There has been a substantial growth of interest in Human Computer Interaction. Smart phones characterize our everyday lives, and in light of their importance, this project implements a real-time hand gesture recognition system on Android smart phones, to enable touch-free interaction with the phone using gestures. These gestures were implemented using the Camera and the Proximity Sensor on Android platform.

### Implementation using Camera

Robust real-time identification and classification of gestures is challenging for several reasons including varying illumination and dynamic noise in background which make it computationally extensive. We used the methods below to achieve a high accuracy rate despite the challenges posed by the environment:

- **Detect** the hand using a binary classifier called Haar detector developed by Viola-Jones trained with ~6000 images to distinguish between hand and background.
- **Track** the hand trajectory using the CAMSHIFT or Continuously Adaptive Mean Shift algorithm. It uses colour information and calculates backprojection of each pixel of the image to identify which region has the highest probability of being a hand in every frame.
- **Classify** gestures based on the motion trajectory of the hand.

### Implementation using Proximity Sensor

We implemented a SensorEventListener to monitor the Proximity Sensor’s readings and PhoneStateListener to check phone state. We implemented the gestures below:

- **Silence call** by waving over the phone if phone is ringing.
- **Lock phone screen** by holding hand over the phone if phone is in idle state.

### Results

Using the phone camera we can successfully detect a fist and recognize the following gestures:

- Wave from Left to Right
- Wave from Right to Left

The performance of the system is robust in varying light and noisy background as shown in pictures below:

The time taken to detect the gestures is negligible. Hence gestures implemented using camera and proximity sensor in this project are real-time.