# FingerPuppet
Finger-Walking Performance-Based Puppetry for Human Avatar

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Background

- Interfaces for <u>virtual human avatar controlling</u> are widely used in gaming, digital storytelling and animation editing
  - **Human avatars** are very common

- Novel interfaces utilize <u>user's performances</u>, which provides intuitiveness, enjoyment interaction
 - Wii, Kinect, Switch,…
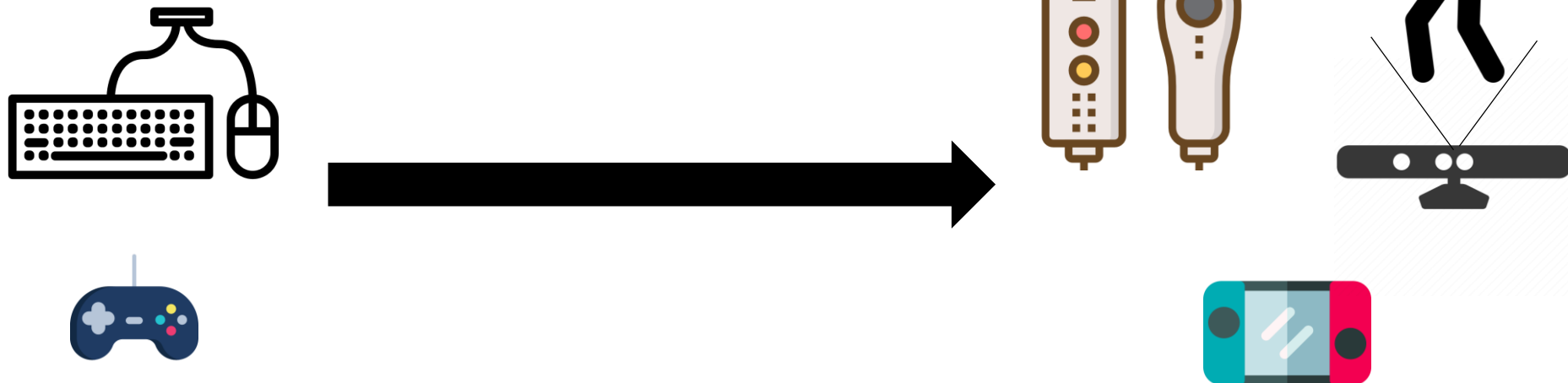
Background – Related work

- **Finger-walking** is a common performance for mimicking leg motion and has been adopted for avatar manipulation in following research

- **FingerWalking [SCA 2012]**
  - Identify that finger-walking is widely accepted by casual users
  - Use touchpad to collect contact information for locomotion generation

- **Motion Editing with Data Glove [ACE 2004]**
  - Use data glove to collect finger joint rotation for gait generation

- Both of them proposed a **non-real time** manipulation for animation editing,
and only focus on walking
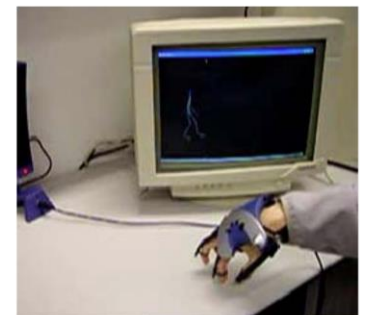
Background – Related work

- What's the actual **mapping** of Finger-walking?

- **Miniature Haptics [CHI 2020]**
    - Explored a skeletal mapping of haptic feedback between full-body and hand
    - Aim to provide a strong sense of embodiment
    - We are interested in adopting this mapping for avatar manipulation

Pilot study

| Run	Kick	Cross fingers	Stand	Front and side split	Single step	Crouch
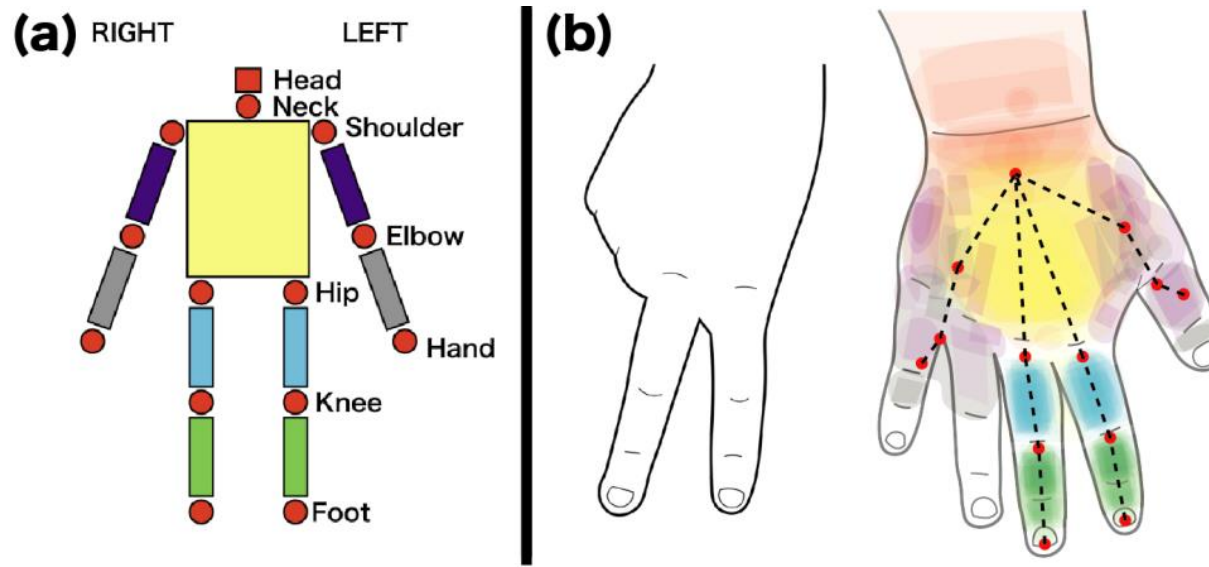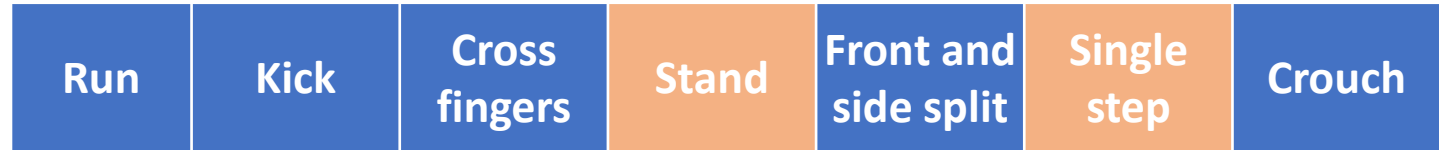
- Goal:
  1. Verify if naïve users prefer to use the finger-walking mapping for human avatar controlling
  2. Explore types of finger-walking movement they want to used for manipulating human avatar

- Interviewing 5 casual participants
  - Showing **replays of 28 sports** from Tokyo 2020 Olympics
  - Ask them to choose the best way to perform movement of the athlete
    - Between finger-walking movement, self-design hand gesture and body movement

- **Half of the sports** are preferred to be represented via finger-walking

- **7 types of finger-walking gestures** are identified, and 5 of them are preferred by participants. We implement 4 of them in our application.

What problem are we going to solve?

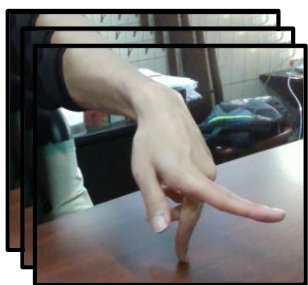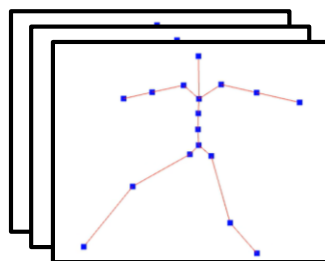**We aim to achieve a retargeting method**

Capture

Retarget
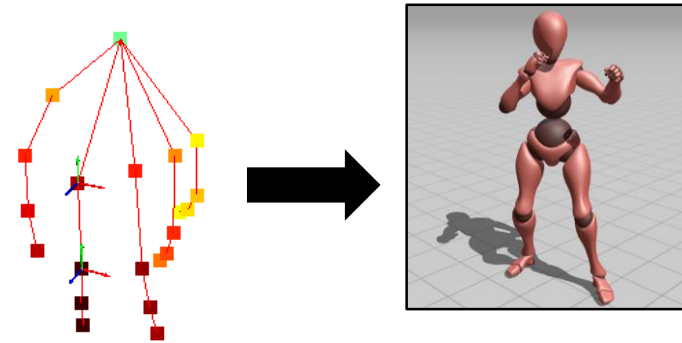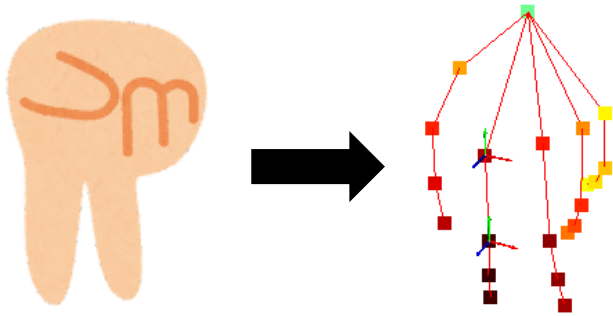
The proposed retargeting method

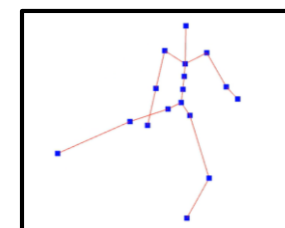**Lower body motion retargeting**   **Full-body pose reconstruction**

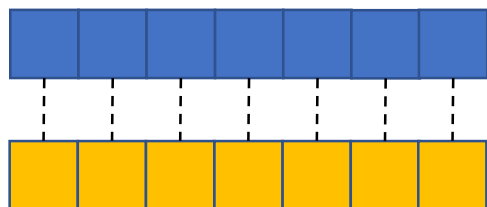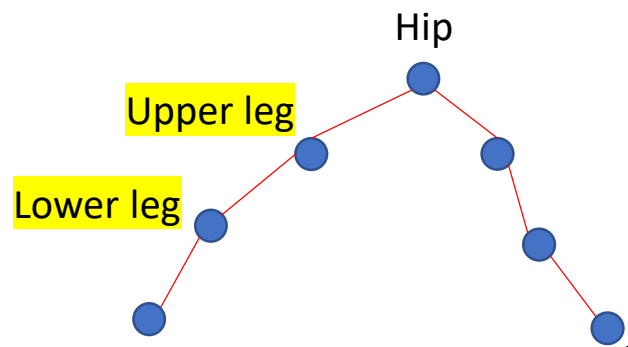Finger performance video   Lower body motion   Full body Pose

Rotation mapping

$$\Phi: \theta \to \phi$$
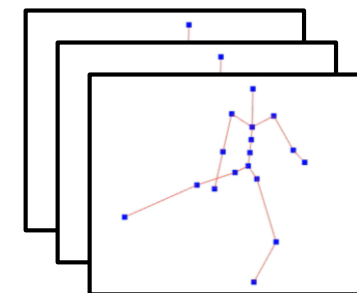
Forward kinematic

Hip

Upper leg

Lower leg

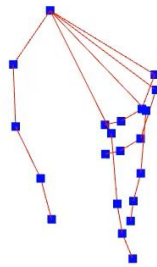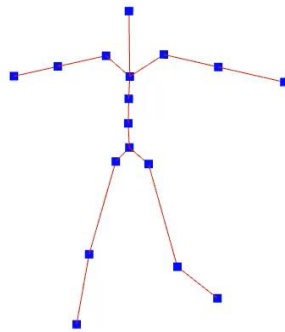**Search similar feature vectors**

FV1
FV2
FV3
FV4
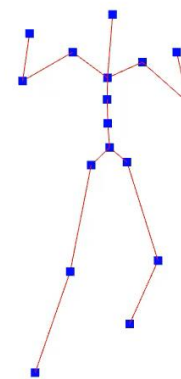FV5
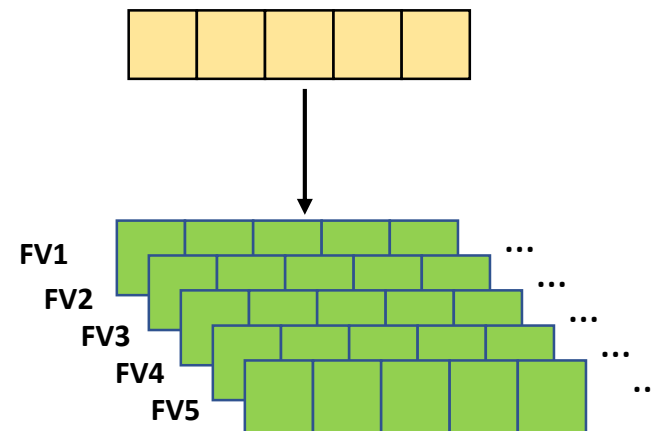
Pose blending

Result – Computation time and visualization

- Average computation cost is 34.03 ms ≈ 30 Hz
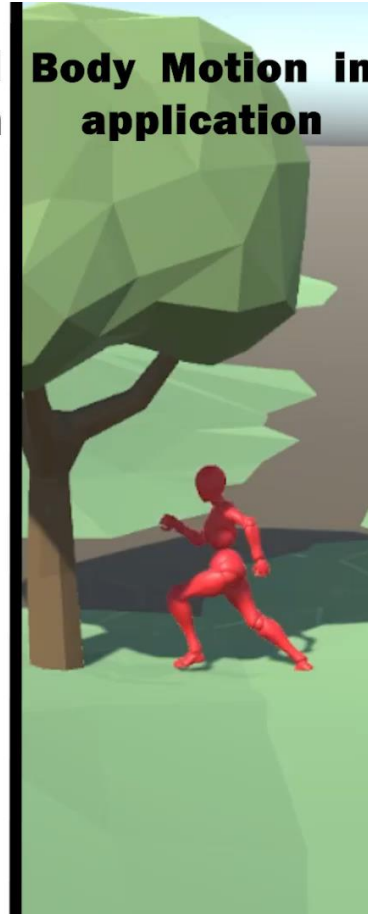

Retargeted lower body motion

Reconstructed full-body motion

Body Motion in application

Result – Digital storytelling prototype

Body motion	Finger-walking performance
Run	Run
Front kick	Kick
Side kick	Side split
Double leg jump	Crouch
Joyful jump	Crouch

Limitation and Future work

- Adopting **hardware solution** of the hand pose estimation can improve the detection accuracy and delay time

- Interface with finger performances expressing **upper body actions**

- Example animation includes frames that has **similar lower body motions** but **slightly different upper body motion** can cause ambiguity when performing *full-body pose reconstruction*.

Thank you for listening