The Estimation of Missing Body Feature Points in Moving Images Using LSTM

Satoshi Yamanaka[1], Chonho Lee[2], Susumu Date[2], Shinji Shimojo[2]
1:Graduate School of Information Science and Technology, Osaka-University 2:Cybermedia Center, Osaka-University

Introduction & Aim

- When teaching a form (e.g., running, pitching, spiking, etc.) suitable for each person, it is important to analyze the form by grasping the pose and movement of the person. **OpenPose** (Fig.1) is OSS, able to extract body feature points in an image or moving images.
- The aim of this project is to analyze posture and movement from video and compare the before and after.

Fig.1. An example feature points detected by OpenPose

Problems

- There are cases where **the feature point extraction fails** because the body in moving images is shielded by objects or due to the image blurring (Fig.2). Data analysis with missing values may lead to the lack of validity and reliability in analysis results.
- Conventional interpolation methods do not work well if feature points are missing in multiple frames (Fig.3).

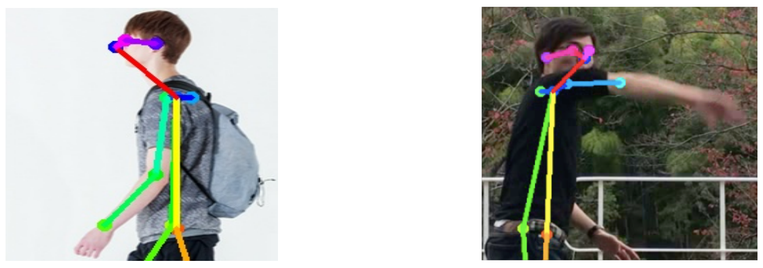

Fig.2. Example reasons for failure of point extraction by OpenPose

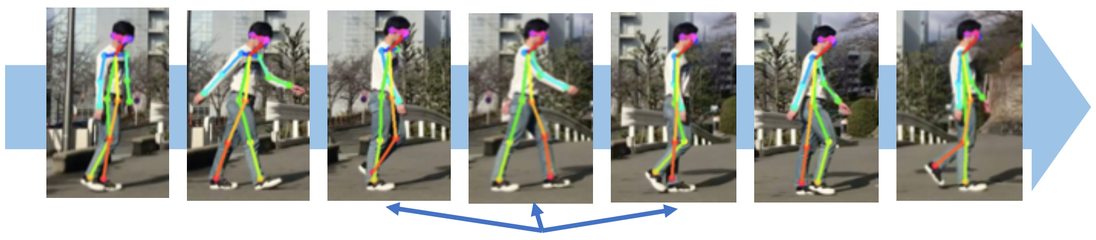

Fig.3. Conventional interpolation methods is difficult to estimate if feature points are missing in multiple frames

Approach & Solution

We propose **a LSTM-based feature point estimation model** that consists of 4 sub-LSTMs trained by different sets of feature points (Fig.4).

- **Division of feature point set**
  - ➢ Dividing a body into a few parts (e.g., head, arm, body, leg) and using a set of feature points in the part to train the corresponding sub-LSTM
- **Use of relative coordinates**
  - ➢ Transforming the absolute coordinates of feature points in images to the relative

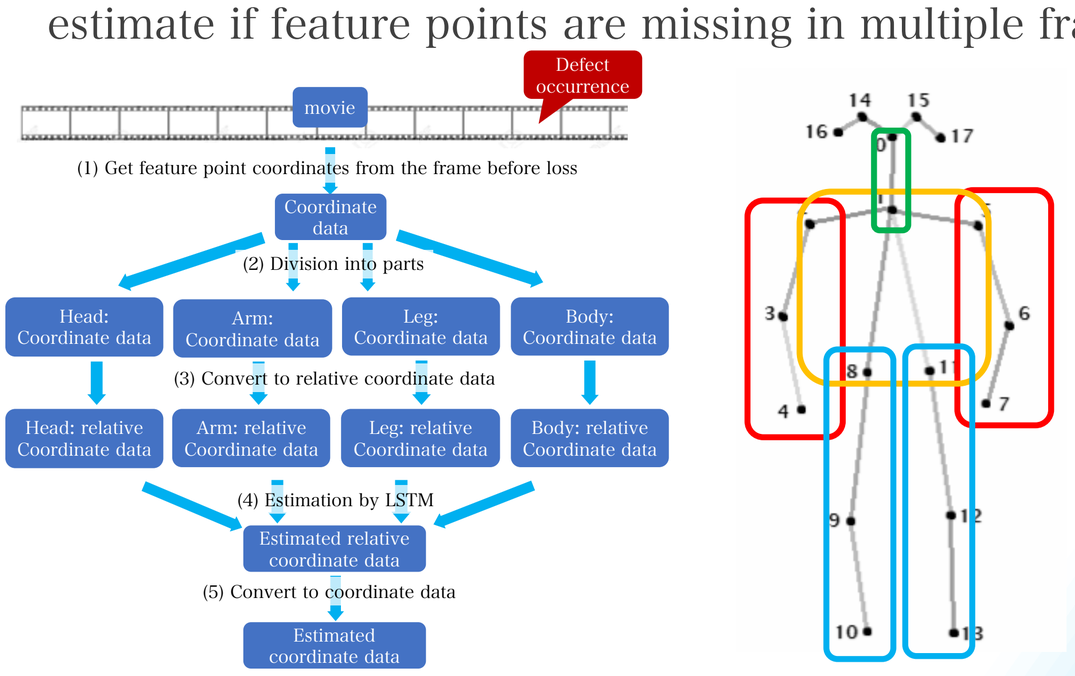

Fig.4. A data flow of the proposed model

Evaluation

We evaluate the proposed model by estimating missing feature points in a walking video.

- Fig.5 shows the estimation error from the true value for (a) wrist and (b) elbow over frames. It follows that **the proposed model outperforms a few conventional graph interpolation methods in terms of estimation accuracy.**
- Fig.6 shows the estimation error by the model with and without the division of feature point set and the use of relative coordinates. We verify that **the proposed solution has a strong impact to reduce the estimation error.**

(a) wrist error

(b) elbow error

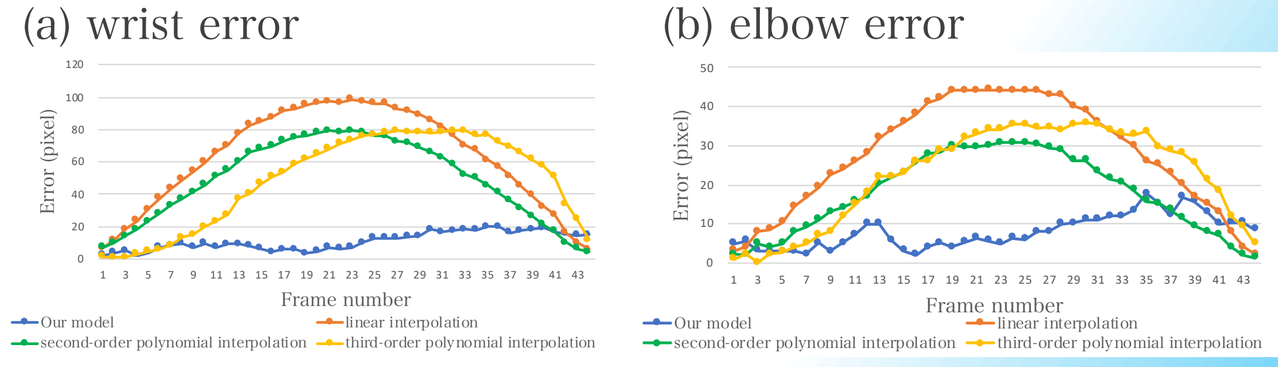

Fig.5. Evaluation results

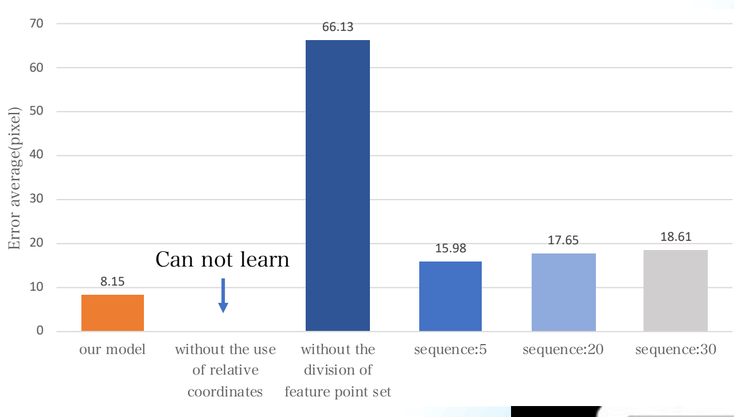

Fig.6. Estimation error with/without feature point division and the use of relative coordinates

Future Works

- We will extend the model to automatically **increase the frame rate** by integrating frame interpolation technique.
- We will also develop an application that
  - ➢ analyzes Volleyball forms (e.g., spiking, receiving, tossing, etc) by showing **the comparison results of the before and after**(Fig.7).
  - ➢ **tracks the movement of volleyball**

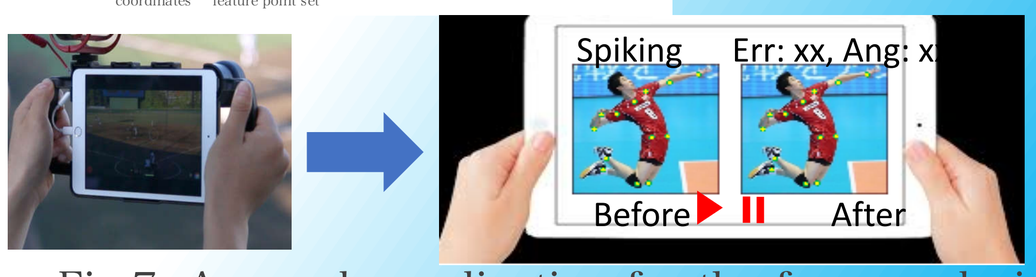

Fig.7. A sample application for the form analysis

Contact:yamanaka.satoshi@ais.cmc.osaka-u.ac.jp 2019.4.24 PRAGMA36