Hit spacebar to record Sample 3/5 of gesture 'Backhand Tennis'

PROTOTYPING WITH ML 1: INTRO TO ML FOR HCI

CSE 599 Prototyping Interactive Systems | Lecture 11 | Oct 31

Jon Froehlich • Liang He (TA)

DESIGN USE BUILD

MAKEABILITY LAB

PAUL G. ALLEN SCHOOL OF COMPUTER SCIENCE & ENGINEERING

UNIVERSITY of WASHINGTON

A2 SHARE OUTS & CRITIQUE

A2: Fabrication: 3D-Printed Interactive Night Light

Published | Edit

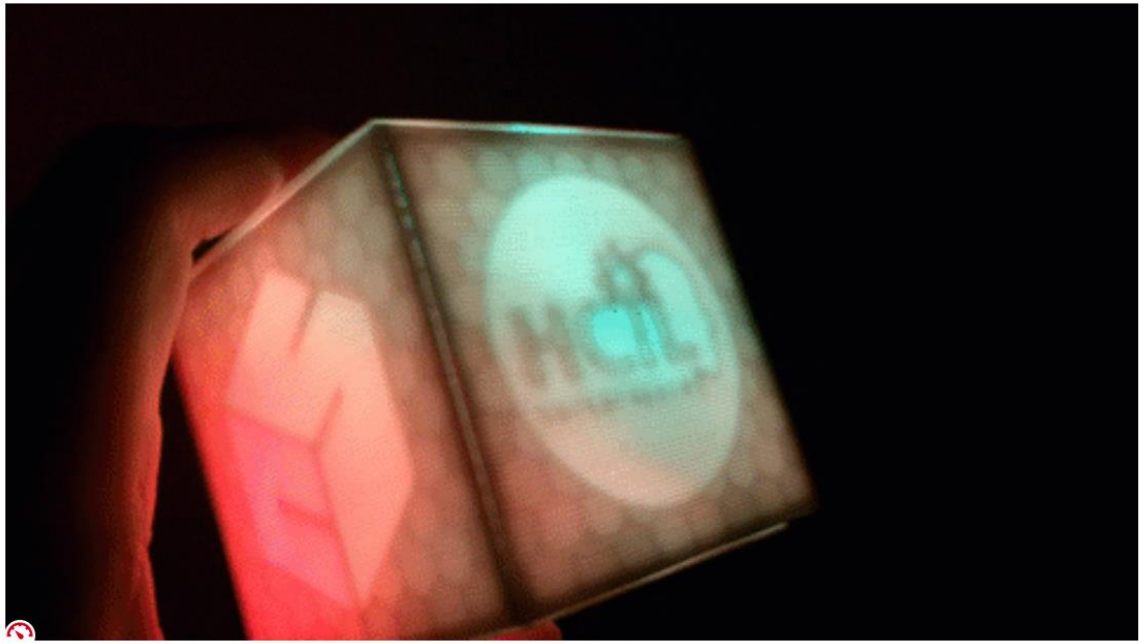


Image caption: The *Tangible Interactive Computing* Top Maker Award from CMSC838f, Spring 2015 designed by Jon Froehlich based on the Holocron Nightlight by CMSC838f student Philip Dasler.

Overview

In this assignment, you will design and fabricate a 3D-printed interactive night light, which responds to user interaction, creatively diffuses the light (*e.g.*, playfully or elegantly), and fully encloses your Arduino and electronics. The specific model is up to you but should include: (1) a mounting stand for the internal electronics; (2) a carefully measured and tightly fit input slot for the USB micro cable to power your design; (3) and similarly well-designed fittings for any input controls you want to expose. You will likely need to design and print a multi-part model, which

Related Items

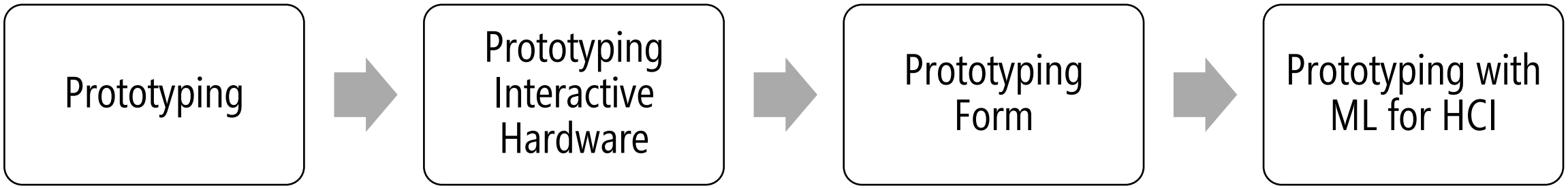
SpeedGrader™

Download Submissions

0 out of 9 Submissions Graded

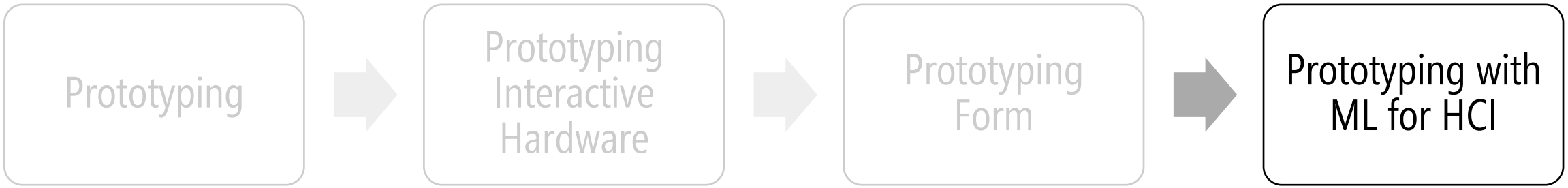
PROTOTYPING INTERACTIVE SYSTEMS

COURSE CURRICULUM

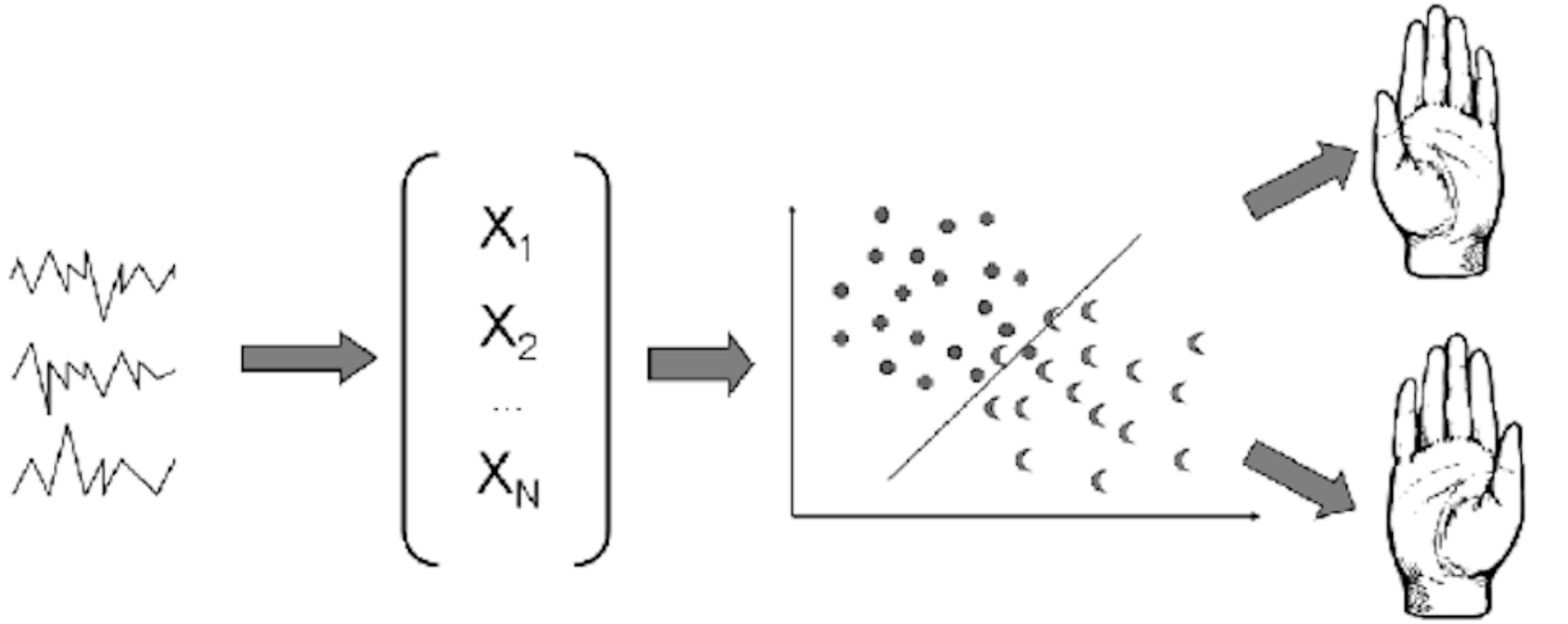


PROTOTYPING INTERACTIVE SYSTEMS

COURSE CURRICULUM



PROTOTYPICAL ML PIPELINE



EEG signals

Ex: signal recorded during left or right hand motor imagery

Feature extraction

Ex: band power in the μ and β rhythms for electrodes located over the motor cortex

Classification

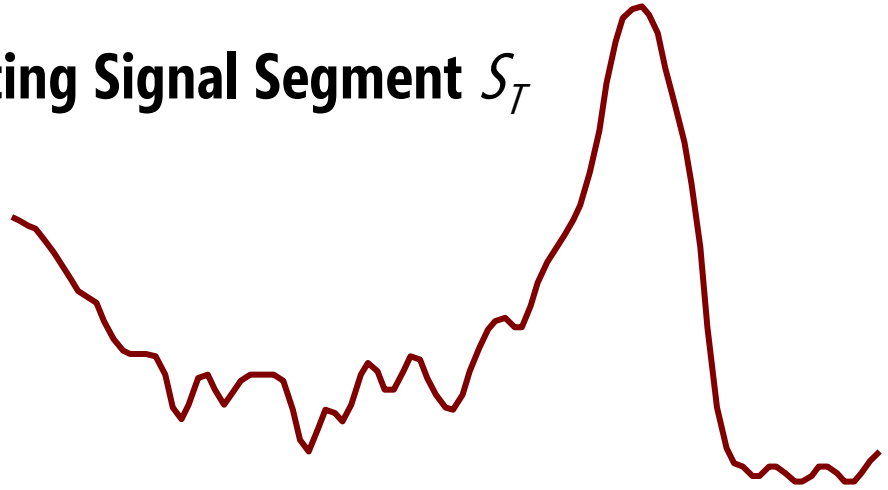
Ex: Linear Discriminant Analysis (LDA)

Estimated class

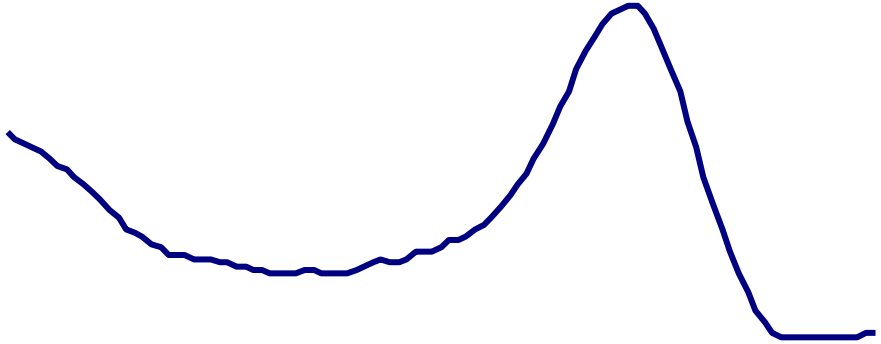
Ex: Left or Right (imagined hand movement)

CONSIDER TWO SIGNALS: IS S1 THE SAME AS S2?

Existing Signal Segment S_T



Incoming (New) Signal Segment S_N

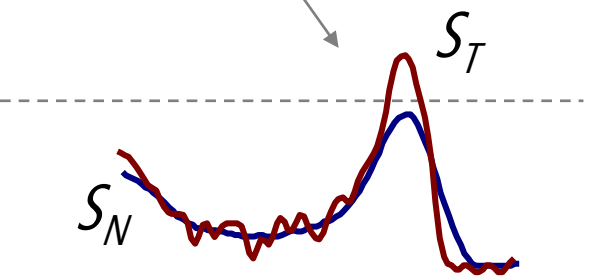


How can the computer determine whether S_N is the same signal as S_T?

3 PREVAILING APPROACHES FOR SIGNAL CLASSIFICATION

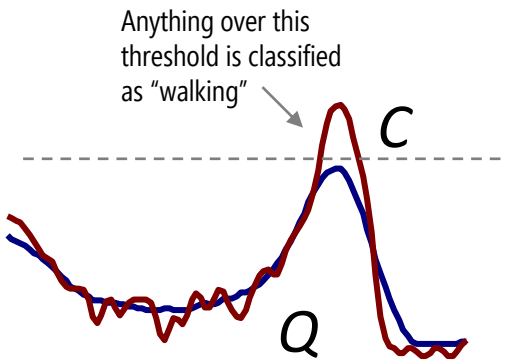
1. RULE-BASED

Anything over this threshold is classified as "walking." This threshold learned from "training" data

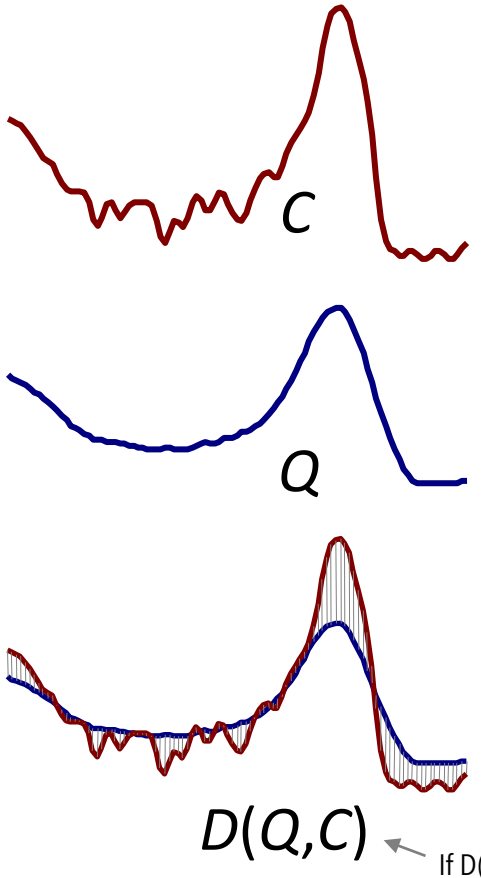


3 PREVAILING APPROACHES FOR SIGNAL CLASSIFICATION

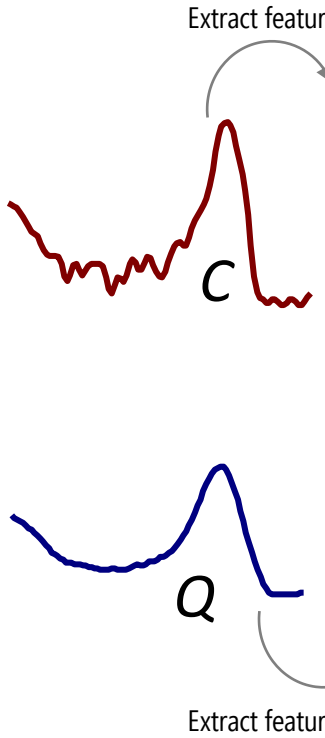
1. RULE-BASED



2. SHAPE MATCHING



3. FEATURE-BASED MODELS



Raw Signal	1st Derivative	FFT
Mean	Mean	Top N freqs
Variance	Variance	Fundamental
Skewness	Skewness	
Kurtosis	Kurtosis	

Raw Signal	1st Derivative	FFT
Mean	Mean	Top N freqs
Variance	Variance	Fundamental
Skewness	Skewness	
Kurtosis	Kurtosis	

Supervised Learning Model

Output

Enabling Always-Available Input With Muscle-Computer Interfaces

T. Scott Saponas[1,2], Desney S. Tan[1], Dan Morris[1],
Ravin Balakrishnan[1,3], Jim Turner[4], James A. Landay[2]

[1]Microsoft Research
[2]University of Washington
[3]University of Toronto
[4]Microsoft Corporation

ACM UIST 2009

Scratch Input: Creating Large, Inexpensive, Unpowered and Mobile Finger Input Surfaces

Chris Harrison Scott E. Hudson

Human-Computer Interaction Institute
Carnegie Mellon University
5000 Forbes Ave., Pittsburgh, PA 15213
{chris.harrison, scott.hudson}@cs.cmu.edu

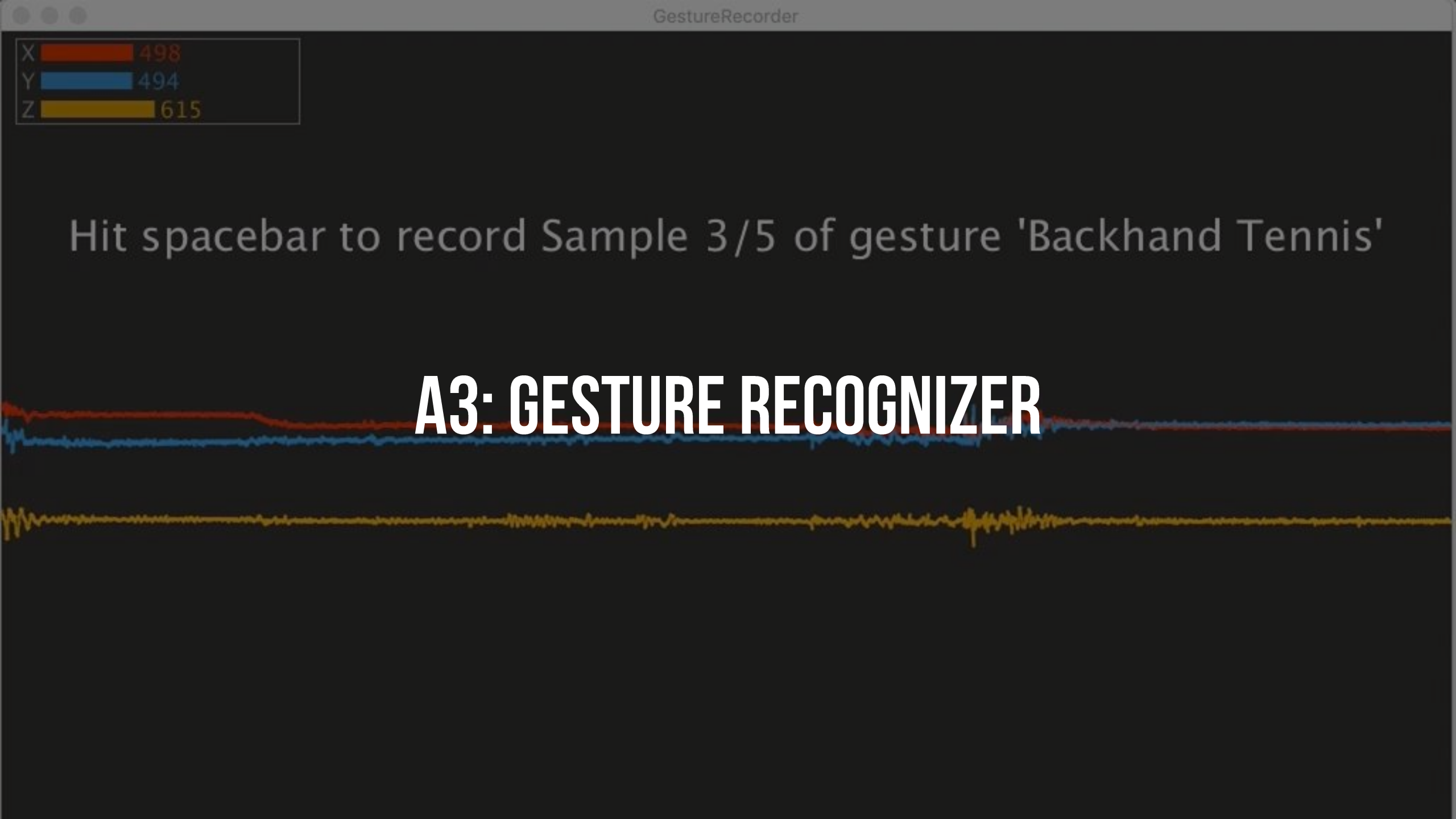
Sensing Fine-Grained Hand Activity with Smartwatches

Gierad Laput Chris Harrison

Carnegie Mellon University

FUTURE INTERFACES GROUP

Carnegie Mellon University


GestureRecorder
X 498
Y 494
Z 615
Hit spacebar to record Sample 3/5 of gesture 'Backhand Tennis'
A3: GESTURE RECOGNIZER

Autumn 2019

Home
Announcements
Assignments
Discussions
Grades
People
Pages
Files
Syllabus
Outcomes
Quizzes
Modules
Conferences
Collaborations
Chat
Attendance
UW Libraries
Add 4.0 Grade Scale
Panopto Recordings
Settings

A3: Gesture Recognizer

Published | Edit

This assignment is still a draft! I will remove this statement after it's finalized.

Overview

Imagine working for a new hardware startup designing new input controllers. You've been asked to prototype a new, custom input device with gesture recognition (using an accelerometer)--for example, to use the input controller as a paddle in tennis, as a "ball" in bowling, or to recognize the "overhand throwing motion" in baseball. In this assignment, you will build your own 3D gesture recognizer to automatically recognize these gestures.

While in the "real world" you would ultimately need to create a real-time gesture recognizer, for this assignment you will make an *offline* version in Jupyter Notebook (please use the Anaconda Distribution, as recommended). Specifically, in this assignment you will build a *shape-matching* (or *template-matching*) recognizer such as via a Euclidean distance metric or Dynamic Time Warping.

[Note: we will not do the following this year because I'm trying to emphasize the projects more but typically we have a follow-up assignment, A4, where you would build a *feature-based* (or *model-based*) recognizer using a support-vector machine (SVM) (recommended) or an alternative supervised learning approach of your choosing (*e.g.*, a decision tree).]

Within Jupyter Notebook, we will use Python 3 and these amazing libraries numpy, scipy, matplotlib, and scikit-learn. Numpy and scipy provide numeric array handling and signal processing, matplotlib provides visualization, and scikit-learn is the de facto machine learning library in Python. You are welcome to use other libraries as well (*e.g.*, this DTW library).

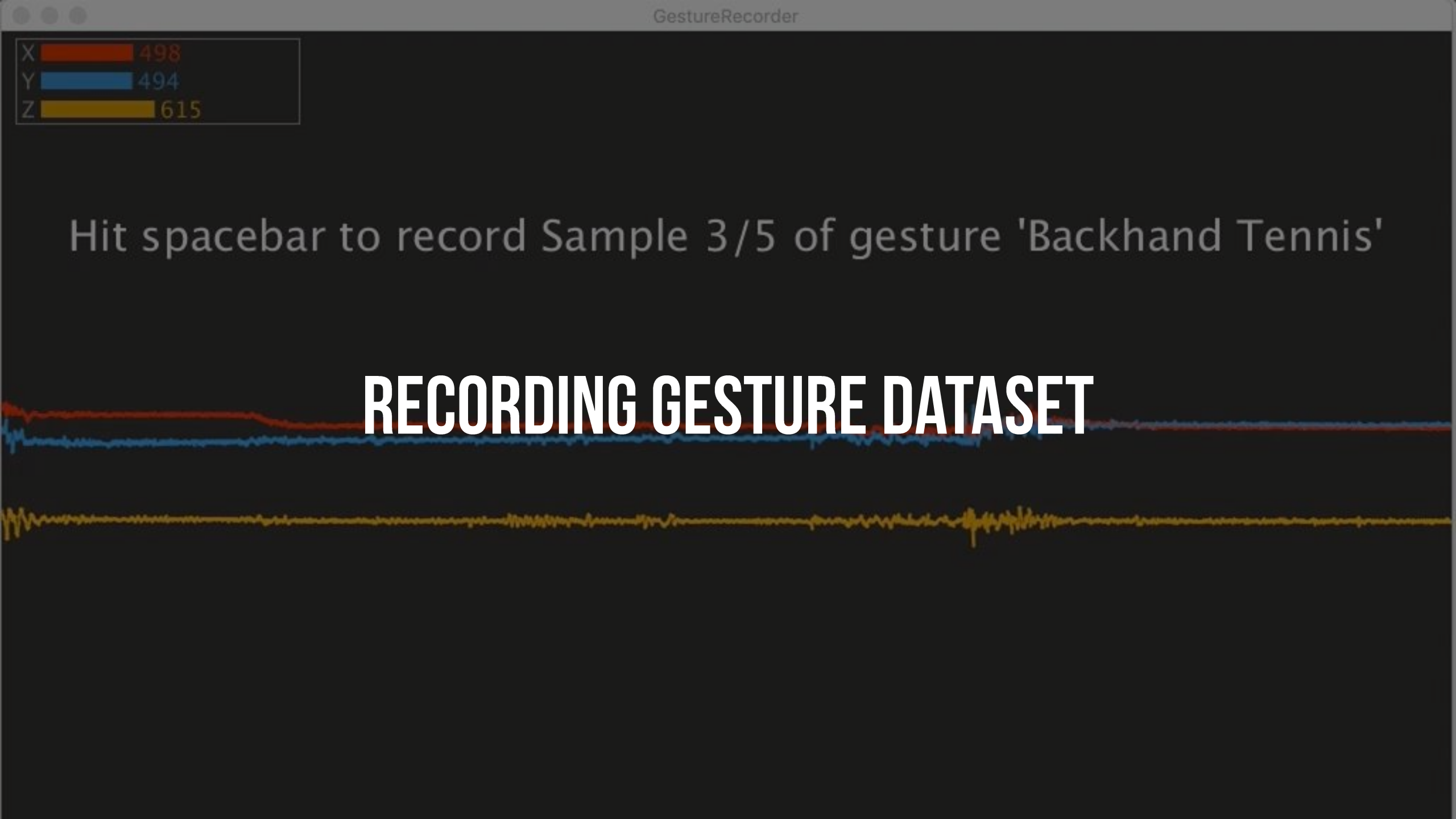
For your deliverables, you will turn in your Jupyter Notebook, your recorded gestures, and a slide deck report on your algorithmic approaches and performance results.

Things You Need

- Download and install Jupyter Notebook using Anaconda for offline data analysis, signal processing, and machine learning. We've created an initial skeleton to parse the data, which is available here (TODO: add link).
- The ADXL335 3-axis accelerometer with soldered header pins hooked up to an Arduino running ADXL335GestureRecorder.ino (if you want help soldering this, pleas ask!). The wiring diagram for hooking up the

Related Items

SpeedGrader™


GestureRecorder
X 498
Y 494
Z 615
Hit spacebar to record Sample 3/5 of gesture 'Backhand Tennis'
RECORDING GESTURE DATASET