



# Softball Swing Classifier

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# Introduction

This project is an activity classifier centered around a baseball/softball swing and the different patterns and mistakes commonly encountered when learning to swing. The component of the swing I seek to help correct is a player's back leg and its pivot, as this is a foundational piece of a proper swing.

Inspiration for this project comes from my experience as a long-time softball player and my specific love of batting. One of the first things a player is taught when learning to swing is to “squash the bug,” or pivot one’s back leg enough to optimize rotational power, while still remaining in control of one’s swing. This movement can be very hard for beginners, especially younger players, to master; therefore, this project aims at reducing that steep learning curve.



Proper Technique





# Overview

01 Data Collection via SensorLog

02 Model Development in Apple's CreateML, outputting the CoreML Model

03 Deployment to SensorLog app, but a separate iOS app in the works



# Project Development



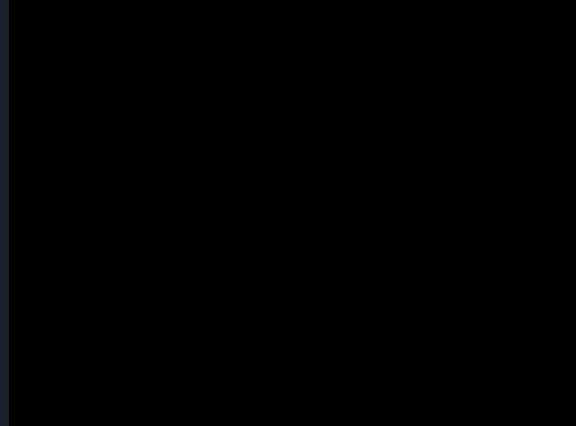


# Data Collection



- SensorLog iOS App
- Placement on Back Leg w/ Screen facing out

Video of Different Swings:



# Features and Feature Extraction

- Facilitated through RStudio Cloud
- Main Accelerometer + Gyroscope Data: A\_Z, G\_X
- Device Motion Data: A\_Y, A\_Z, G\_X

Device Motion Swing Data Analysis

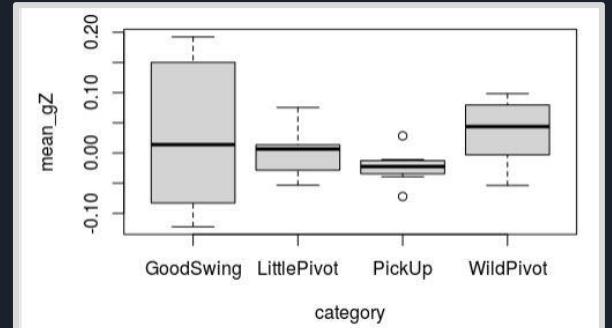
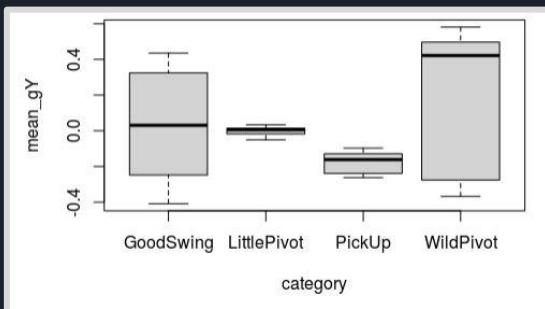
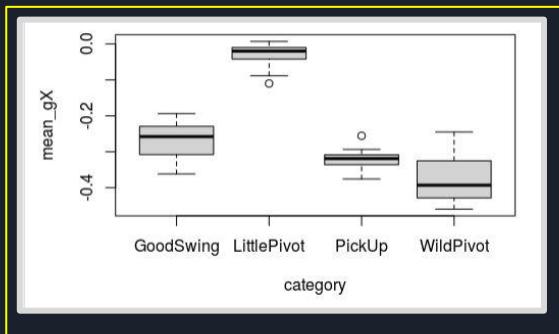
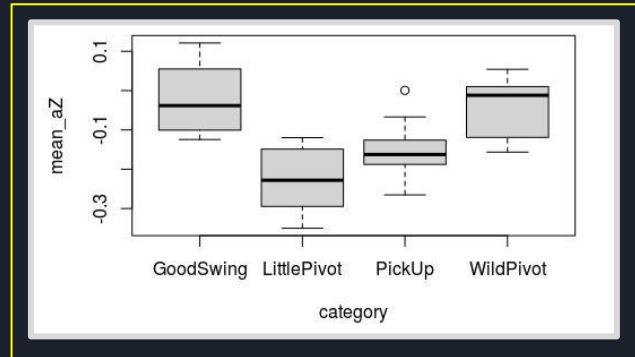
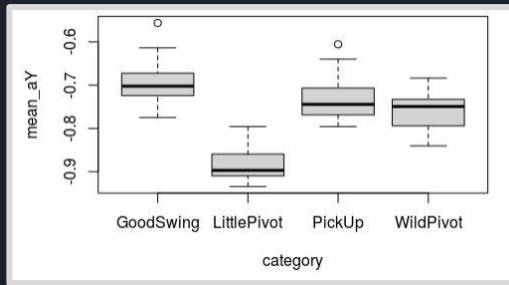
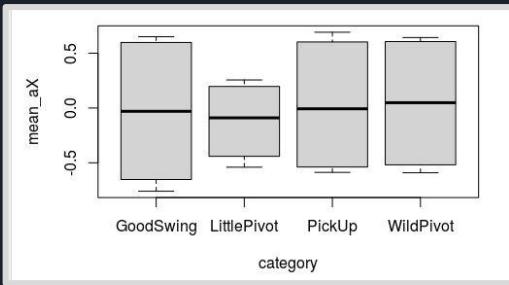
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Main Swing Analysis

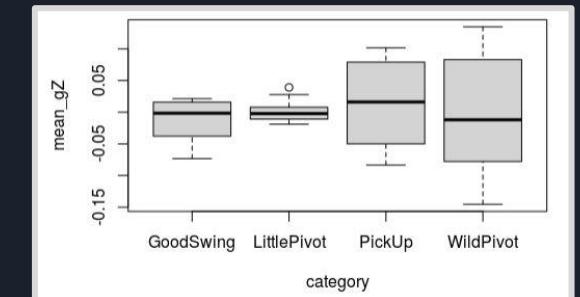
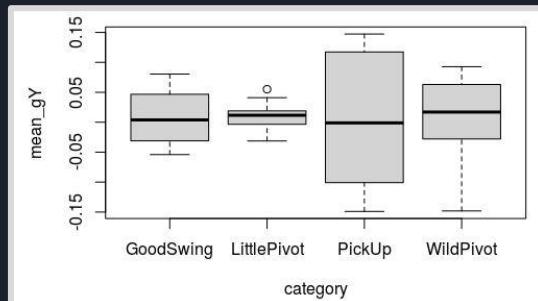
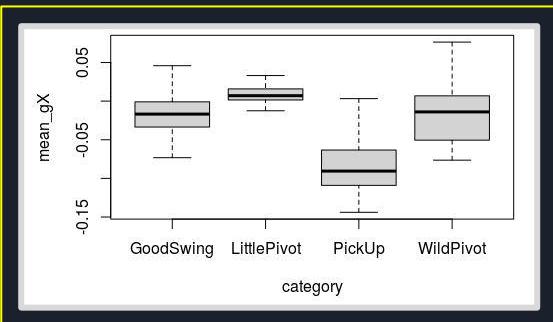
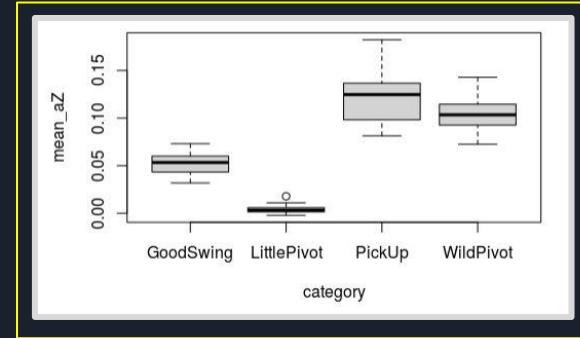
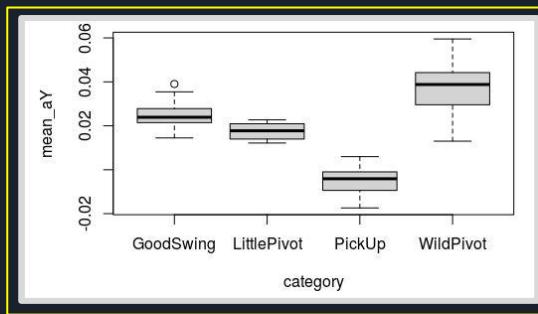
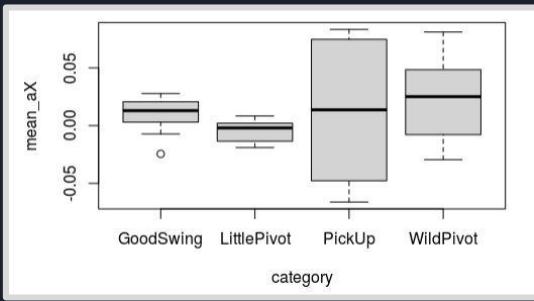
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The screenshot shows a dark-themed interface of RStudio Cloud. At the top, there's a navigation bar with three horizontal bars on the left. Below the title, there are two project cards. Each card contains the project name in blue, a 'Created' timestamp, and a lock icon. To the right of each project name are two icons: a trash can for 'Delete' and a hand for 'Move'.

# Main Accelerometer and Gyroscope Data Graphs

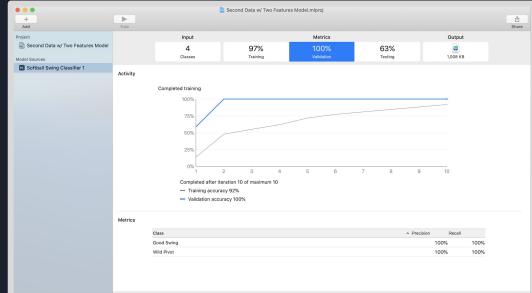
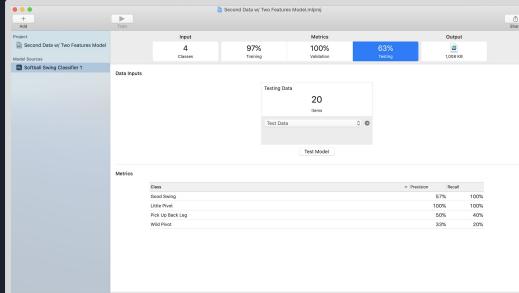
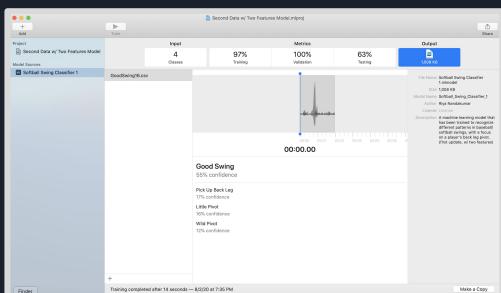
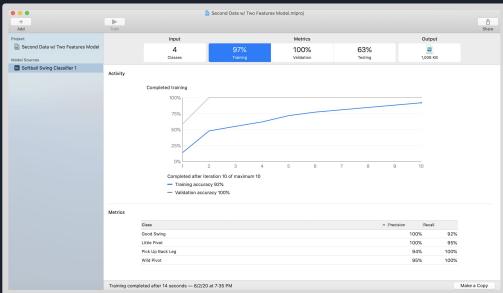
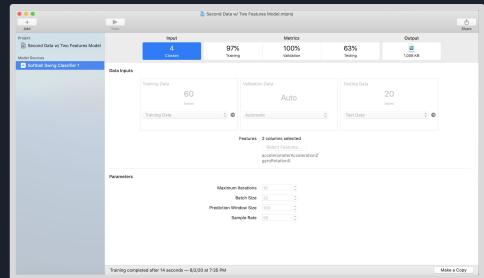


# Device Motion Data Graphs

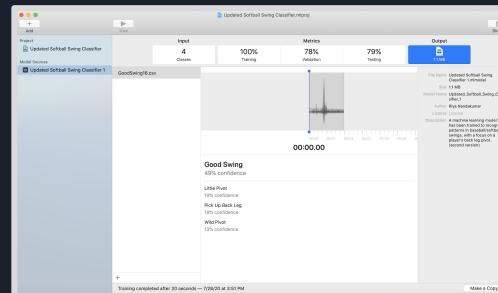
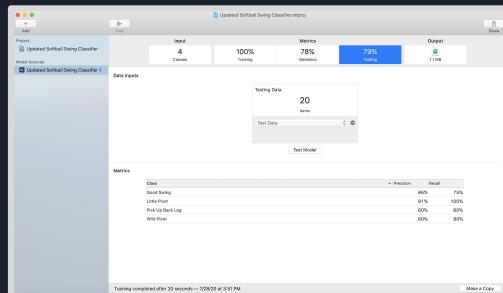
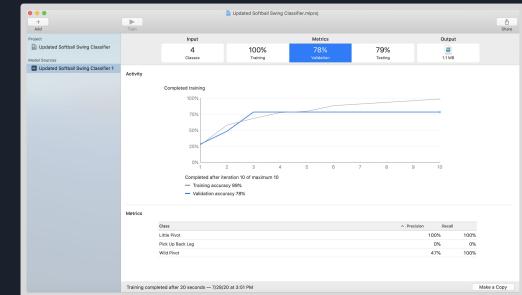
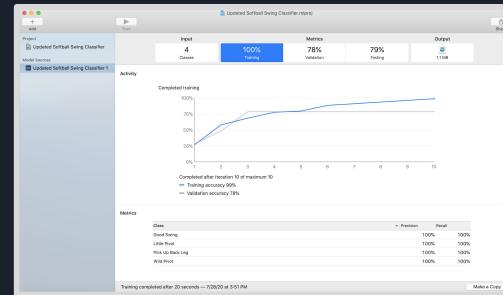
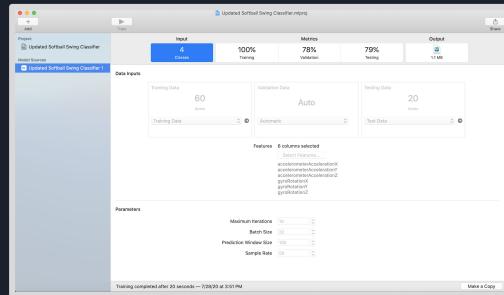


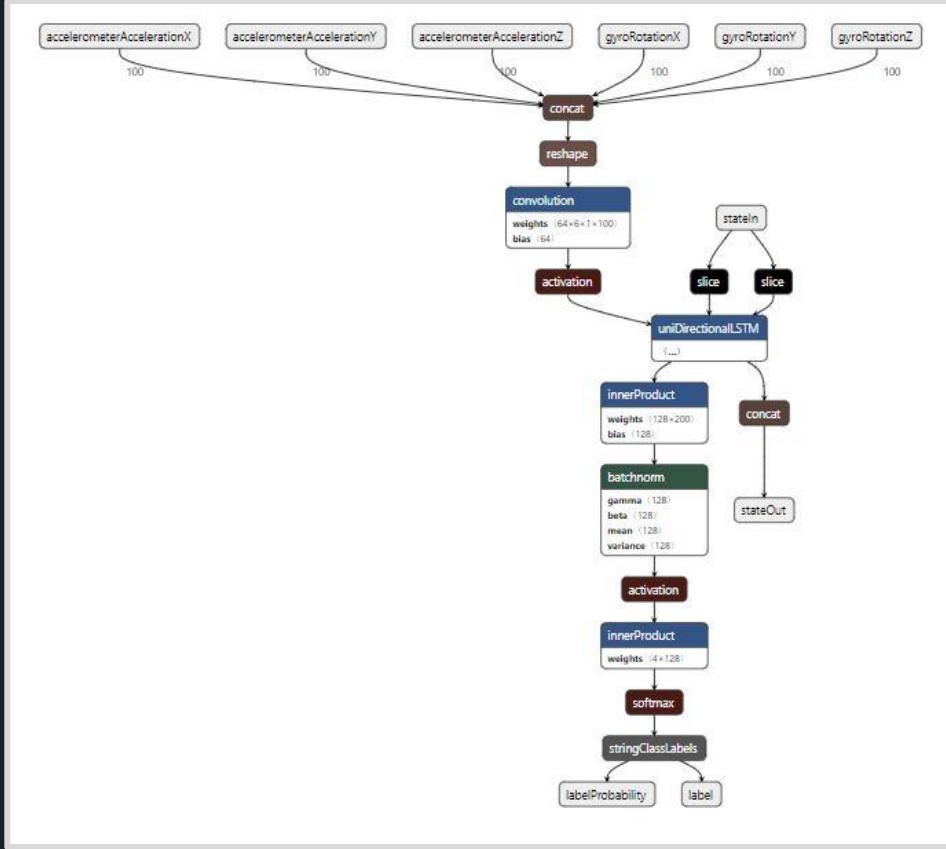
# Model Training and Testing

- Utilizing CoreML and Apple's CreateML
  - Activity Classifier template
  - Neural Network
- Shown Here: Second Dataset Model w/ Two Features



# Final Results of Model





Netron Flow Chart

# App Development

- Deployment to SensorLog
  - Fickle, Harder to get constant stream of results
- iOS App Development
  - Not finished :/

The image displays two side-by-side screenshots of a mobile application interface for managing a machine learning model.

**Left Screenshot:**

- Model Selection:** Shows "Model: Updated Softball Swing Classifi..." with a right-pointing arrow.
- Input Rate:** Set to 2 Hz.
- Performance Options:** Buttons for "use only CPU to calculate:" and "run model:" are both turned on (green).
- Model Output:** A section labeled "Model Output" with an info icon (i) below it.
- Model Input Feature Mapping:** A table showing feature-sensor mappings:
  - feature: accelerometerAccelerationZ sensor: accelerometerAccelerationZ
  - feature: accelerometerAccelerationX sensor: accelerometerAccelerationX
  - feature: gyroRotationX sensor: gyroRotationX

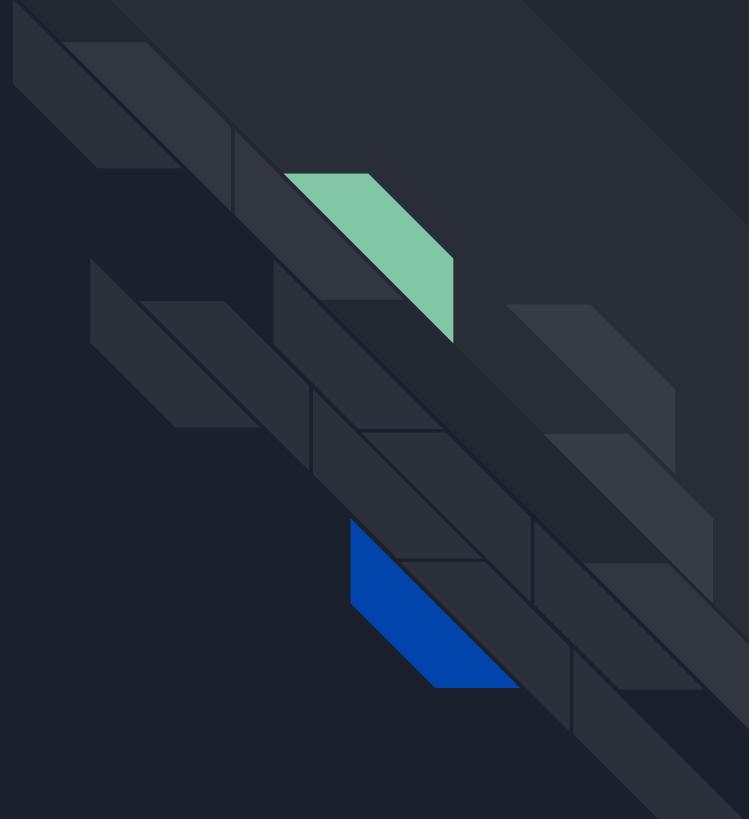
**Right Screenshot:**

- Model Selection:** Shows "Model: Updated Softball Swing Classifi..." with a right-pointing arrow.
- Input Rate:** Set to 2 Hz.
- Performance Options:** Buttons for "use only CPU to calculate:" and "run model:" are both turned on (green).
- Model Output:** A section labeled "Model Output" with an info icon (i) below it, showing the following label probabilities:
  - label: Pick Up Back Leg labelProbability: Good Swing:0.267368
  - label: Little Pivot:0.264846
  - label: Pick Up Back Leg:0.301836
  - label: Wild Pivot:0.165950
- Model Input Feature Mapping:** A table showing feature-sensor mappings:
  - feature: accelerometerAccelerationZ sensor: accelerometerAccelerationZ
  - feature: accelerometerAccelerationX sensor: accelerometerAccelerationX
  - feature: gyroRotationX sensor: gyroRotationX

# Timeline

- Initial SensorTile and Python Notebook System
  - Compatibility issues with SensorTile
- Data Collection via iPhone's SensorLog
  - Accelerometer and Gyroscope
- First Model Training
- Cleaned up Good Swing Category Data
- (main) Second Model Training
- Trial of new "No Activity Class"
- First Trial of iOS App Development
- Device Motion Data Collection
- Data Analysis on both datasets
- Device Motion Model Training
- Second Trial of iOS App Development
- Deliverables

Moving Forward





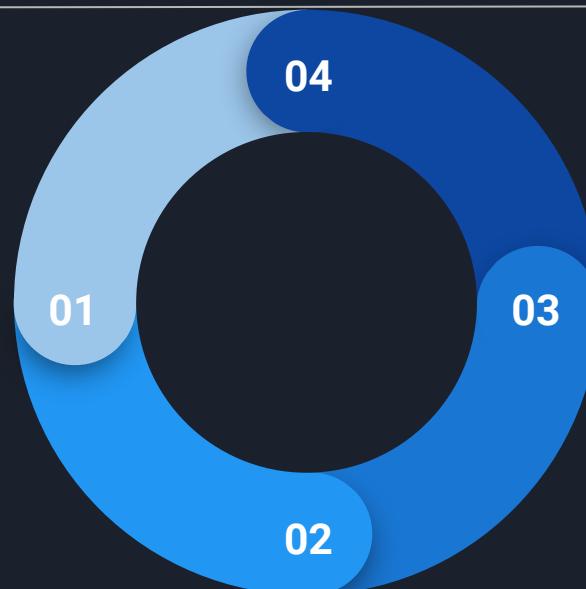
# Project Cycle

## Plan

Initial Research and Formulating Schedule

## Data

Collection, Cleaning and Labeling, Analysis



## Deploy

SensorLog / separate iOS App

## Model

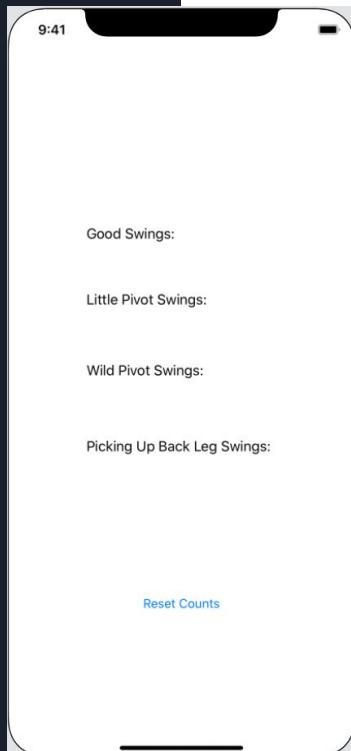
Training and Testing, experimentation with features and types



## Moving Forward: Current Idea and New Ideas

### Improvements:

- Broadening Data
- Trials of Different Models
- Finishing iOS App Development



- Trials with SensorTile and Python Notebook
- Better Swing Classification tallying interface

### New Ideas:

- Video classification

# Thank You!

Repo: <https://github.com/riyanandakumar/Softball-Swing-Master>

[https://www.google.com/search?q=bryce+harper+squash+the+bug&rlz=1C1CHBF\\_enUS753US753&sxsrf=ALeKk03Xj4Jsop3WOiH64WmptjhkiXKF9Q:1596389437973&source=lnms&tbo=isch&sa=X&ved=2ahUKEwiGI\\_6Khv3qAhVEInIEHeKgDEwQ\\_AUoAXoECAsQAw&biw=1366&bih=657#imgrc=krqzO7G5jmQfXM](https://www.google.com/search?q=bryce+harper+squash+the+bug&rlz=1C1CHBF_enUS753US753&sxsrf=ALeKk03Xj4Jsop3WOiH64WmptjhkiXKF9Q:1596389437973&source=lnms&tbo=isch&sa=X&ved=2ahUKEwiGI_6Khv3qAhVEInIEHeKgDEwQ_AUoAXoECAsQAw&biw=1366&bih=657#imgrc=krqzO7G5jmQfXM)

[https://www.google.com/search?q=sensorlog&rlz=1C1CHBF\\_enUS753US753&sxsrf=ALeKk03KuUR0K3uXy7XHg2d7Ksuf8P2\\_YA:1596388371616&source=lnms&tbo=isch&sa=X&ved=2ahUKEwjk9sCOgv3qAhVjg3IEHecnD1EQ\\_AUoAHoECAsQCA&biw=1366&bih=657#imgrc=ChZ5zfx\\_zktA7M](https://www.google.com/search?q=sensorlog&rlz=1C1CHBF_enUS753US753&sxsrf=ALeKk03KuUR0K3uXy7XHg2d7Ksuf8P2_YA:1596388371616&source=lnms&tbo=isch&sa=X&ved=2ahUKEwjk9sCOgv3qAhVjg3IEHecnD1EQ_AUoAHoECAsQCA&biw=1366&bih=657#imgrc=ChZ5zfx_zktA7M)