Gender Classification Using Video Sequences of Body Sway Recording by Overhead Camera

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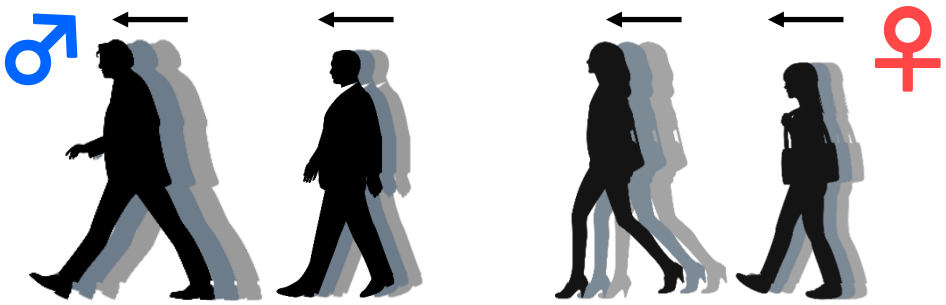
Introduction

- There is high demand for technology that can classify the gender of a person based on a video sequence.
  - To classify the gender, the characteristics that distinguish between females and males must be obtained.
  - The movements of a person have been considered for representing the characteristics.

Walking

- Gait



- Existing methods using the GEI
  [Shan+, Neurocomputing'08][Yu+, TIP'09]

They are designed for classifying the gender of a walking person.

Standing

- **Body Sway**

- No existing methods

We design a method for classifying the gender of a standing person.

Analytical research in the medical field

It investigates whether body sway has differences between females and males.

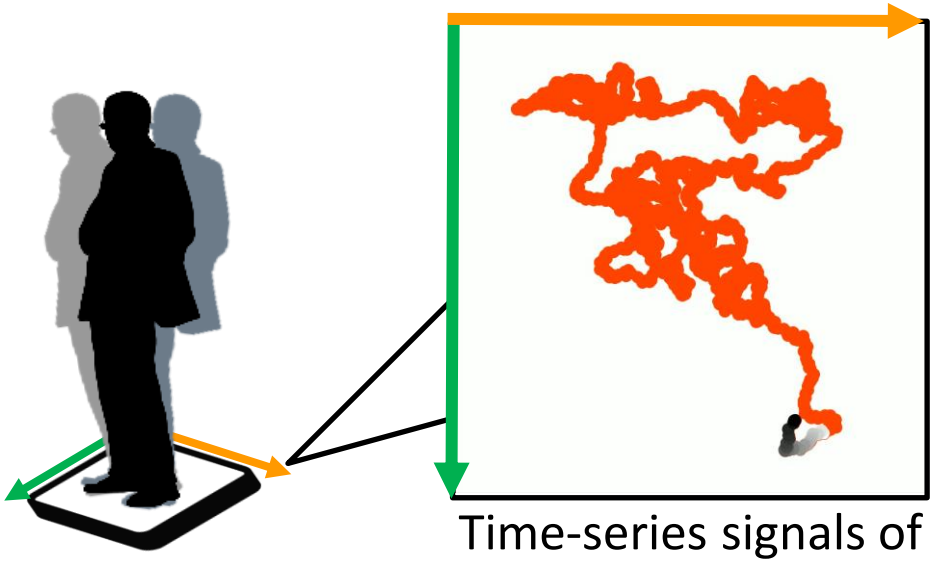
[Kitabayashi+, J Physiol Anthropol Appl Human Sci'04] [Kim+, GGI'09] [Plandowska+, PLoS ONE'20]

Method:

- A force plate placed on the floor
- Time-series signals of the center positions

Observation:

- There are significant differences between standing females and males in terms of the time-series signals.



Force plate:
Contact-type sensor

Time-series signals of center positions of the pressure of the feet

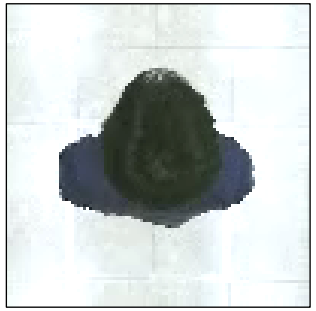
Problem:

- To apply such medical data on body sway for gender classification, a contact-type sensor must be placed on the floor.
- These studies did not consider the use of cameras for gender classification applications.

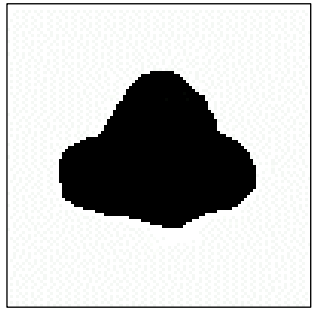
Purpose

We propose a method for extracting a feature from a video sequence of body sway and investigate whether it can be used for gender classification.

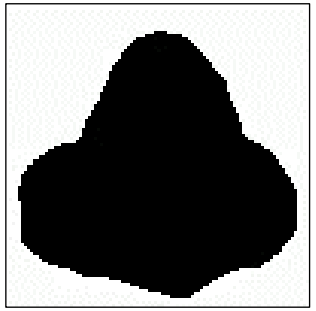
Estimation of silhouette sequence of upper-body regions → Removal of variation of apparent upper body size → Measurement of time-series signals of body sway → Extraction of features of local movements (LM) for gender classification

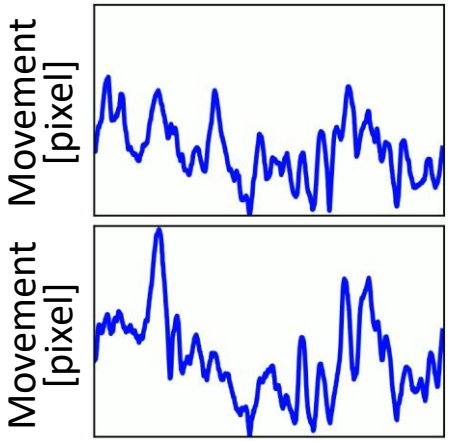


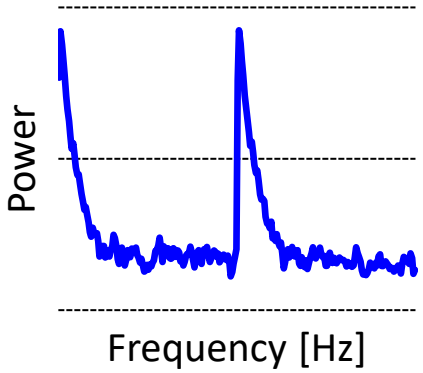
A video sequence from an overhead camera



Silhouette

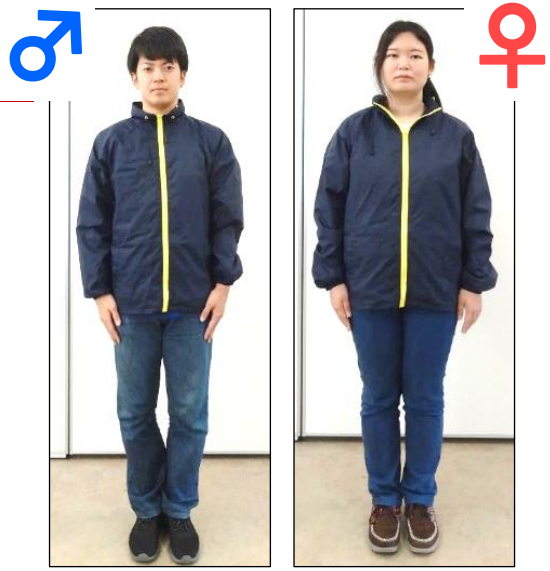


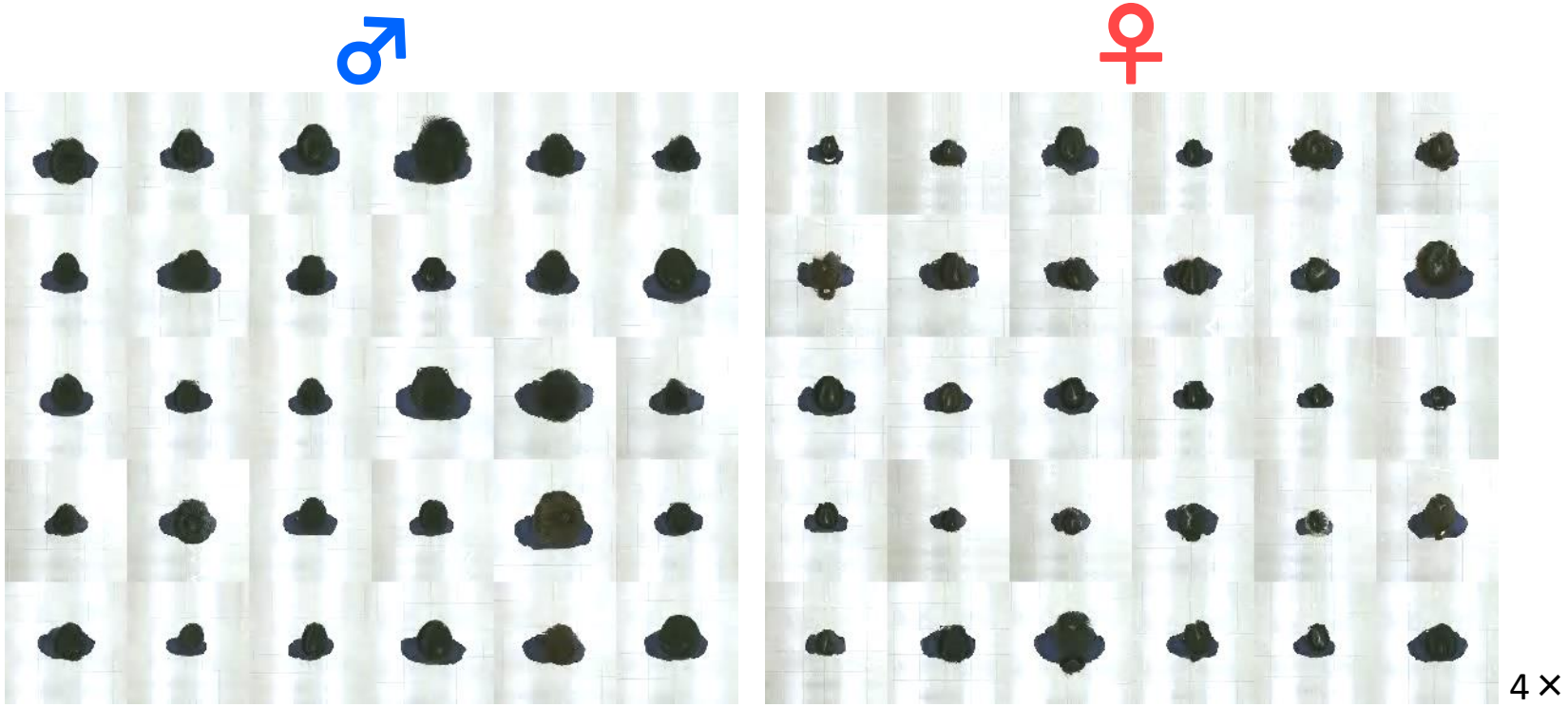


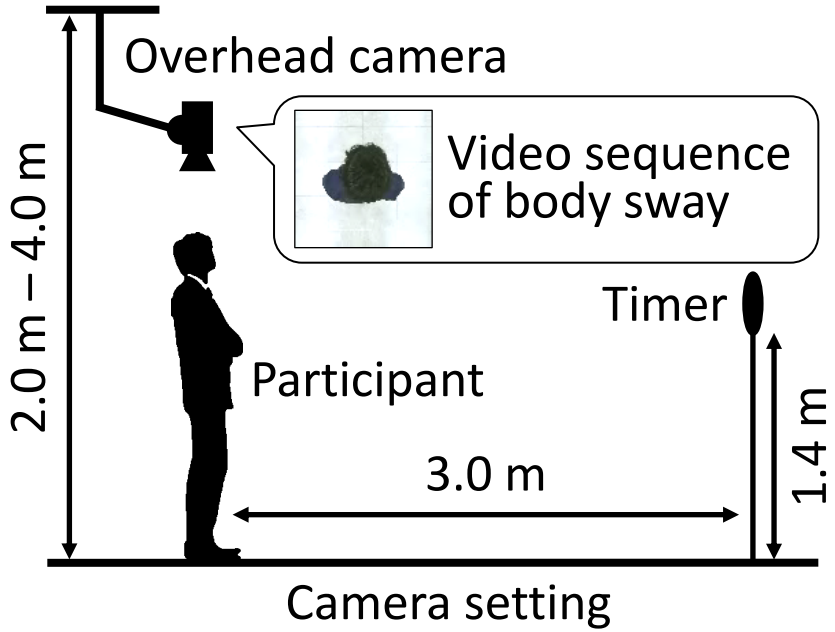


Dataset

- Number of participants: 60
  - Male: 30 participants (Average height: 170.2 cm)
  - Female: 30 participants (Average height: 158.7 cm)
- Time length of a video sequence: 60 seconds
- Posture: Romberg's pose
- Clothes: Dark-blue nylon outerwear



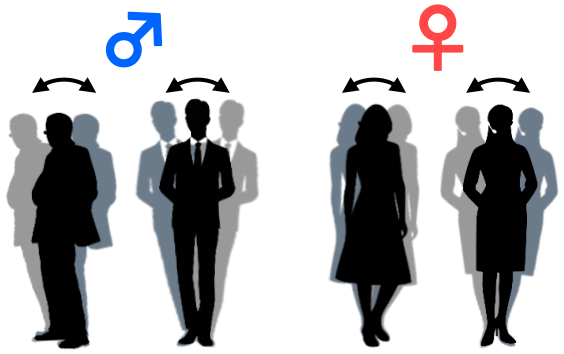




Evaluation of gender classification accuracy

Comparison with:

1. GEI reported in previous studies on the gender classification of a walking person.
2. C3D with short video sequences as a representative of spatio-temporal features extraction.



Our LM features	$\mathbf{90.3 \pm 1.3}$
1. GEI [Shan+, Neurocomputing'08] [Yu+, TIP'09]	67.7 ± 0.8
2. C3D [Tran+, ICCV'15]	87.6 ± 1.7

- Accuracy (%)
- Number of participants: 60

The proposed LM features include better spatio-temporal characteristics for representing body sway.