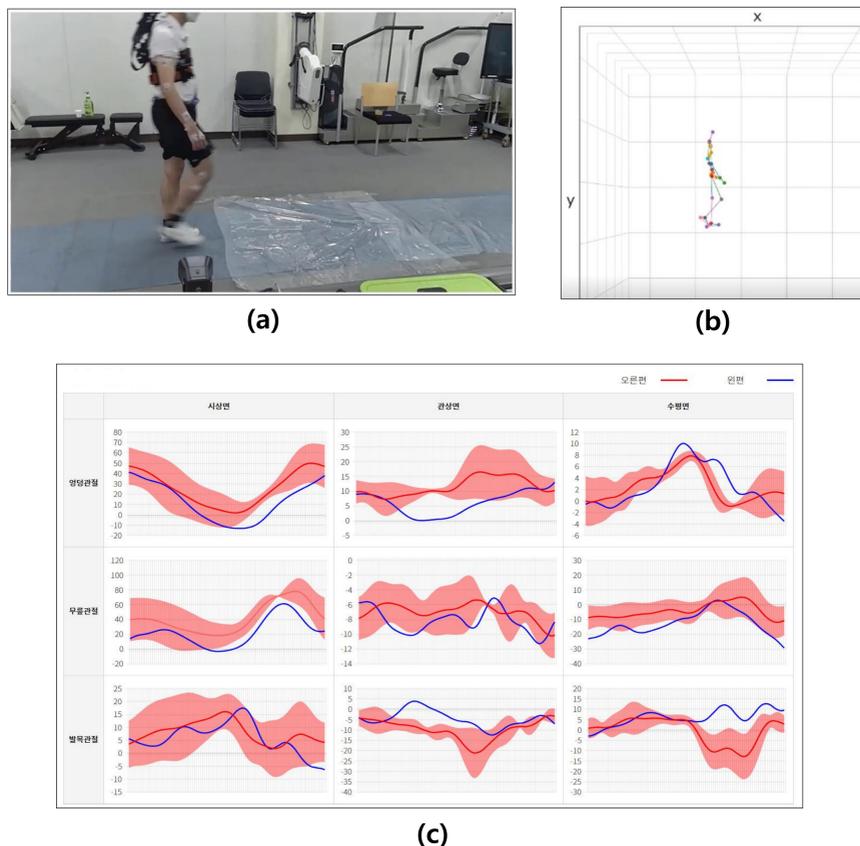


Figure 1. Video data analysis: (a) Actual experimental video, (b) Skeleton image recognition using artificial intelligence, (c) Analyzed joint angles

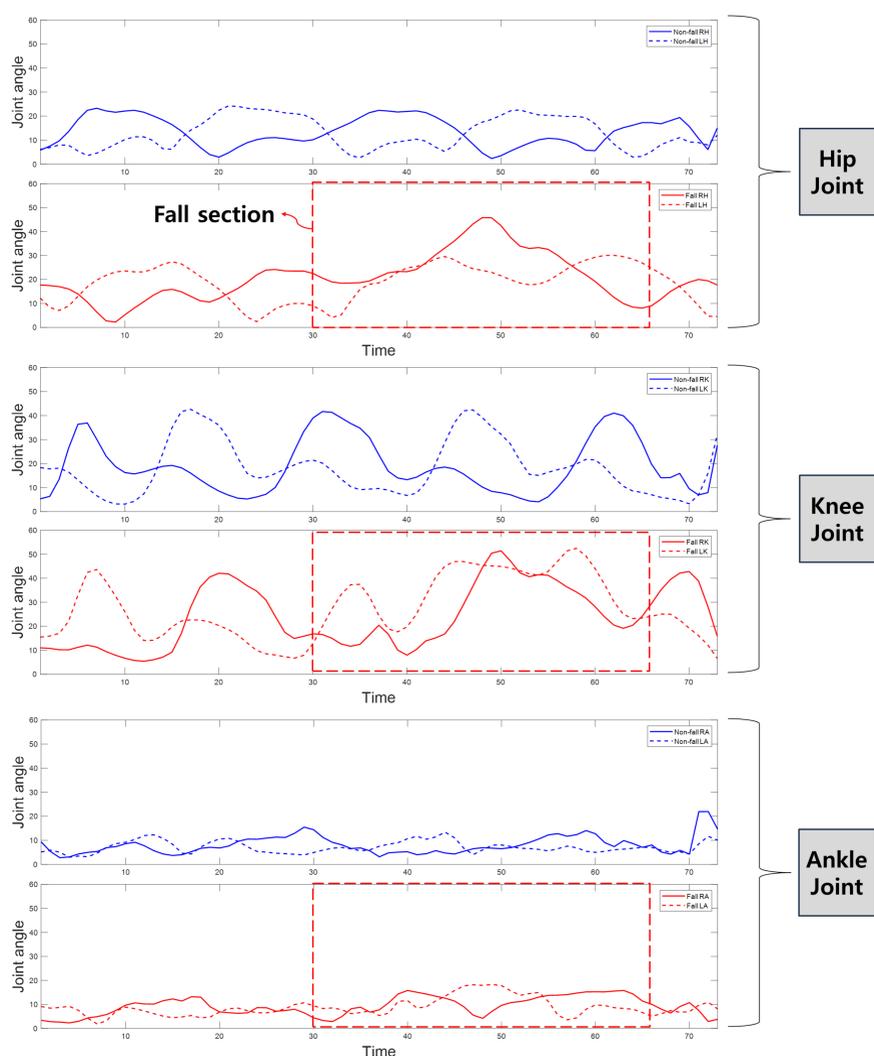


Figure 2. Comparison graph of each joint angle (normal gait & fall)

Results

- The comparison of three-dimensional joint angles revealed the following results.
- The hip joint showed an increase of 4.25% on the right side and 8.90% on the left side, indicating greater hip flexion during falls.
- For the knee joint, the average angle increased by 16.54% in the right knee and 9.96% in the left knee.
- This suggests a reflexive response to instability, where both the hips and knees bend to mitigate the impact of the fall.

Conclusion

- In this study, an AI-based pose estimation program was used to compare general walking and falls.
- While differences in kinematic data were observed in each condition, the analysis was conducted using a single dataset.
- Therefore, additional data is required to further compare kinematic differences between general walking and falls.

Reference

- Englander, F., Hodson, T. J., & Terregrossa, R. A. (1996). Economic dimensions of slip and fall injuries. *Journal of forensic sciences*, 41(5), 733-746.

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