Gesture Based Smartwatch Control

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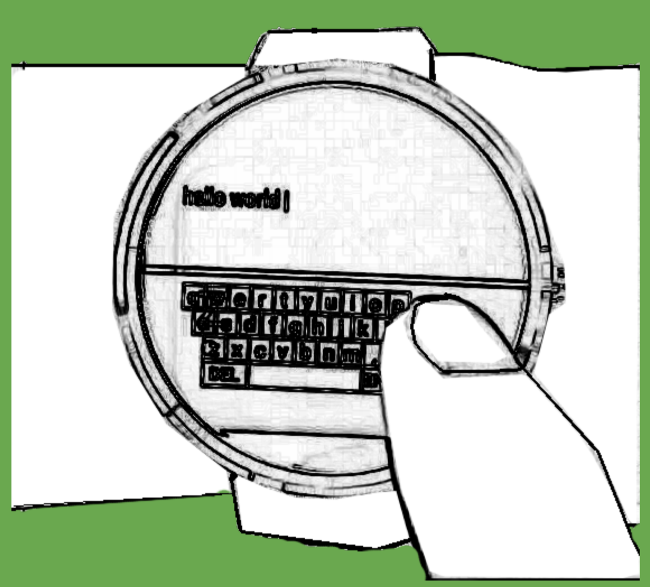
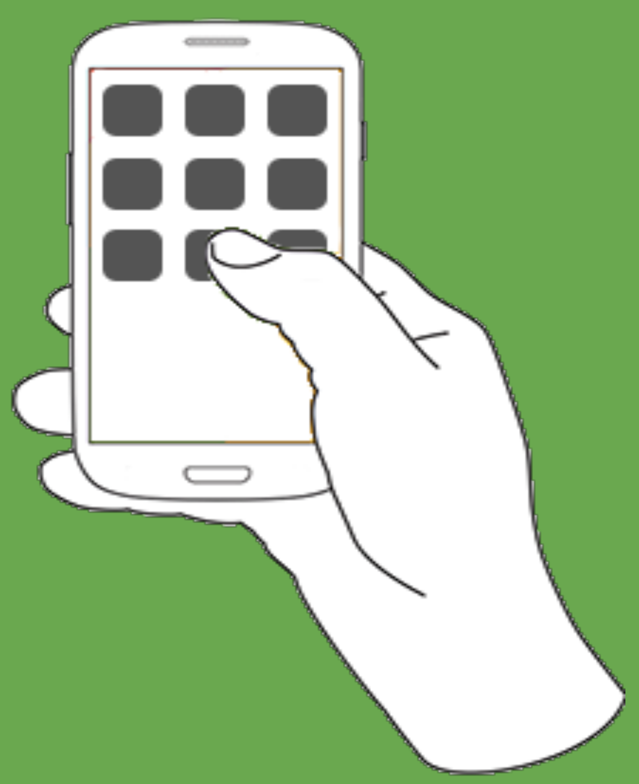
Problem



Fat Finger Problem

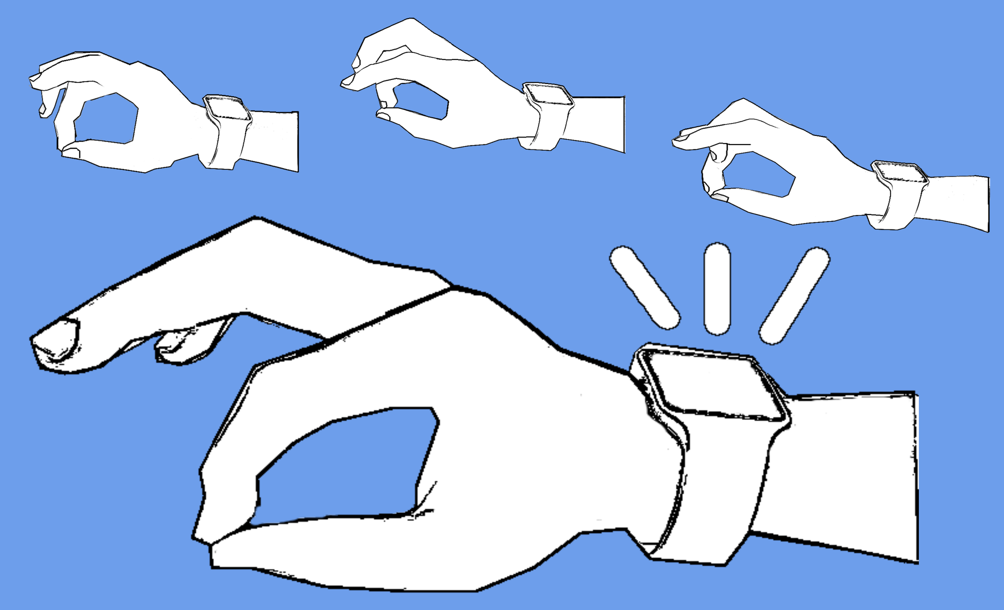
The touchscreen is the primary method in which we interact with our smartphones and smartwatch devices. Due to the limited screen real estate on smartwatch devices large fingers can accidentally trigger input UI elements other than those that were intended to be pressed.



No Single Handed Interaction

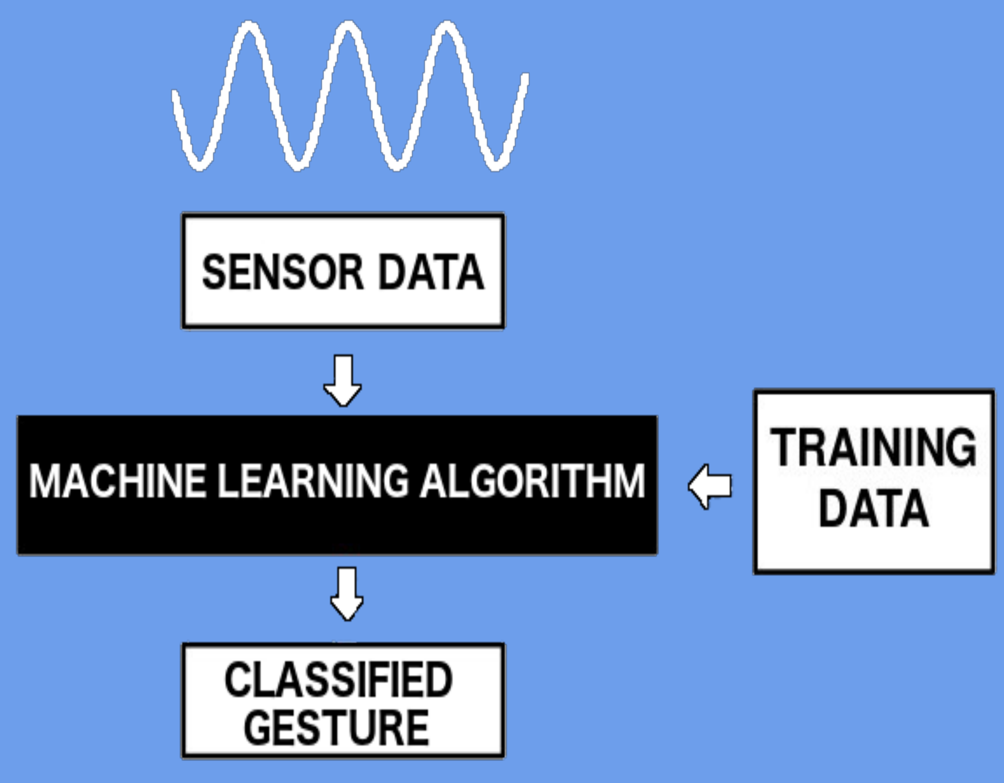
Current smartwatch devices require both hands for interaction, one to touch the screen and one to support the watch in the proper orientation. When using a smartphone it is common for people to interact with the device using only one hand, freeing the other hand for other purposes such as holding a coffee.

Approach



One Handed Pinch Gestures

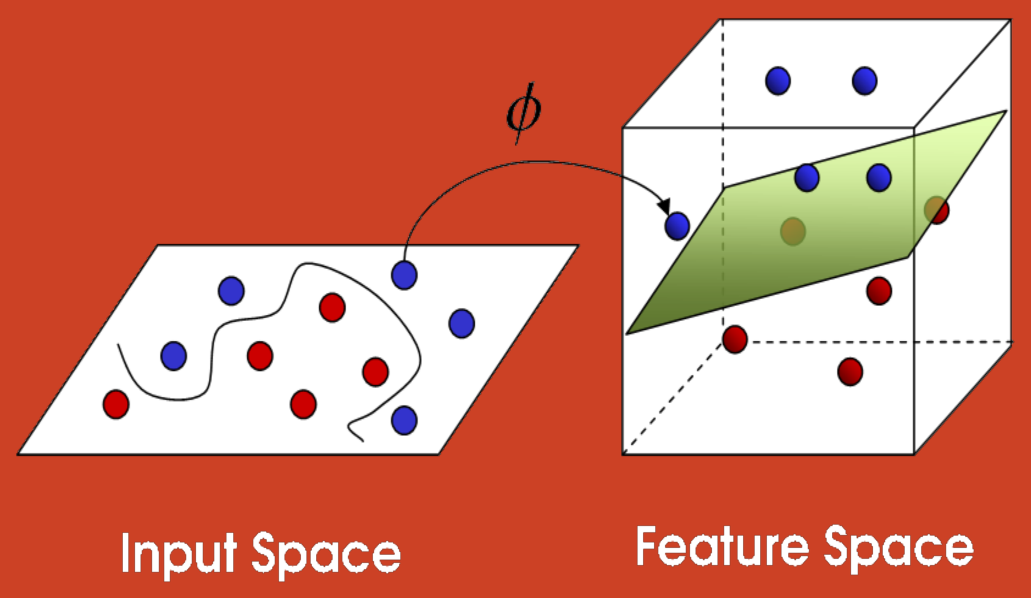
Our method of smartwatch interaction involves pinching gestures between the thumb and fingers on the hand wearing the watch, giving a total of four possible gestures. This augments traditional touchscreen input and allows convenient, ergonomic control of the watch without recruitment of the other hand and without occlusion of the screen.



Machine learning

Our goal was to implement this system without requiring additional hardware on the watch. To make this a reality we make use of the onboard sensors (accelerometer, gyrometer, microphone) present on almost all consumer smartwatch devices. Machine learning software is first trained on sample training data to recognize the gestures and is then able to classify unseen sensor data thereafter.

How does It work?



When a user pinches one of their fingers with their thumb several unseen tiny physical changes occur. The impact from the pinching action creates micro vibrations that propagate through the skin and other tissues at high frequencies. These waves will travel through different types of tissues (bone, skin, muscle) each of which affects the propagation of the wave differently, resulting in a unique pattern for every gesture. The wrist also slightly rotates and wobbles in 3D space, the direction and magnitude of such motion is dependent on the pinching gesture being performed. These minute physical changes are detectable from sensors present on the smartwatch. For example the wobbling movement can be detected by a 3-axis accelerometer and the rotational movement by a 3-axis gyrometer. The vibrations that propagate through the skin can be sensed by a regular acoustic microphone. Our system samples these three sensors and computes features from the collected data. These features are fed to a Support Vector Machine that is capable of being trained to recognize the sensory input that corresponds to a particular gesture. After training, the SVM is able to classify unseen sensory input and determine what gestures are being performed.