Exercise Routine Optimization Via Sensor Fusion

SenSIP Algorithms and Devices REU

Farib Khondoker, REU Student

Graduate Mentor: Uday Shantamallu, Payam Mehr Faculty Advisor: Drs. Trevor Thornton and Andreas Spanias

SenSIP Center, School of ECEE, Arizona State University

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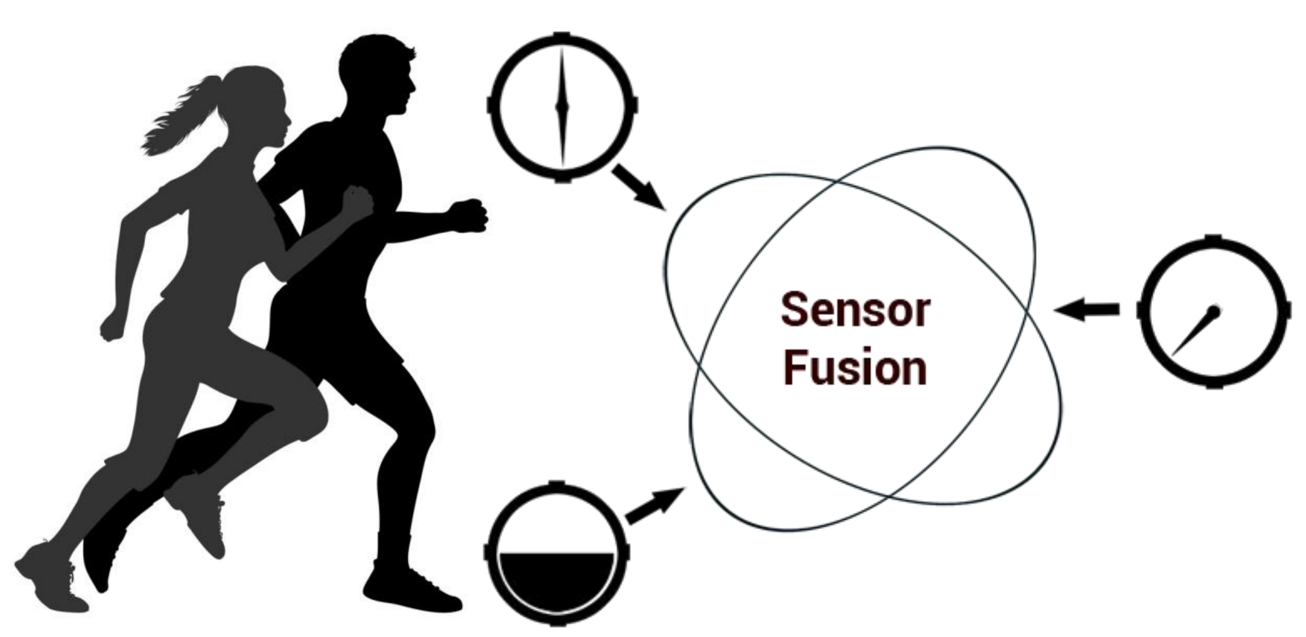
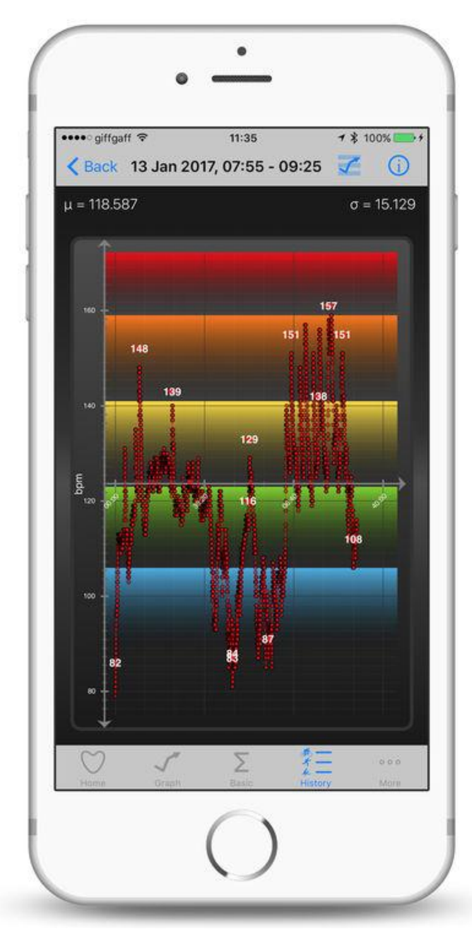
ABSTRACT

- ❑ Extreme workout routines may cause irreparable damage to body.
- ❑ Modern machine learning algorithms can minimize workout severity and maximize workout gains.
- ❑ We will develop methods to utilize integrated sensor data and machine learning techniques to create an ideal workout routine.

MOTIVATION

- ❑ Demonstrate the effectiveness of data-driven predictive analytics
- ❑ Utilize easily-accessible sensor board for consumer applications
- ❑ Develop a model for classifying/optimizing workout routines





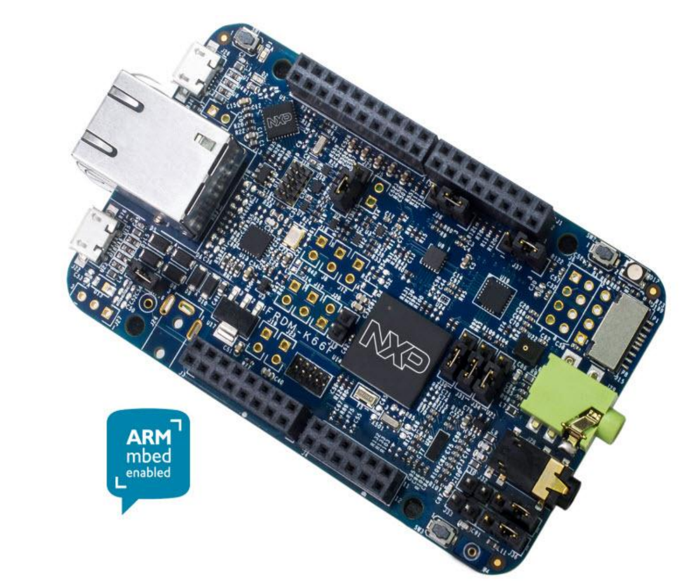
PROBLEM STATEMENT

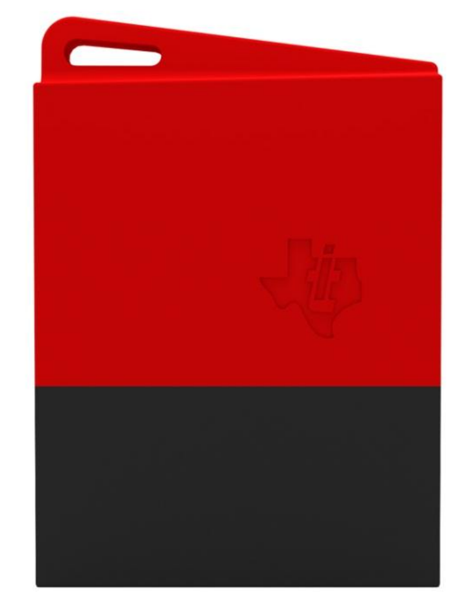
- ❑ Extreme workout routines cause excessive stress on muscles, tendons, etc.
- ❑ Method required to record previous workout data, and optimize based on workout, needs, etc.

METHOD

1. Acquire Data via Sensor Platform

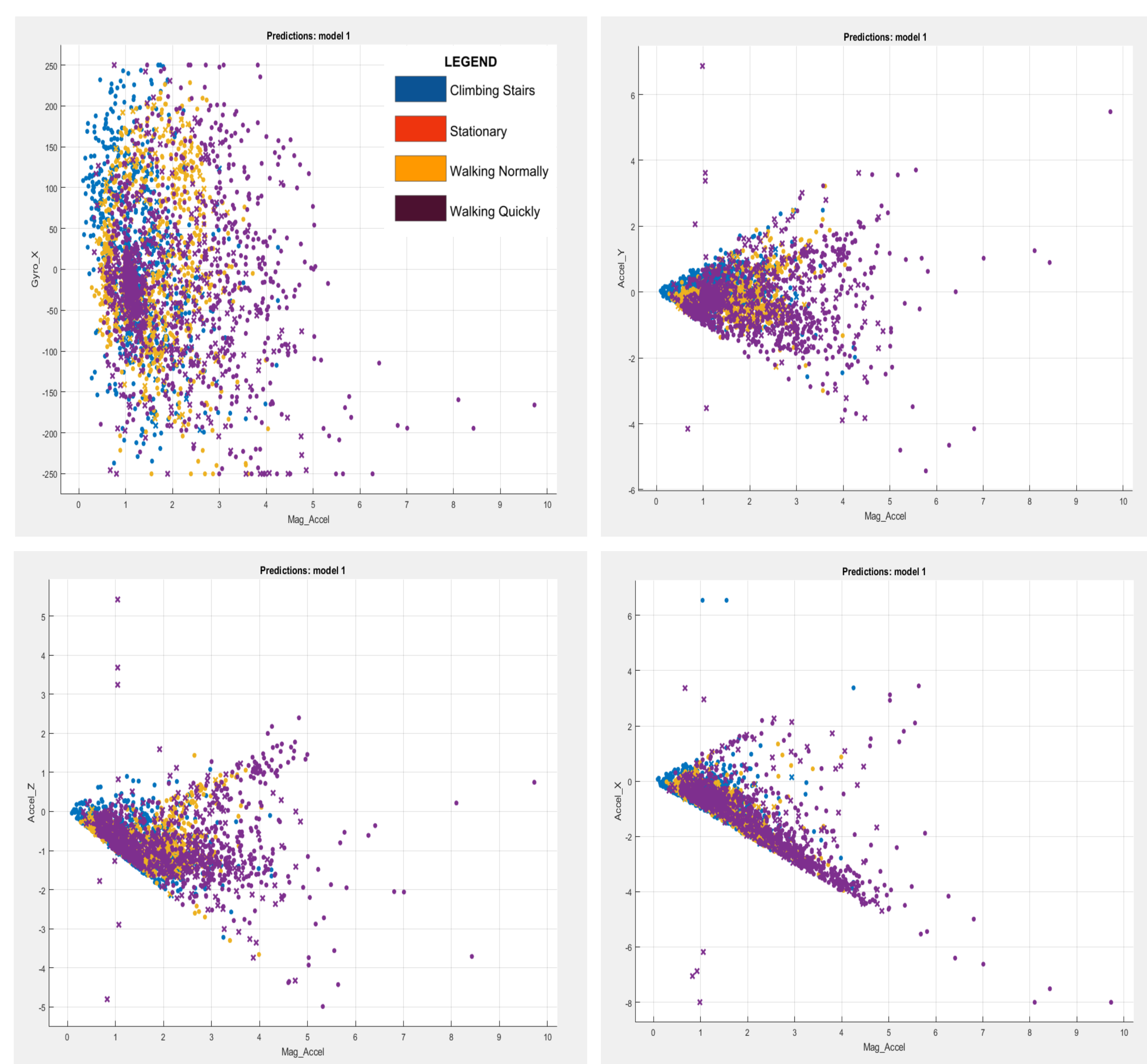
- ❑ Sensors and Dev. Board: NXP Freedom K66F, TI CC3200STK SensorTag





2. Define/Extract Features from Data

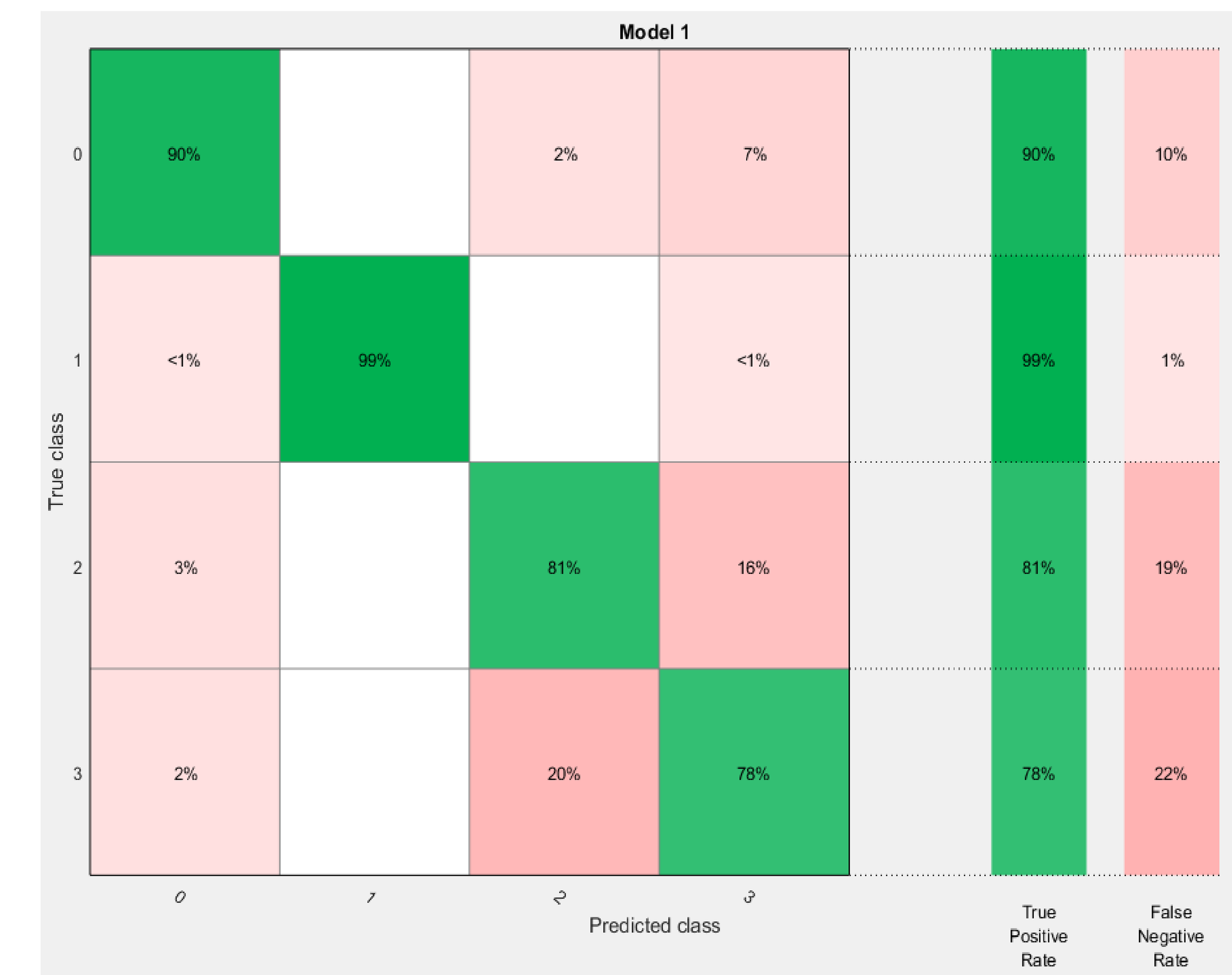
- ❑ Time domain: Translational/Rotational Motion in XYZ Directions
- ❑ PCA – Reduce dimensionality of dataset
- ❑ (0=stairs, 1=stationary, 2=walking, 3=fast-walking)

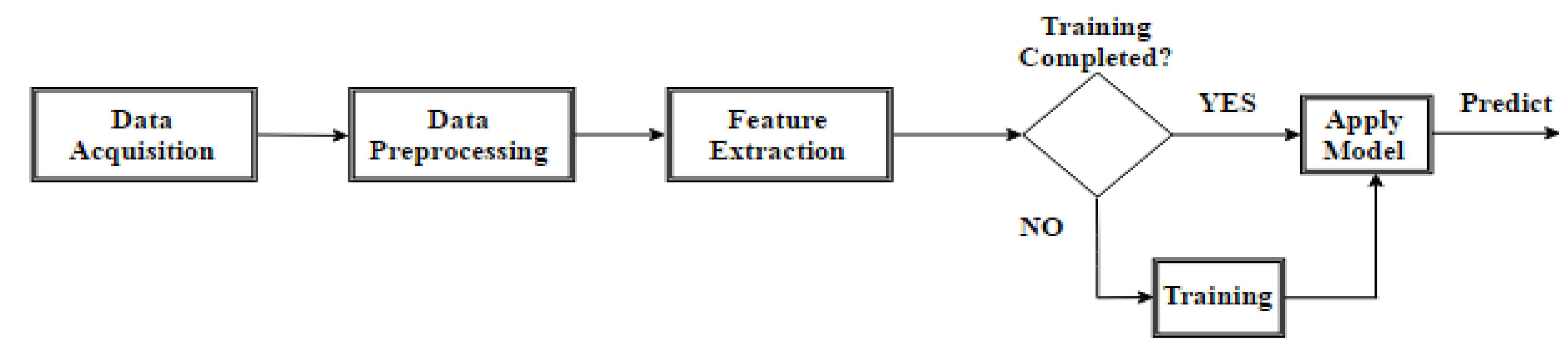


TRAINING SET RESULTS

3. Classify Data via Fine Gaussian SVM (Supervised Algorithm)

- ❑ Supervised Learning → labeled features
- ❑ ~87% accuracy for four-state model
- ❑ (0=stairs, 1=stationary, 2=walking, 3=fast-walking)





FUTURE DEVELOPMENTS

Can be extended to other applications such as:

- ❑ Rehabilitation
- ❑ Disease-specific Health Management
- ❑ Environmental and Safety Conditions

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Ira A. Fulton Schools of Engineering
ARIZONA STATE UNIVERSITY

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