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Unstable Gait Recognition Using Trunk Inertial Data and Body Measurements of Public Datasets: A Pilot Study

Kodai Kitagawa[1], Chikamune Wada[2], Nobuyuki Toya[3]

[1]National Institute of Technology, Hachinohe College, Hachinohe, Japan
[2]Kyushu Institute of Technology, Kitakyushu, Japan
[3]Hokkaido Information University, Ebetsu, Japan

INTRODUCTION & AIM

- Elderly people experience **fall accidents** since they **cannot recognize own stability** in walking [1].
- Thus, **recognition systems** for **unstable gait** have been developed **to prevent falls**. However, many previous systems **required multiple sensors** [2].

AIM

The aim of this study was to **develop an unstable gait recognition system** using only **a single inertial sensor** for daily fall prevention.

PROPOSED METHOD

- The proposed method recognizes an **unstable** gait by **machine learning** with **trunk inertial data** and **body measurements** (Fig.1).
- The trunk inertial data are measured using a **single inertial sensor** on the **low back**(Fig.1).

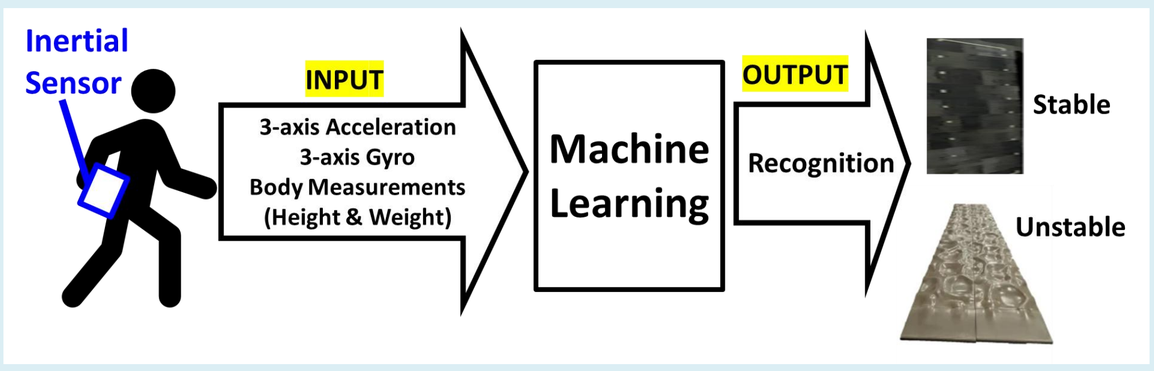

Fig.1 Proposed Method

EVALUATION

- The proposed method was **tested** by the North American Congress on Biomechanics **(NACOB) multi-surface walking dataset** published by Jlassi et al [3].
- The **trunk inertial data** and **body measurement** values of 134 people in the NACOB public dataset were used in this study.
- The proposed method **recognized two gait patterns** on flat (**stable**) and bumpy (**unstable**) roads.

Conditions of Evaluation

Participants: 134 people（30 ± 9.2 years, mean ± S.D.）

Inertial Sensor: Dot (Xsens Tech) (Sampling:120Hz)

Software: MATLAB R2024a

Machine Learning: k-Nearest Neighbor (k=1)

Training and Testing: 5-folds cross validation

RESULTS & DISCUSSION

Performances of Proposed Method

Accuracy ➡ 82.7%

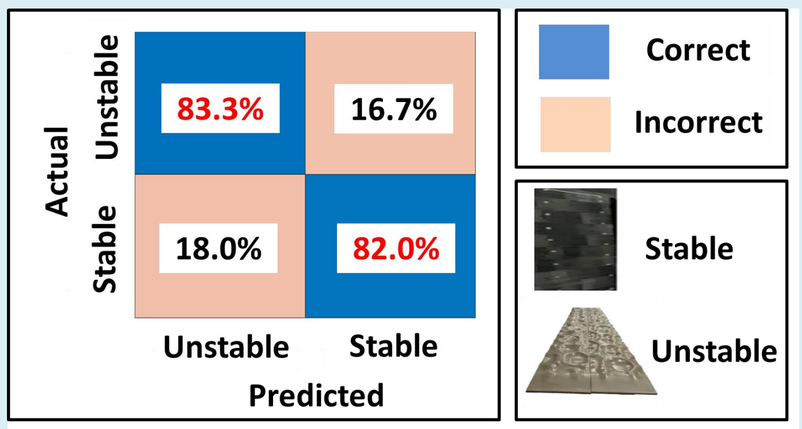

Fig.2 Confusion Matrix

- The proposed method recognized stable and unstable gait patterns with **greater than 80% accuracy**.
- This **accuracy was comparable to previous gait recognition** [2].

The proposed method can be used for daily gait recognition systems using a single inertial sensor.

CONCLUSION / FUTURE WORK

- The proposed method recognized an unstable gait by machine learning with trunk inertial data and body measurements.
- The results indicate possibility that the proposed method can be used for daily gait recognition systems using a single inertial sensor.
- In the future, the proposed method **should be evaluated in more various conditions**.

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Acknowledgements / Conflict of Interest

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Conflict of Interest: None.