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

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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.

**Existing methods using the GEI**

[Shan+, Neurocomputing’08][Yu+, TIP’09]

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

**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.

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.
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

Movement [pixel]

Time [s]

Frequency [Hz]

Power
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

![Image of body sway dataset]

- Overhead camera
- Video sequence of body sway
- Participant
- Timer
- Camera setting

Dimensions:
- 2.0 m - 4.0 m
- 1.4 m

4x4 grid of images
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.

<table>
<thead>
<tr>
<th>Our LM features</th>
<th>Accuracy (%)</th>
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<tbody>
<tr>
<td>1. GEI [Shan+, Neurocomputing’08] [Yu+, TIP’09]</td>
<td>67.7 ± 0.8</td>
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<tr>
<td>2. C3D [Tran+, ICCV’15]</td>
<td>87.6 ± 1.7</td>
</tr>
<tr>
<td>90.3 ± 1.3</td>
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The proposed LM features include better spatio-temporal characteristics for representing body sway.

Number of participants: 60