Sonic Pong

A simple game using acoustic tracking

Author
Anand Doshi
MSI ’18, School of Information, University of Michigan

Abstract
This report describes a simple game that uses discrete and continuous acoustic signal tracking to count the number of times that the ping pong ball hits the paddle.

Keywords
Tap Tennis, Acoustic, Discrete Sound Signal, Continuous Sound Signal

Introduction

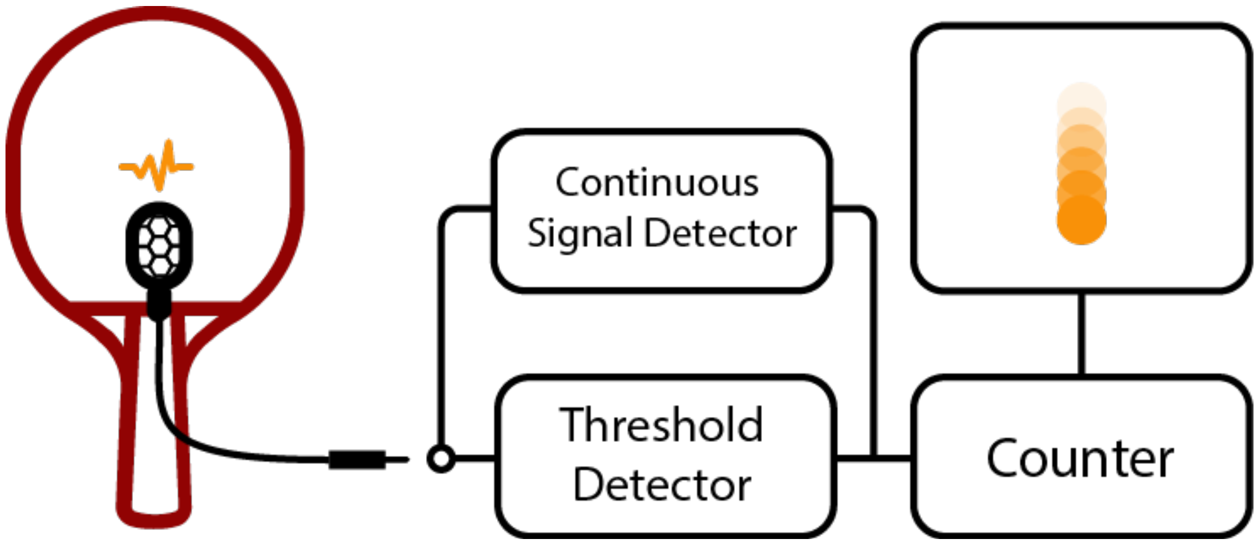
Sound Pong is a simple game in which a player uses a ping pong paddle to bounce the ball in the air and aims to get the highest score for the number of times the ball bounced on the paddle. It uses a mic, attached to the base of the paddle, to capture the audio signal. A Max patch is then used to detect the peaks in the audio and increment a counter. Once the player loses control of the ball, the counter can be reset by blowing air into the mic.

Interaction

The game requires the player to hold the ping pong paddle horizontally in one hand and start the game by dropping the ball on top of it using the other hand. To prevent the ball from hitting the mic, the mic is mounted on the bottom face instead. Wood being a good conductor of sound, the sound made when the ball hits the paddle is accurately detected by the mic. It is also convenient to twist the paddle and blow air into the mic in order to reset the counter. The count on the screen as well as the animated bouncing ball keep the audience excited and builds on the competitive spirit. The difficulty of the game can be increased by limiting the paddle and ball to the player’s peripheral vision or alternatively bouncing balls between two paddles.

Design

The Max patch can be divided into 4 components: an amplitude threshold detector, a counter, a continuous audio signal detector to reset the counter and an animation renderer. Different gain levels are used for detecting discrete and continuous signal to accurately detect the desired sound signal and ignore the ambient ones.



Schematic diagram of Sonic Pong

To detect only the loudest sounds in the vicinity of the paddle's surface, like the one created when the ball hits the paddle, we use the threshold detector to allow signals over -2dB to pass through to the counter. The counter considers this signal as discrete, after a delay of 20ms, if no sound is detected in this time period by the continuous audio signal detector. For each peak, the counter is incremented by 1.

The continuous signal detector uses a metronome and a counter to detect amplitudes above -10dB over a window of 70ms. If the signal lasts for that window, it is considered as a continuous signal. This is used by the counter to reset itself and it then waits for new discrete signals.

The animation renderer displays a fixed size circle using Max Jitter objects and imitates the rise and fall of the ball on the paddle. The discrete signal that is used to trigger the counter is also used to trigger the animation. For simplicity, it uses fixed top and bottom positions and relies on difference in the rise and fall time to create the illusion of acceleration and deceleration. The time was heuristically determined to approximate the motion of the ball in reality.

Further Work

This design could be improved further by using frequency detection and filtering to prevent undesired sounds from triggering the counter and reset mechanism. Calibrated wireless microphones mounted within the handle of the paddles can be used to monitor strokes in a ping pong match and the acoustic signal can be analyzed to potentially detect and categorize the type of stroke, its power and its spin, based on the amplitude and pitch of the sound. This method of sensing, combined with video and inertial trackers could provide data for players to learn and improve their playing style, and help paddle manufacturers to improve their designs.