

POSE ESTIMATION ON MOBILE IN STRENGTH SPORTS

DESIGN

Server

- FastAPI
- RTMDet + RTMPose model [1]
- Metrics calculation
- Multiple exercises

Client

- Android application
- Recordings history management
- Analyzing results in visual

METRICS

- Mean velocity [2], Mean Propulsive Velocity [2]

• Impulse: $I = \int_{t_1}^{t_2} F(t) dt$

- Error propagation reduction:

$$I = ma\Delta t = m \frac{\Delta v}{\Delta t} \Delta t = m\Delta v$$

ARCHITECTURE

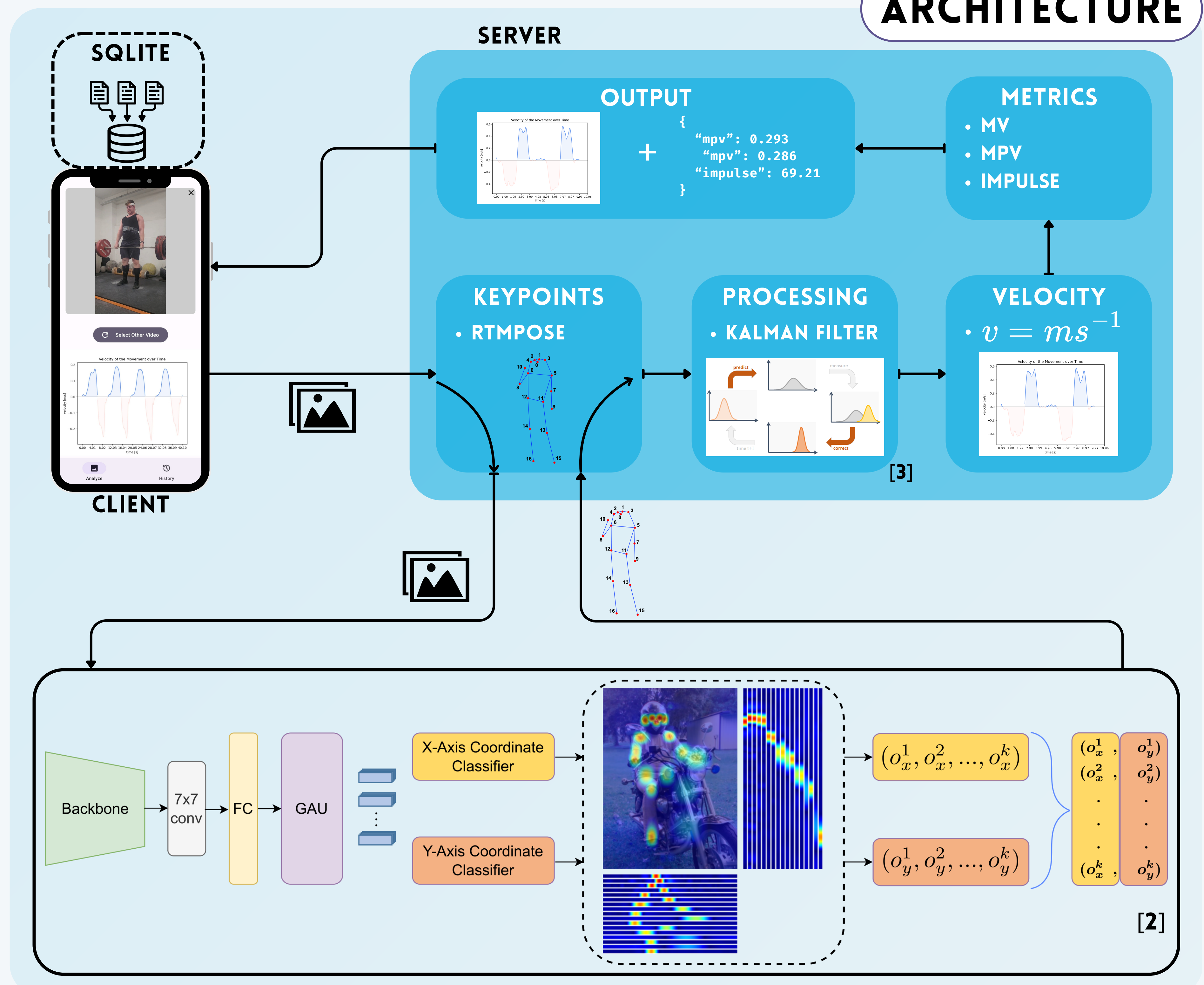


FIGURE 1

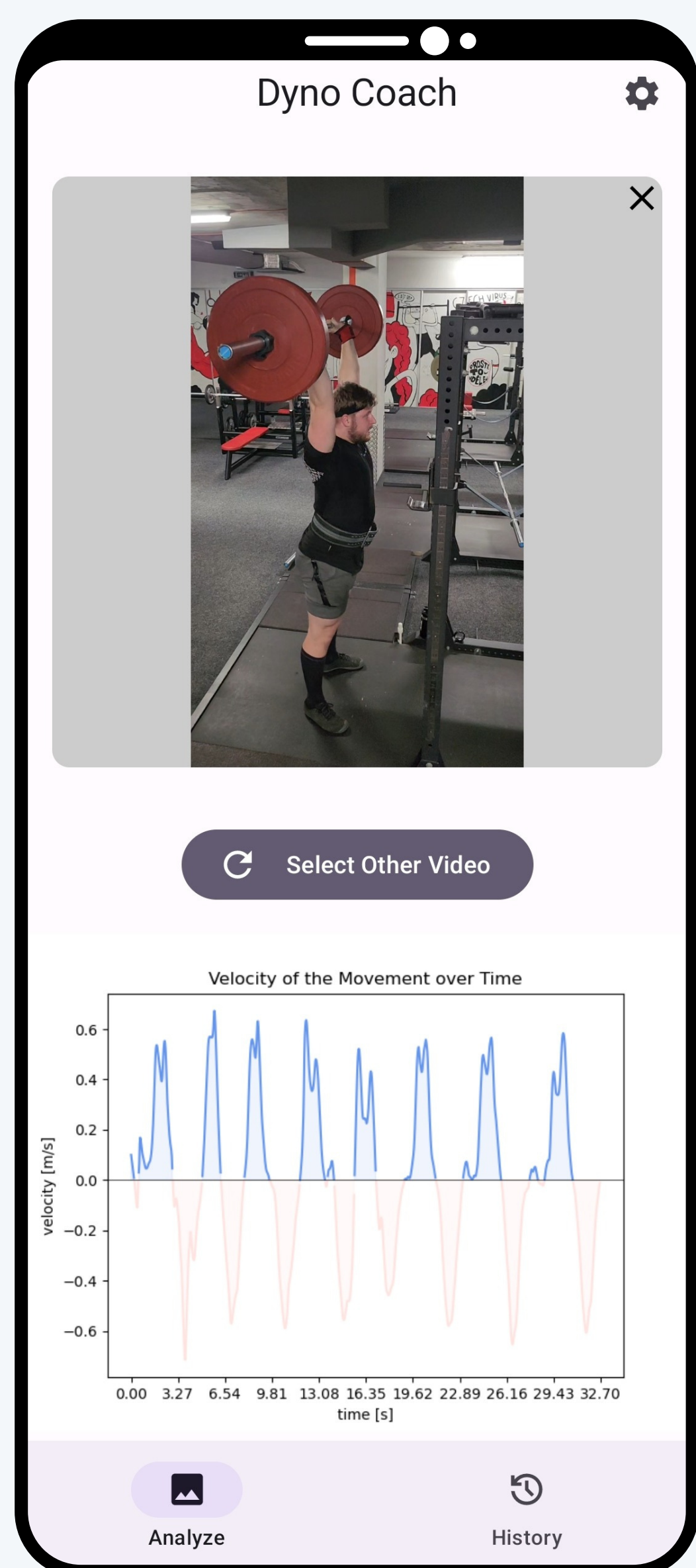


FIGURE 2

DEVICE COMPARISON

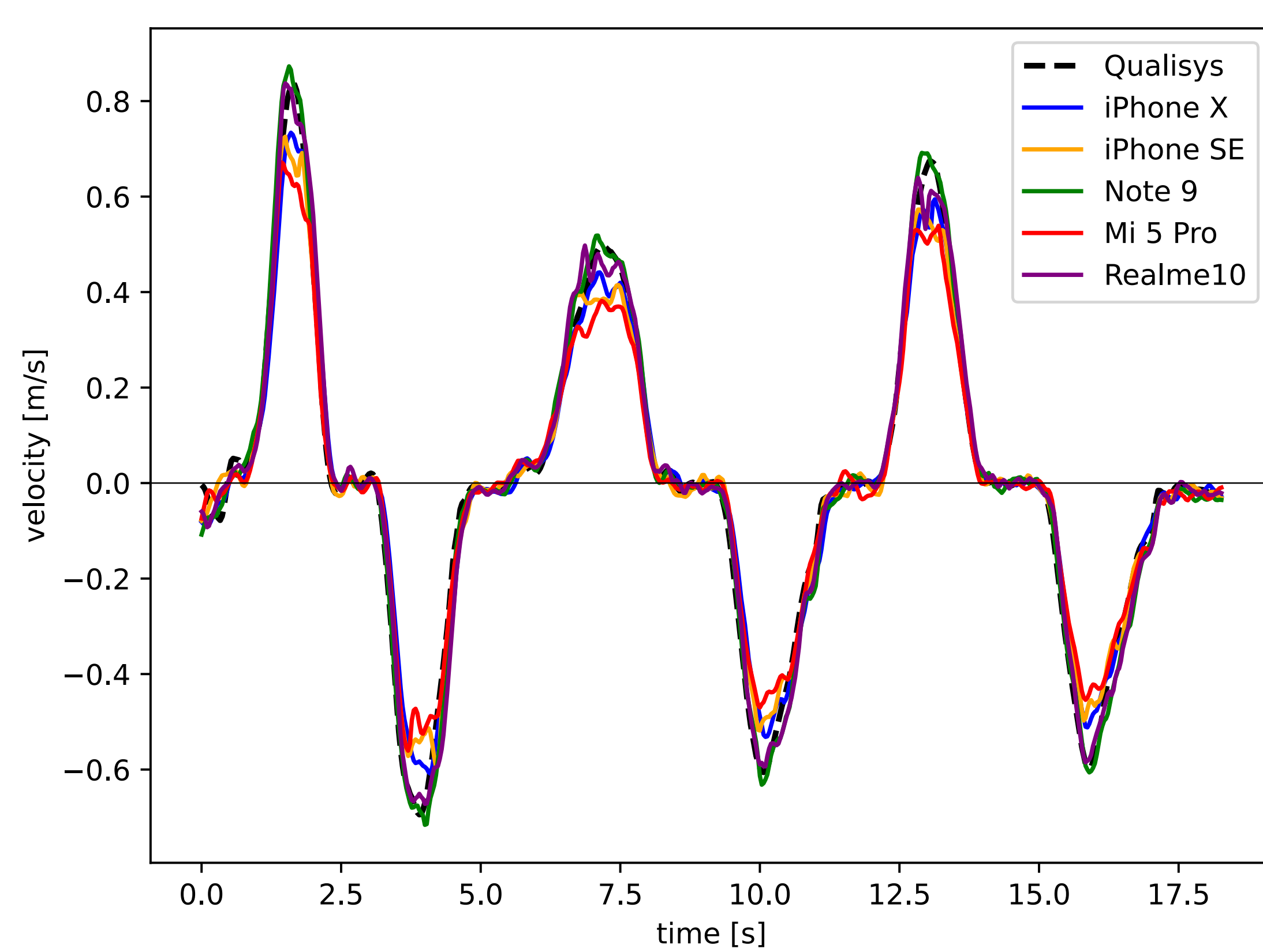


FIGURE 3

ABSOLUTE DEVIATION

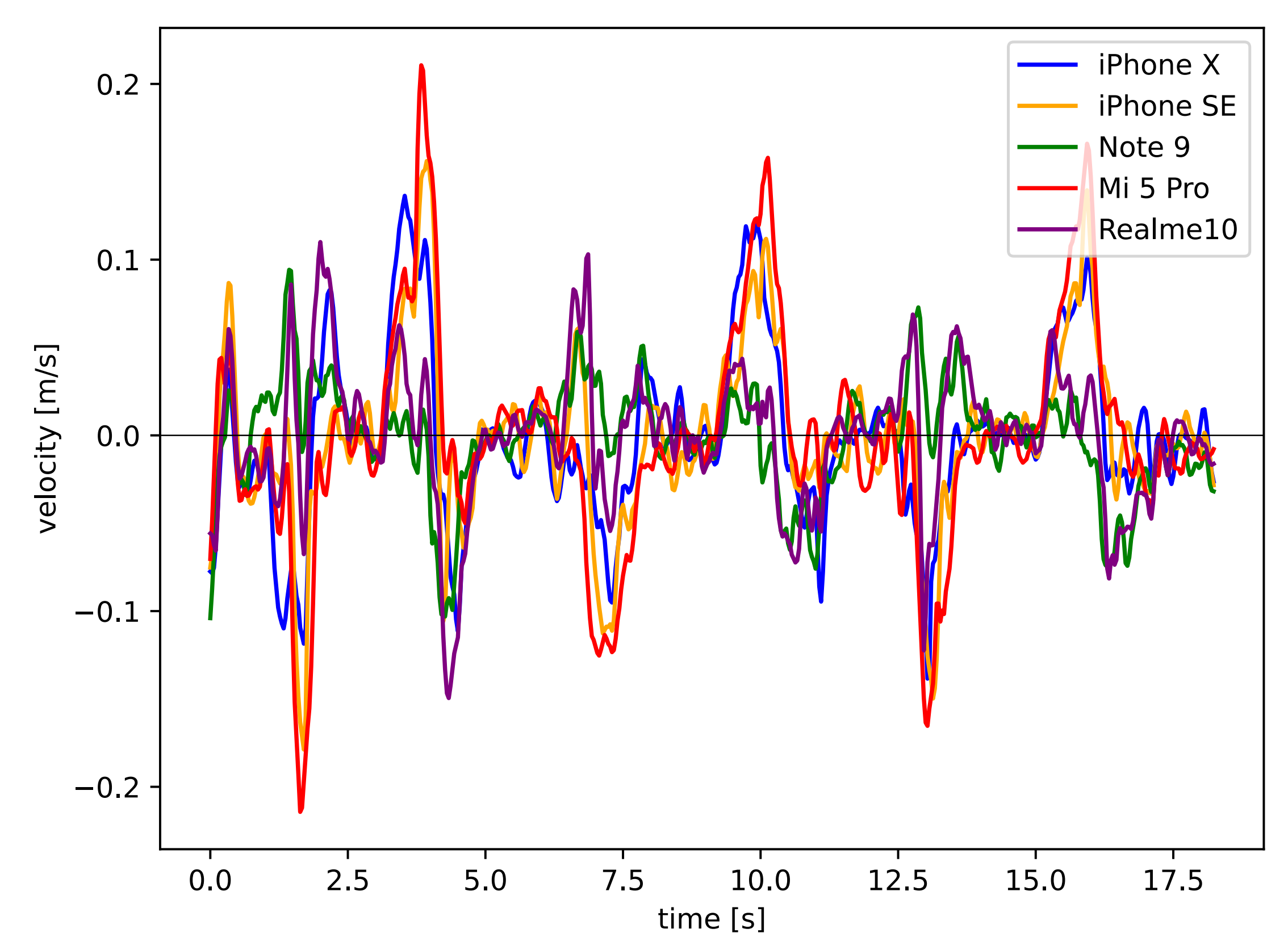


FIGURE 4

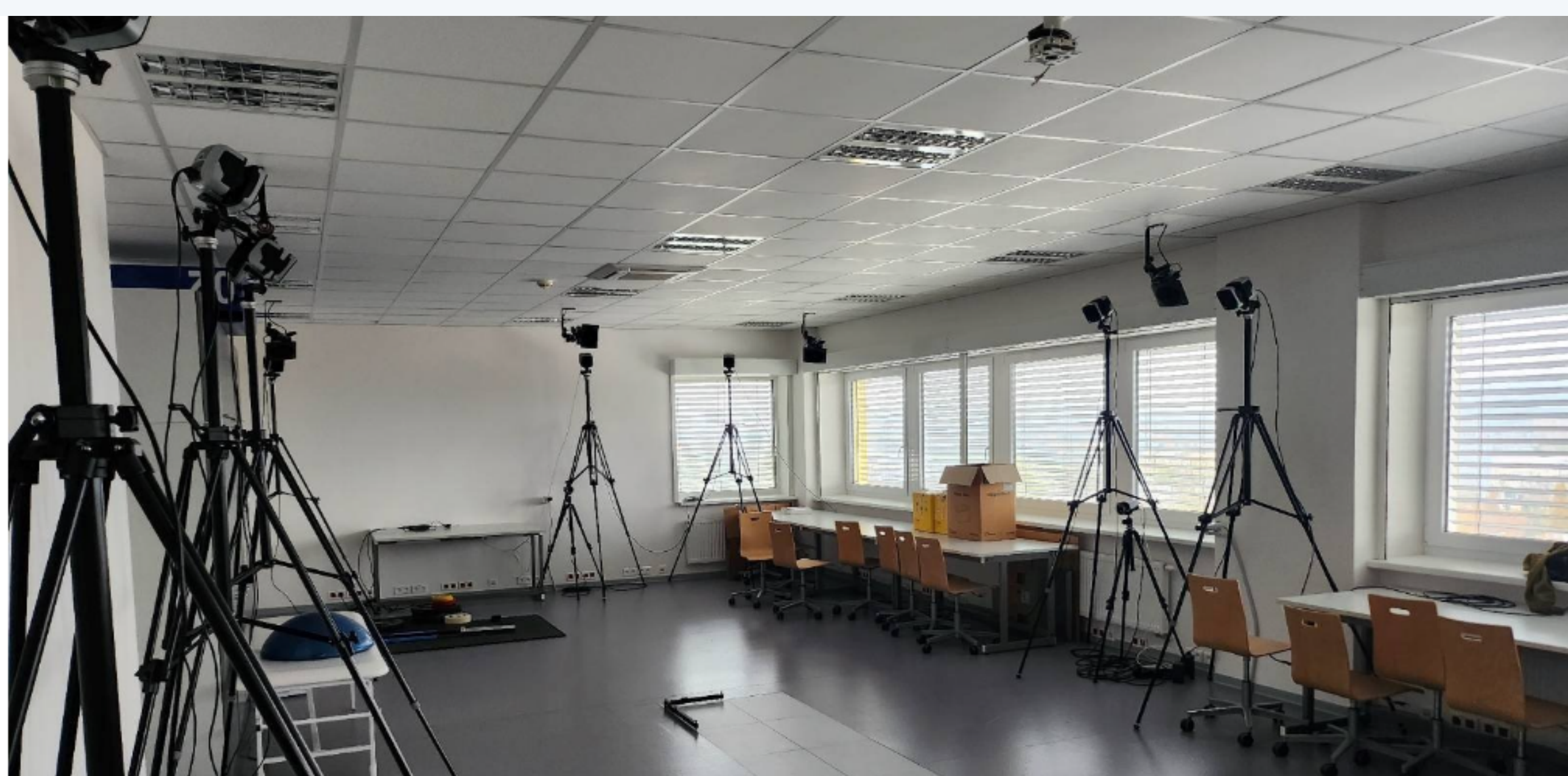


FIGURE 5

EXTENSIONS

- More advanced calibration
- Estimate Rate of Perceived Exertion (RPE)
- Edge model inference (ONNX, ncnn)
- Athlete - coach interactions
- Trend monitoring
- Overtraining detection

[1] Jiang, T., Lu, P., Zhang, L., Ma, N., Han, R. et al. RTMPose: Real-Time Multi-Person Pose Estimation based on MMPose. 2023

[2] González Badillo, L. Movement Velocity as a Measure of Loading Intensity in Resistance Training. Int J Sports Med. Apr 2010. vol. 31, no. 05, p. 347-352

[3] Jurić, D. Object Tracking: Kalman Filter with Ease. January 2015. Available at: <https://www.codeproject.com/Articles/865935/Object-Tracking-Kalman-Filter-with-Ease>