

Data Collection Guide

Project: Mobile App Grip Strength Model

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Date: @August 14, 2025

1. Input Features: Core IMU Signals

- Accelerometer: x, y, z
 - Gyroscope: x, y, z
 - **Phone Sampling rate:** phone dependent (420 Hz for Pixel 4 and 372Hz for S25)
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2. Output Features(Ground Truth): Force Measurement

- Measured continuously via linear actuator + load cell
 - Record:
 - Instantaneous force (per timestamp)
 - Load Cell Sampling rate: Maximum [input max sampling rate here]
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3. Squeeze Dynamics

- Ramp profiles
 - fast: Highest priority, people tend to suddenly squeeze the phone during test
 - medium: Some people hesitate and do a 2 step increase to maximal grip strength
 - gradual: Could be an interesting behavior based on future feature(test kind) expansion
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4. Simulation of Hold Configuration Variability

Type	Hold Configuration	Right Side of Phone(Assuming Righty)	Left Side of Phone(Assuming Righty)
1	Pinch	Thumb	index finger
2	Full grip - loose	Thumb	4 fingers below the buttons
3	Full grip - firm	Palm	4 fingers below the buttons

Note 1: All of the finger positioning in description must not touch the buttons on the phone.

Note 3: Number with asterisk() is just opposite dexterity*

Optional Enhancements

- Slight randomization of initial contact points within realistic bounds
- Could include minor offsets or rotations of contact points to simulate natural variability
- Small controlled shakes of varying intensity

5. Force Levels

- **Maximum actuator capacity: 330lbs/1500N**
- **Load cell maximum: 100lbs**
- **Target force range for human-relevant grips: ~10–100 pounds (~45–450 N)**
- **Recommended force levels for data collection:**
 - **Low:** 10–50 pounds (~45–225 N) — light grip, below average human strength
 - **High:** 50–100 pounds (~225–445 N) — typical adult grip strength

Notes:

- For each finger configuration × ramp profile × shake/no-shake combination, perform trials at **all relevant force levels** (Low, Medium, High)

- Peak force should be controlled via the linear actuator
 - Capturing multiple points across this range ensures the model can generalize well across realistic human grips
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6. Test Duration

- Test duration will be **10 seconds** per test
 - Please make sure to have at least **3 seconds** recorded for the desired force level
 - All force level should start at the minimum force(min_force) that can exerted by the linear actuator to hold the phone still
 - For Example, if we do a test with gradual increase, we would like to see a data sample going from min_force up to 50, and another sample going from min_force up to 100
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7. Number of Repetitions

- In total, we should test each combination of:
 - Squeeze Dynamics (3 types of squeezes)
 - Hold configuration (3 types of hold)
 - Force Levels (2 types of levels)
 - For pinch, you should only do lower force level
- Perform **10 repetitions per combination (~ 180 trials)** to ensure robust coverage
 - Suggestion here would be to make a table to make sure that you won't miss a combination but here are some examples:
 - [Fast] x [Full Grip - loose] x [Low] → A 10 seconds test with a longer 3D printed block with the circular 3D compartment on the left and right side exerting fast force up to 50 pounds.
 - [Gradual] x [Pinch] x [Low] → A 10 seconds test with 2 3D printed blocks representing thumb and index finger holding the phone, with a

gradual increase up to 50 pounds of force.

8. Additional Variability

- Minor variations in ramp speed or hold duration to simulate human inconsistency
 - Slight randomization of contact points
 - Small controlled shakes of varying intensity
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Notes

- Phone orientation is fixed; orientation variability is not required at this time
- Ensure that each trial begins with the phone at rest and the actuator in its starting position
- Avoid excessive vibration or movement outside the specified minor shakes