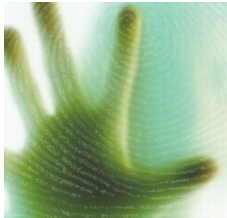


TABLEMAT

TUIO

Touchlib | reacTIVision | CCV



TableMAT Software


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TUIO


- An open framework that defines a common protocol and API for tangible multitouch surfaces.
- The TUIO protocol allows the transmission of an abstract description of interactive surfaces, including **touch events** and **tangible object states**.
- This protocol encodes control data from a tracker application (e.g. based on computer vision) and sends it to any client application that is capable of decoding the protocol.

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- Technically TUIO is based on Open Sound Control - an emerging standard for interactive environments not only limited to musical instrument control - and can be therefore easily implemented on any platform that supports OSC.

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Software Implementing TUIO

- TUIO Application Frameworks:
Java(MT4j), Python(PyMT), Pure Data(fib_abs), Cocoa (Coconut), QT(qtuio), Max/MSP(MMF), etc.
- TUIO Client Reference Implementations:
C++, Java, C#, Processing, Pure data, Max/MSP, etc.
- TUIO Tracker Implementations:
reacTIVision, Community Core Vision, Touchlib, etc.


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Touchlib

- A library for creating multi-touch interaction surfaces. It handles tracking blobs of infrared light, and sends your programs these multi-touch events, such as “finger down”, “finger moved”, and “finger released”.
- Does not provide you with any graphical or front end abilities - it simply passes you touch events.
- Can broadcast events in the TUIO. This makes Touchlib compatible with several other applications that support this protocol, such as Flash, VVVV, Processing, PureData, etc.


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Why not Touchlib

- Works **only** under Windows.
- For Mac OS X:
 - Install Apple Developer Tools.
 - Install Darwinports and required packages using Darwinports.
 - Install OpenCV
 - Install OSCPack
 - Install SVN
 - Install Touchlib


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reactIVision

- An open source, cross-platform computer vision framework for the fast and robust tracking of fiducial markers attached onto physical objects, as well as for multi-touch finger tracking.
- Mainly designed as a toolkit for the rapid development of table-based tangible user interfaces (TUI) and multi-touch interactive surfaces.
- Also able to send MIDI messages for the direct use with MIDI sequencers.

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- Available for the following operating systems: Windows, MacOS X and Linux.
- Windows: any camera with a proper WDM driver, such as USB, USB2, FireWire and DV cameras.
- MacOS X: all FireWire cameras and any camera supported by QuickTime will work in reactIVision.
- Linux: FireWire cameras are best supported, as well as most Video4Linux2 USB cameras.

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How it works

- 1. Converted to a black&white image with an adaptive algorithm.
- 2. Searched for unique left heavy depth sequences, which have been encoded into the fiducial symbol.
- 3. Match symbol to a dictionary to retrieve a unique ID number.
- OSC messages implementing the TUIO protocol encode the fiducials' **presence, location, orientation** and **identity** and transmit this data to the client applications.

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reactIVision TUIO clients

- C++
- C#
- Java
- Processing
- Pure data
- Max/MSP

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Why not reactIVision

- Initially designed for fiducial tracking, thresholder and segmentation modules are optimized for this task.
- Finger tracking was added at a later stage, seem difficult to set up reactIVision in order to achieve good tracking performance for both the fiducial symbols and the finger tips.
- generally the reactivation code for finger tracking has been much less robust than other trackers.

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Community Core Vision

- A open source/cross-platform solution for computer vision and machine sensing.
- Takes an video input stream and outputs tracking data (e.g. coordinates and blob size) and events (e.g. finger down, moved and released) that are used in building multi-touch applications.
- CCV can interface with various web cameras and video devices as well as connect to various TUIO/OSC/XML enabled applications and supports many multi-touch lighting techniques.

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Why CCV

- Cross-platform: works on Windows, Mac, and Linux.
- Filters (dynamic background subtraction, high-pass, amplify/scaler, threshold): it works with all optical setups (FTIR, DI, LLP, DSI). More filters can be added as modules.
- Input Switcher: test video is really useful for testing apps.

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Screen Shot

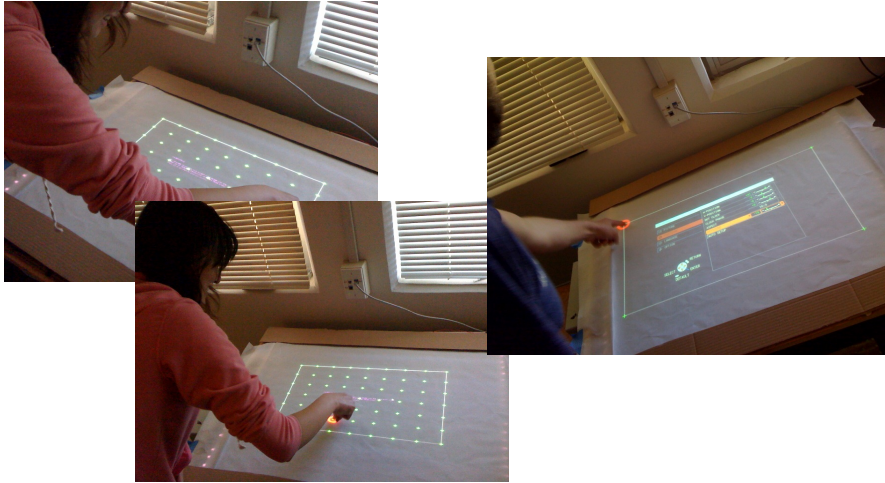
The screenshot displays the TABLEMAT software interface. At the top left is the 'TABLEMAT' logo. The main window is titled 'Community Core Vision' and contains several panels:

- Source Image:** Shows a grayscale image of a surface. Below it are controls for 'SHOW OUTLINES (O)', 'SHOW ID (I)', 'USE CAMERA', 'PREVIOUS CAMERA', 'NEXT CAMERA', and 'USE VIDEO'.
- Tracked Image:** Shows a dark image with a small white dot and the text 'id: 260'. Below it are controls for 'TRACK DRAW BLOB', 'FRAME THRESHOLD: 1', 'MOVEMENT THRESHOLD: 0', 'MIN BLOB SIZE: 15', and 'MAX BLOB SIZE: 219'.
- Background:** Controls for 'REMOVE BG (B)', 'DYNAMIC SUBTRACT', and 'LEARN SPEED: 10'.
- Smooth:** Control for 'SMOOTH: 5'.
- Highpass:** Controls for 'BLUR: 10' and 'NOISE: 4'.
- Amplify:** Control for 'AMPLIFY: 150'.
- Source Properties:** Includes 'GENERAL SETTINGS (G)', 'FLIP VERTICAL (L)', and 'FLIP HORIZONTAL (H)'.
- GPU Properties:** Control for 'GPU MODE (A)'.
- Communication:** Includes 'SEND YUO OSD (T)', 'SEND YUO TOP 1 FOR FLASH (F)', and 'SEND HEIGHT & WIDTH'.
- Calibration:** Control for 'ENTER CALIBRATION (C)'.
- Files:** Control for 'SAVE SETTINGS (S)'.
- Calc. Time [ms]:** 4
- Camera [Res]:** 320 x 320
- Camera [fps]:** 31
- Sending OSC messages to:** Host: 127.0.0.1, Port: 3333
- Footer:** 'Press spacebar to toggle text mode' and '© beta.rui@gmail.com'.

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Calculating...



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References:

- CCV Group: <http://ccv.nuigroup.com/>
- NUI Group Community: http://wiki.nuigroup.com/Main_Page
- TUIO: <http://www.tuio.org/>
- OSC: <http://opensoundcontrol.org/introduction-osc>
- reacTIVision: <http://reactivision.sourceforge.net/>
- Touchlib: <http://nuigroup.com/touchlib/>
- Install Touchlib on Mac OS: http://wiki.nuigroup.com/Installing_Touchlib_on_Mac_OS_X

Papers:

- reacTIVision and TUIO: A Tangible Tabletop Toolkit
- The Design and Evolution of Fiducials for the reacTIVision System

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