

# Assignment 1: Sampling and Processing

## Accelerometer Data: Step Counter

Assigned: Jan 29 2024

Due: 11:59 pm EST Feb 12 2024

Develop a **phone app** that **counts steps**. Design an interface that shows the number of steps as a user walks with the phone in their hand. You will be using the raw data from the accelerometer to complete this task. The data will require some simple signal processing before you can count the number of steps. You can use peak detection, zero crossings, or your own technique for counting. Overall, please refer to all the techniques we discussed in the class.

We strongly recommend following the tutorials and resources provided during class to complete this assignment, including Processing for Android with the Ketai library, for efficient development.

The app should also display the sensor data and/or processed data in realtime. It may be useful to implement some interactive features for debugging during development, such as pause or reset. If you make any assumption about the phone's orientation, your app should inform the user about the assumptions.

In addition to accurately measuring step count, your solution should also reject spurious or clearly false data such as a user wringing their hands to boost their step count.

**Optional** – If you want a challenge, attempt to detect steps in any orientation and posture and run it as a service in the background. We won't give you extra credits, but maybe chocolate!!

### Deliverables

1. A **live demo** before the class or during office hours. Please have your application installed and ready to show during the office hours on the due date. We will post a sign-up sheet for demos soon.
2. Canvas submission:
  - a. Source code (an archive of the whole project folder)
  - b. Video(s) of the app (in case of unexpected outages during demo)
  - c. Very short description of your approach

## Grading Rubric

70% Performance

15% Real-time data display

15% Resilience to spurious data (e.g., user wringing hands)

For performance, as long as the estimate will be within 15% of the actual number of steps, you will get full credit, below that, you lose 10% grade for every 10% error. We will test the app on the instructor(s) and the student themselves, and grade the **\*best\*** performance.

## Notes

### Built-in step counters

The Ketai sensor library exposes a suite of event methods for the **StepDetector** built-in to some Android devices. While this may be useful as a sanity check, using these methods to complete the assignment will result in **no points awarded**. The goal of this assignment is to become familiar with manually capturing and processing raw movement data from the phone's sensors.

### Usage of signal processing techniques

While machine learning is a valid solution for step counting, we encourage you to complete this assignment using only the signal processing tools discussed in class so far.

### Working with Android 12+ Sensor Permission

The phones we provided should **not** need any special permission as they are not equipped with the latest Android OS.

If you would instead like to challenge yourself to work with newer OS versions (Android 12+), you will need to request motion sensor permission (`HIGH_SAMPLING_RATE_SENSORS`) explicitly in your code. You can use [requestPermission\(\)](#) to request a `HIGH_SAMPLING_RATE_SENSORS` permission, and add `<uses-permission android:name="android.permission.HIGH_SAMPLING_RATE_SENSORS"/>` below `</application>` in `manifest.xml`.