Testing the temporal accuracy of keystroke logging using the sound card

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Published in: [Publication information missing]

2012

Citation for published version (APA):

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Writing research has seen an increased use of keystroke logging. Keystroke logging programs log the writing process in a continuous and non-obtrusive way. They enable researchers to collect fine-grained data because they log every keystroke in relation to a timestamp (in milliseconds), which indicates the time that a specific key was used. For the researcher interested in, for example, word-internal processing, it’s important to know the degree of precision and accuracy that can be achieved by the program.

We propose a method of measuring the accuracy of keystroke timestamps using a recording of the sounds made by key presses. Sound cards fit the purpose well since they typically have much better temporal resolution than computer keyboards and they are readily available in most computers.

Key presses produce noise patterns that are easily temporally located in an acoustic waveform. The timestamps of the noise patterns can then be compared with the corresponding timestamps reported by the keystroke logging program. Specifically, the differences between the two timestamps of each keystroke, provides an estimate of the accuracy of the program.

We tested the accuracy of different keystroke loggers, including the latest version of the keystroke logging program ScriptLog as well as two prototypes of a new ScriptLog version implemented in C++ and Java respectively.

Due to the increased use of web-based written communication another keystroke logger was implemented in Javascript, and ran in a recent version of Firefox.

Each test case consisted of 50 key presses of the ‘space’ bar, and was run on identical hardware and operating system.

### RESULTS

<table>
<thead>
<tr>
<th>Method</th>
<th>point-by-point</th>
<th>interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>std range maxdiff</td>
<td>std range maxdiff</td>
</tr>
<tr>
<td>ScriptLog</td>
<td>0.005 0.023 0.012</td>
<td>0.007 0.028 0.015</td>
</tr>
<tr>
<td>Javascript prototype (Firefox)</td>
<td>0.003 0.012 0.006</td>
<td>0.004 0.017 0.011</td>
</tr>
<tr>
<td>Java prototype</td>
<td>0.003 0.012 0.007</td>
<td>0.004 0.014 0.008</td>
</tr>
<tr>
<td>C++ prototype</td>
<td>0.003 0.010 0.005</td>
<td>0.004 0.016 0.009</td>
</tr>
<tr>
<td>SoundCard</td>
<td>5.29E-05 0.0002 0.0001</td>
<td>8.75E-05 0.0002 0.0001</td>
</tr>
</tbody>
</table>

Point-by-point compares the individual timestamps of one keystroke. Interval compares the length of the interval between two-consecutive keystrokes.

std is the standard deviation of the distribution of all differences between a program measured and sound measured timestamp. range and maxdiff are other properties of this distribution.

This tests the accuracy of the soundcard with a sine wave at 377 Hz + some noise.

We find significant differences between the variances of the prototypes and ScriptLog (example: for Java: F=0.287, p<0.001)

This implies that a reimplemented version will provide improved timing accuracy.

This method can be implemented as part of any keystroke logging program in order for the user to test the accuracy in his/her own computer environment.

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