Biomechanics of human movement – The Legacy & the Future!

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Research Topic, Question & Contents

- **Research topic** -> Biomechanics of movement in humans

- **Research question** -> Can we move towards simple smartphone-based videos in biomechanics instead of lab-based expensive Motion Capture (Mo-Cap) systems?

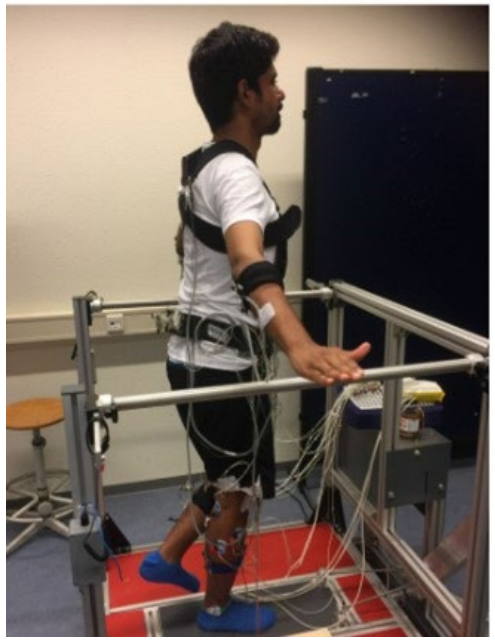
- **Part 1**: Past research (the legacy)

- **Part 2**: Current research (also the future)

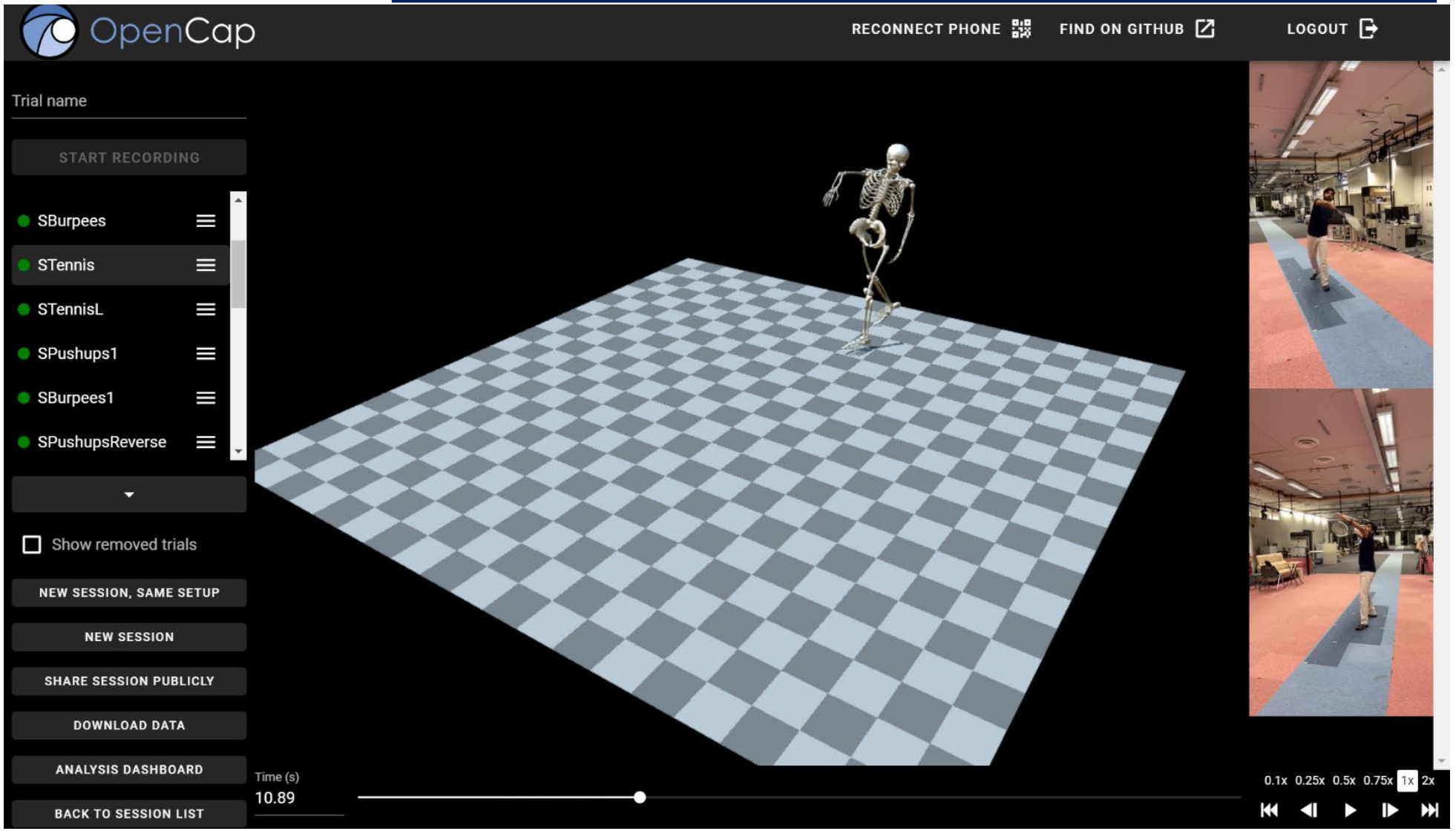
- **Part 3**: Pictures of simulation results

The Problem (legacy)

- Traditionally biomechanical experiments are costly, time-taking, requires specific expertise and done (mostly) within labs
- Movement dynamics rarely measured in clinical settings/outside lab
- Data collection, processing & generating dynamic musculoskeletal simulations takes several days
- Inertial Measurement Units (IMUs) and marker less, video-based Mo-cap systems are current alternatives



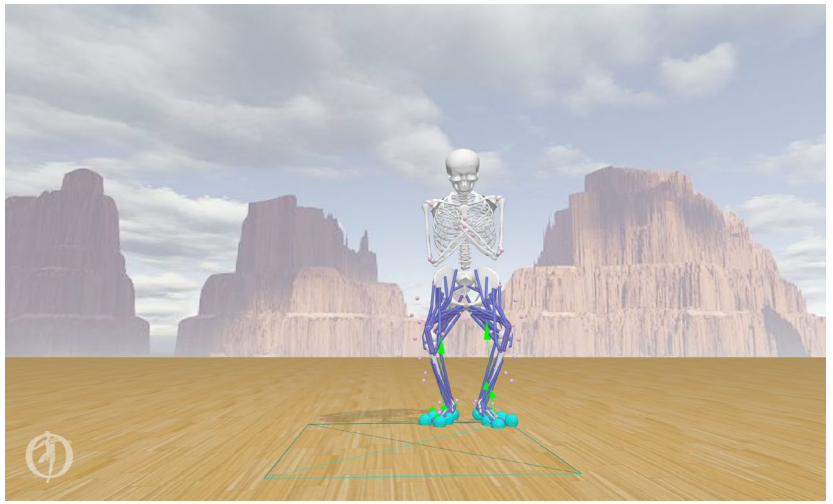
Videos with AI (the future)



- Video-based (markerless) kinematics & kinetics
- Based on Deep learning (LSTM) models

Muscle-driven simulations





Above figures show biomechanics of various human movements, like a jump (left), squat (center) and a sit-to-stand motion (right). These are simulation results after the video data is analyzed (see the previous slide).

The red colored muscles in the hips & lower limbs show which muscles are activated during the movement and the green arrows show the vertical ground reaction forces that are applied back at the body during the movement from the ground. These forces are equal and opposite to the forces exerted by the body on the ground (according to Newton's 3rd., law of motion in Physics).

References

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