Sensei: A Multi-Modal Framework for Assessing Stress Resiliency

(May 1-31, 2013)

From:
Ajay Divakaran, Technical Leader
Jeffrey Lubin, Senior Research Scientist
Joe Ferraro, Program Manager

Sensei (SRI #P21103)
Contract # N00014-12-C-0288

1 Update: Technical Progress and Accomplishments for Period 17 (May 2013):

Task 3.1: Capture Behavioral Stress Markers in Real-Time in Lab Environment with graded exposure to ICT’s scenarios

MAC 1-6

During this reporting period, we began data collection using the video clips provided by ICT in the table below.

Table 1. ICT provided clips and rating results

<table>
<thead>
<tr>
<th>Var</th>
<th>Clip Name</th>
<th>Grp</th>
<th>Code</th>
<th>E1</th>
<th>E2</th>
<th>secs</th>
<th>YouTube Tag</th>
<th>Cod</th>
<th>PSR</th>
<th>Valence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NON-STRIVE A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NS A_1</td>
<td>TBFM-MS-COMPANY</td>
<td>NS</td>
<td>A</td>
<td>W4U</td>
<td>QE</td>
<td>Sadness</td>
<td>Neutral</td>
<td>34</td>
<td><a href="https://www.youtube.com/watch?v=1XX8KSSsaHEA">https://www.youtube.com/watch?v=1XX8KSSsaHEA</a></td>
<td>1</td>
</tr>
<tr>
<td>NS A_2</td>
<td>RES-CS-SSNIPEr</td>
<td>NS</td>
<td>A</td>
<td>4QR7</td>
<td>6</td>
<td>Anger</td>
<td>Happ/Amu</td>
<td>34</td>
<td><a href="https://www.youtube.com/watch?v=Lb6yJUrLgAo">https://www.youtube.com/watch?v=Lb6yJUrLgAo</a></td>
<td>2</td>
</tr>
<tr>
<td>NS A_3</td>
<td>RES-CS-LOSS</td>
<td>NS</td>
<td>A</td>
<td>DN7</td>
<td>D6</td>
<td>Sadness</td>
<td>Anger</td>
<td>38</td>
<td><a href="https://www.youtube.com/watch?v=0Qct25KYe04">https://www.youtube.com/watch?v=0Qct25KYe04</a></td>
<td>3</td>
</tr>
<tr>
<td>NS A_4</td>
<td>TBFM-CS-CLOSE</td>
<td>NS</td>
<td>A</td>
<td>PX21</td>
<td>A</td>
<td>Happ/Amu</td>
<td>Surprise</td>
<td>39</td>
<td><a href="https://www.youtube.com/watch?v=W9IMv_Yuk0s">https://www.youtube.com/watch?v=W9IMv_Yuk0s</a></td>
<td>4</td>
</tr>
<tr>
<td>NS A_5</td>
<td>RES-CS-HIGH</td>
<td>NS</td>
<td>A</td>
<td>2VW89</td>
<td>Happ/Amu</td>
<td>Sadness</td>
<td>16</td>
<td><a href="https://www.youtube.com/watch?v=3arjFYHZqDM">https://www.youtube.com/watch?v=3arjFYHZqDM</a></td>
<td>5</td>
<td>3/15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STRIVE A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA_1</td>
<td>STRIVE-CS1-KANYE</td>
<td>SA</td>
<td>T84P3</td>
<td>Happ/Amu</td>
<td>Surprise</td>
<td>38</td>
<td><a href="https://www.youtube.com/watch?v=gI6EyJvAPYWc">https://www.youtube.com/watch?v=gI6EyJvAPYWc</a></td>
<td>1</td>
<td>0/15</td>
<td>3.66 [1.510]</td>
</tr>
<tr>
<td>SA_2</td>
<td>STRIVE-CS1-BISCUIT</td>
<td>SA</td>
<td>DF22K</td>
<td>Happ/Amu</td>
<td>Disgust</td>
<td>20</td>
<td><a href="https://www.youtube.com/watch?v=OK3No6V0X4">https://www.youtube.com/watch?v=OK3No6V0X4</a></td>
<td>2</td>
<td>3/15</td>
<td>3.25 [1.507]</td>
</tr>
<tr>
<td>SA_3</td>
<td>STRIVE-CS1-DISNEY</td>
<td>SA</td>
<td>MGO98</td>
<td>Happ/Amu</td>
<td>Fear</td>
<td>17</td>
<td><a href="https://www.youtube.com/watch?v=Njpb15ET5ps">https://www.youtube.com/watch?v=Njpb15ET5ps</a></td>
<td>3</td>
<td>3/15</td>
<td>3.48 [1.311]</td>
</tr>
<tr>
<td>SA_5</td>
<td>STRIVE-Chiko</td>
<td>SA</td>
<td>M792</td>
<td>Surpris</td>
<td>Fear</td>
<td>38</td>
<td><a href="https://www.youtube.com/watch?v=y32rBYb2LxI">https://www.youtube.com/watch?v=y32rBYb2LxI</a></td>
<td>5</td>
<td>0/15</td>
<td>1.96</td>
</tr>
</tbody>
</table>
**Sensei: A Multi-Modal Framework for Assessing Stress Resiliency**

1. **REPORT DATE**  
   JUL 2013

2. **REPORT TYPE**

3. **DATES COVERED**  
   01-05-2013 to 31-05-2013

4. **TITLE AND SUBTITLE**

5. **AUTHOR(S)**

6. **PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
   SRI International (Sarnoff), 201 Washington Road, Princeton, NJ, 08540

7. **SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

8. **PERFORMING ORGANIZATION REPORT NUMBER**

9. **DISTRIBUTION/AVAILABILITY STATEMENT**  
   Approved for public release; distribution unlimited

10. **NUMBER OF PAGES**  
   4

**REPORT DOCUMENTATION PAGE**

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

<table>
<thead>
<tr>
<th>16. SECURITY CLASSIFICATION OF:</th>
<th>a. REPORT</th>
<th>unclassified</th>
<th>b. ABSTRACT</th>
<th>unclassified</th>
<th>c. THIS PAGE</th>
<th>unclassified</th>
<th>17. LIMITATION OF ABSTRACT</th>
<th>Same as Report (SAR)</th>
<th>18. NUMBER OF PAGES</th>
<th>4</th>
<th>19a. NAME OF RESPONSIBLE PERSON</th>
</tr>
</thead>
</table>

Standard Form 298 (Rev. 8-98)
Prepared by ANSI Std Z99-18
Each session began with a two minute relaxing video from the same set as we used previously, in the Stroop experiments.

Then, each of the four blocks listed in the table (i.e., Non-Strive A, Strive A, Non-Strive B, Strive B) were presented, with all the sequences shown contiguously within the block, and a thirty second relaxing video refresher between blocks.

Different subjects are being shown one of four different block orders, as indicated below and in the ICT spreadsheet.
In our experiment, the relaxing video was also shown at the end of the four blocks, but with a twist: a loud woman’s scream occurs on the soundtrack a minute into the sequence.

Figure 1 below shows some typical results, in this case of the raw GSR signal, with up in the plot indicating a higher stress level. The light blue shaded areas on the plot indicate phases within which the relaxing beach video was presented; all other are labeled according to the block: NSA, SA, NSB, SB.

One potentially interesting analysis is to try to correlate the observed stress responses, as in Figure 1, with the reported emotional valence from ICT’s subjective rating experiment. For example, one could observe the change in GSR value from beginning to end of a sequence block as an indication of the incremental stress value of that block, and see if this tracks the valence. For the subject in Figure 1, for example, the largest stress increment is in NSB, which is also observed to have the lowest average negative valence of the four blocks in the ICT results. More definitive analyses await more subjects this month.

We have also refined the temporal derivative IIR filters reported last month, as we were finding that the number of filter stages and calculations was growing inordinately large considering the range of time scales in which we are interested (i.e., up to on the order of 30 seconds per lobe). For this purpose, we are now using a cascade of single delay recursive filters, but with the delay increasing by a power of two at each subsequent scale. This power of two condition then enables us to also downsample in time by an additional factor of two at each scale, resulting in major computational and storage savings without loss of resolution, since the downsampling is matched to the passband of each filter; i.e., it is a temporal pyramid, analogous to the Burt spatial pyramid. The temporal derivatives are computed, as before, by taking the difference in consecutive stages of the IIR lowpass cascade.
Figure 2 below shows the impulse responses of the lowpass operators computed from the first five stages of the pyramid. Note the reduction in the number of samples for each subsequent stage.

![Figure 2. Impulse response of IIR cascade pyramid](image)

**Task 3.2: Administer Scenarios and Verify Hypothesis**

Not yet at this stage.

**Task 3.3: Program Management**

**2. Issues:**
- No current issues.

END OF FILE