

A pair of dark, sleek AR glasses is the central focus, set against a light blue background. A large, semi-transparent black circle is positioned on the left side, partially overlapping the glasses. On the right side, there are several white concentric circles of varying radii, also partially overlapping the glasses. The overall aesthetic is clean and futuristic.

# TrainAR

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# Introduction

# Traditional Dance & Sports Training

|   | Pros   | Cons   |
|---|--|--|
| Remote learning <ul style="list-style-type: none"><li>• Video tutorials</li></ul>   | <ul style="list-style-type: none"><li>• Convenient for amateurs to practice at home</li><li>• Control the pace of learning</li><li>• One video helps many students</li></ul> | <ul style="list-style-type: none"><li>• No feedback from the instructors</li><li>• Hard to get 3D perceptions from 2D videos</li><li>• Inconvenient because the video display is fixed</li></ul> |
| Face-to-face learning <ul style="list-style-type: none"><li>• Instructors</li></ul> | <ul style="list-style-type: none"><li>• Engaging learning environment</li><li>• Interactions with the instructor</li><li>• Feedback on postures</li></ul>                    | <ul style="list-style-type: none"><li>• Must have available instructors</li><li>• Cannot control the pace</li><li>• Instructors' attention may get diffused</li></ul>                            |

# 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



The logo for TranAR features the word "TranAR" in a bold, black, sans-serif font. The letter "a" is replaced by a stylized silhouette of a person in a dynamic pose, with a red arc above and a blue arc below, suggesting movement or a specific activity.

**TranAR**

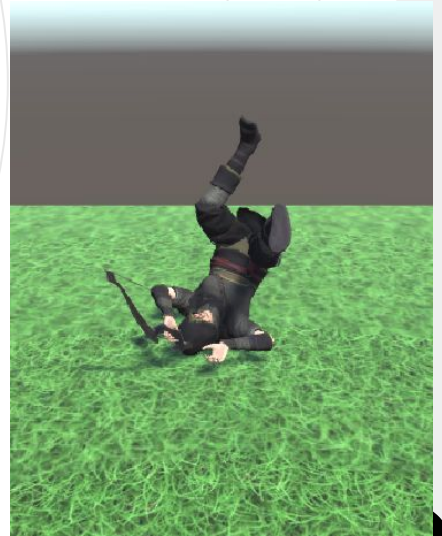
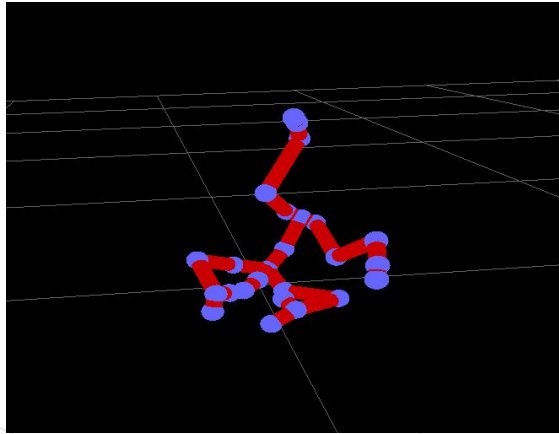
**Prototype**



# 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

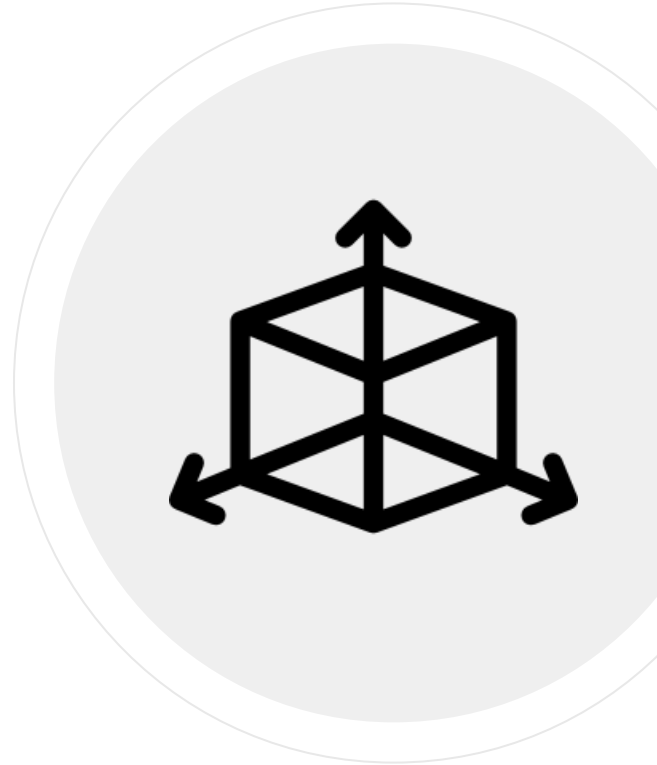




# Size Adjustment

“Shrink” / “Enlarge” / “Normal size”

- User can adjust the height of the avatar





Scale: 0.85

Normal Size

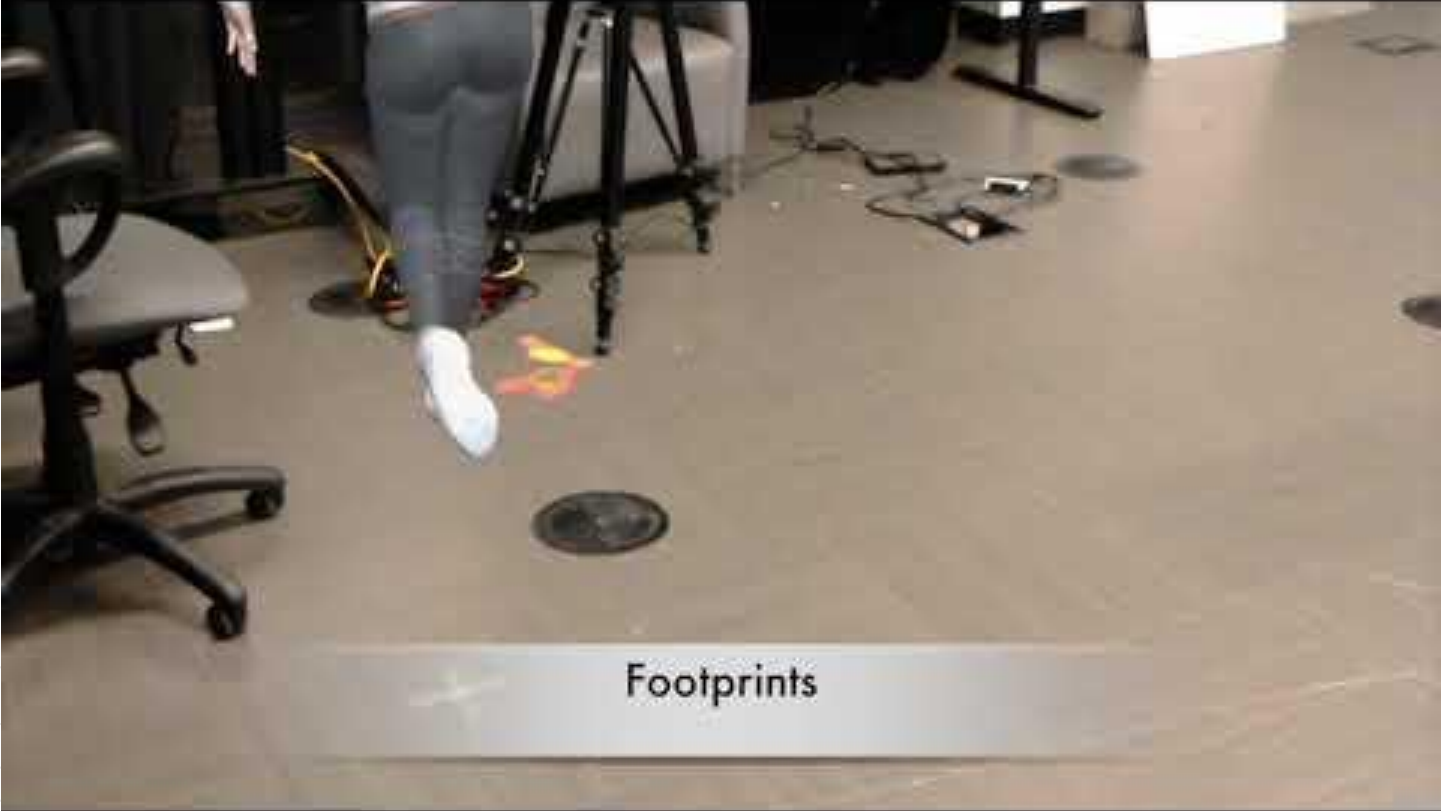


# Footprints

“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





Footprints





# 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





Trails and dots for feet



# 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

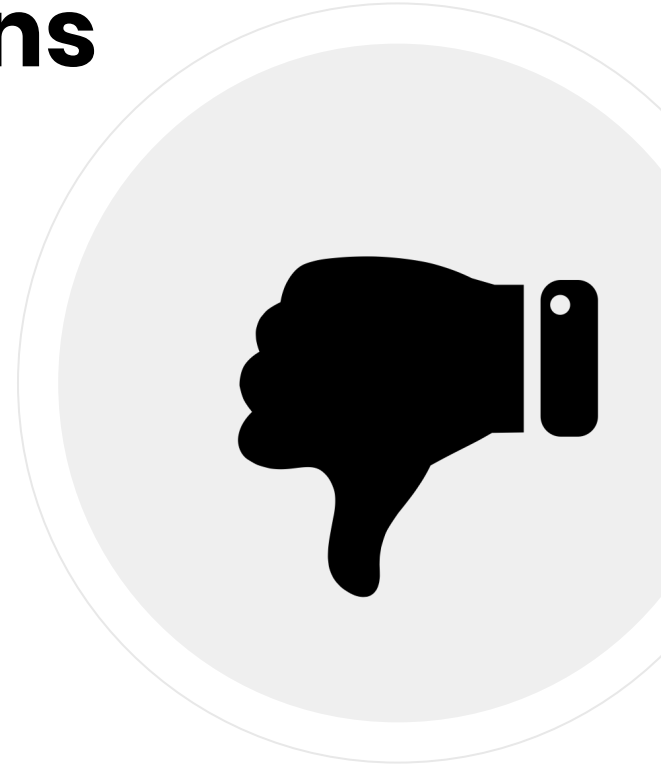
# Project Review

- 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



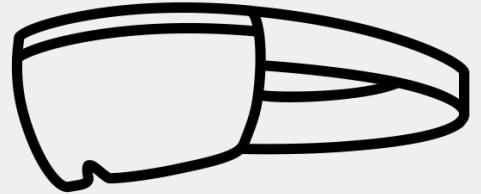
# Application's Limitations

- 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



A large white circle is centered on a black background. To its left, there are two overlapping circles: a larger, semi-transparent grey one and a smaller, semi-transparent white one. To its right, there are four concentric white circles of varying sizes, also overlapping the main white circle.

**Playtime!**