TrainAR

Laura (Di) Chen, Cindy Jinhee Park, Jinyue Feng, Nadav Borenstein
Introduction
# Traditional Dance & Sports Training

<table>
<thead>
<tr>
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<th>Pros</th>
<th>Cons</th>
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<td>Remote learning</td>
<td>● Video tutorials&lt;br&gt;● Convenient for amateurs to practice at home&lt;br&gt;● Control the pace of learning&lt;br&gt;● One video helps many students</td>
<td>● No feedback from the instructors&lt;br&gt;● Hard to get 3D perceptions from 2D videos&lt;br&gt;● Inconvenient because the video display is fixed</td>
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<td>Face-to-face learning</td>
<td>● Engaging learning environment&lt;br&gt;● Interactions with the instructor&lt;br&gt;● Feedback on postures</td>
<td>● Must have available instructors&lt;br&gt;● Cannot control the pace&lt;br&gt;● Instructors’ attention may get diffused</td>
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Our Solution: Augmented Reality

- Picks best properties of 2D tutorials & Personal instructor
- Augmented Reality for visualized instructions
  - Virtual personal teacher
  - Postures and movements in 3D space
  - Visualization of detailed motion data
AR for Dance & Sports Training

- Target Audience: trainees in all dances and sports who require customizable visual data for improvements
- Basic Idea:
  - Capture the motion of the trainer/ Get available motion data
  - Represent the motion or choreography in 3D
  - Use different visualization technique to assist in the learning process
Related Work

- Generating motion data in real time
- Fencing Visualization Project
  - Importance for visualization cues
    - Analysis purpose
    - Training purpose
Tools
Features
Standard Functions

Functions that are available in 2D tutorials
- Play/ Pause/ Stop
- Reset position
- Speed up/ Slow down/ Normal speed
- Rewind/ Backward/ Forward
- Change Direction (of movements)
- Next Clip
- Help
Size Adjustment

“Shrink” / “Enlarge” / “Normal size”

- User can adjust the height of the avatar
Footprints

“Enable footprints” / “Disable footprints”

- Allows users to accurately mimic the footwork of the physical activity
- Use cases:
  - Dances where footwork is critical (e.g. Salsa, Step dance etc)
  - Martial arts
  - Fencing
**Trail and Dots**

“Enable left (right) hand (foot)”

“Disable trail”

**Trails**
- Showing hand/foot positions in space
  - help users to clearly see the details of the flow of motions
Trail and Dots

“Enable left/right hand (foot)”
“Disable trail”

Dots

- Changes color when the hands are above the chest or the feet are above the opposite knees
  - especially useful when the relative positions matter (e.g. fencing)
- Density changes with respect to the speed of the movement
Body Motion Curves

“Enable curve” / “Disable curve”

- Allows users to understand better the body motion and flow
- Visualizes core body movement as a whole
Keyframes

“Enable Keyframe”
“Disable Keyframe”

- Captures important positions
- Holds the key frame in 3D space
- User can pre-define important keyframes
  - able to customize for each movement clip
First Person View

“First person”

- Put the avatar in front of the user
  - User can “step into” the avatar
- Slow motion
  - Easier to follow the visual cues
Discussion
Project Review

- Immersive and effective learning environment using AR
- Universal solution for various movement training
- Visualizes detailed movement data
  - Keyframes
  - Detailed positions of hands/feet
- Customizable app
  - Match user’s height
  - Adjustable pace
Application’s Limitations

- First person view needs improvements
  - User needs to walk into the solid character
  - Solid body obstructs the view
- Needs to conduct user study to evaluate the effectiveness of the visual effects
- All user interactions are performed through voice commands
  - Does not provide enough flexibility
Hardware Related Limitations

- Wearing HMD during physical activity may be inconvenient
- Limited Field of View
- Equipment cost is high
  - Not as accessible
Future
Work
First Person View

- Leave only the limbs opaque so that the solid body does not distract the users
- Explore more 1st-person-view-specific visual cues
  - Future keyframes/footsteps
- Confine the avatar within a certain area around the user so that the user does not have to chase the avatar
User Interaction

- Employ other formats of user interface (e.g. graphical interface)
- Optimize voice commands so that they are easy to remember
- Add more customization options
  - E.g. user-specified keyframes
Closing the Feedback Loop

- Track the learners in real time
- Analyze the learners’ moves to provide feedback
Playtime!