Attention Meter Beta v0.06 Manual

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The attention meter tracks faces in an image stream and assigns them attention scores based on how long they have been in the image, how still they are, and whether they nod or shake their heads. It then outputs all data to a text file readable by programs such as Adobe Flash. This document is a manual describing installation and use of the Attention Meter.

Contents

1) Getting Started

Attention Meter has been tested to work on a Windows XP machine with 2.79 GHz processor and 2.00 GB of RAM. However, its RAM footprint is quite small and has no problem on machines with as low as 256 MB of RAM. CPU is the limiting factor.

Attention Meter requires the OpenCV library dlls: cxcore097.dll, cv097.dll, and highgui097.dll. If your copy of the attention meter did not come with these files, install OpenCV from the OpenCV website and copy them either to the directory with the attention meter executable or your *X*:\WINDOWS\SYSTEM folder, where *X* is drive Windows is installed on (usually C).

To run the attention meter, run the command script, "attention meter.cmd". If a working video stream source is detected, the attention meter will use it. Otherwise it will display the image lena.jpg, found in the folder with the executable. In either case three windows will appear:

- The "Result" window displays the image being processed. (see Output)
- The "Attention Level" window displays the total attention of all the faces in the image. (see Output)
- The "Calibration" window contains sliders which affect the way the attention meter works (see Controls)

Included file list (What does what):

- attention meter.cmd – command script, runs executable with the necessary options

- blankbar.jpg, lena.jpg – images used by the executable

- haarcascade_frontalface_alt.xml – haar cascaed used to detect faces

- Attention Meter.exe – main program

- att_flash_demo.fla, att_flash_demo.sfw – Demo Flash source code and movie

- cxcore097.dll,cv097.dll,highgui097.dll – OpenCV libraries required by attention meter

- attout.txt – Attention Meter output written here

2) Controls

The calibration window contains several sliders that change various aspects of the attention meter. See "Calibration Sliders" below for their individual descriptions.

2.a) Calibration Sliders

- **Attn. Step**

    The amount of attention gained per frame by each face.

- **Attn. Max**

   The maximum amount of attention that a face can have.

- **Max Age**

   The number a frames a face may go undetected before expiring.

- **Face Match**

   The max number of pixels a face may move between two frames to still be tracked.

- **Alt-Thresh**

   The number of alternations a face must make before nodding or shaking is recognized.

- **Alt-Expire**

   The number of still frames a face may have before alternation counts for nodding and shaking are reset to zero.

- **Change**

   The minimum difference (in pixels) between horizontal motion and vertical motion for a motion to be identified as strictly horizontal or strictly vertical.

- **H-Sens**

   The amount of motion in pixels required to classify a move as horizontal.

- **V-Sens**

   The amount of motion in pixels required to classify a move as vertical.

- **H-Spd**

   The number of consecutive horizontal moves required to classify horizontal motion.

- **V-spd**

   The number of consecutive vertical moves required to classify vertical motion.

2.b) Exit

Press any key while any of the windows are selected to exit the attention meter.

3) Output

3.a) Result Window

The result window displays the current frame as processed by the attention meter. The display depends whether faces are present:

If no faces are present, the result window displays a blank image (black) with a red pixel everywhere a sufficient degree of change is detected, that is the pixels where motion most likely occurred.

If any faces are present, the result window displays the original image from the camera, drawing a colored rectangle around each face and a corresponding colored bar above the face representing that face's attention score. The color represents the state of motion the face is in: blue is a still face, yellow is a moving one, green is a nodding one, and red is a shaking face.

Boxes are also drawn around the estimated locations of the eyes and mouth. The eyes appear in orange boxes—pixels within this box that correspond to open-eye specific features (the rim of cornea and the edge of the eyeball) are colored green. The mouth box changes color depending on the mouth state—a mouth with a toothy grin is green, open mouths are red, and anything else is pink. Note: the mouth detection features are new and still very much beta.

3.b) Text File

Detected faces are indicated in the "Result" window by rectangles with a bar above them. The bar represents the attention score for that particular face.

A text file, "attout.txt" readable by Adobe Flash is written to disk after every frame containing the output of the attention meter. The first few variables are for the entire frame, and subsequent ones that have a number for a suffix are for individual faces. An example output after a frame with 2 faces might look like:

```
frame=502&wx=0&wy=0&attentionlevel=58&face=1&nodding=0&shaking=0&movi
ng=0&mouthsOpen=0&x0=49&y0=23&width0=88&height0=88&face_attention0=8&
face_age0=9&face_nodding0=0&face_shaking0=0&face_moving0=0&last_blink
0=8&mouthOpen0=0&mouthSmile0=1&x1=200&y1=29&width1=60&height1=68&face
_attention1=50&face_age1=3&face_nodding1=0&face_shaking1=1&face_movin
g1=0&last_blink1=6&mouthOpen1=0&mouthSmile1=0
```

A description of these fields follows:

`frame` – The frame number (the first frame when attention meter starts running is frame 1).

`wx` – When no faces are present, the average x value of the red motion pixels

`wy` – When no faces are present, the average y value of the red motion pixels

`attentionlevel` – The overall attention level (sum of all faces' individual attention)

`face` – The number of faces in the image

`nodding` – 1 if anyone in the image is nodding, 0 otherwise

`shaking` – 1 if anyone in the image is shaking, 0 otherwise

`moving` – 1 if anyone in the image is shaking, 0 otherwise

`mouthsOpen` – the number of faces with open mouths

`x`N – the x coordinate of the top left pixel of the Nth face

`y`N – the y coordinate of the top left pixel of the Nth face

`width`N – the width in pixels of the Nth face.

`height`N – the width in pixels of the Nth face.

`face_attention`N – the attention score for the Nth face

`face_nodding`N – 1 if the Nth face is nodding

`face_shaking`N – 1 if the Nth face is shaking

`face_moving`N – 1 if the Nth face is moving

`last_blink`N – roughly the number of frames since the last time the eye was closed

`mouthOpen`N – 1 if the mouth is open in the Nth face

`mouthSmile`N – 1 if the mouth is smiling in the Nth face

In this example, the attention meter is tracking two faces, the first of which is moving, the second of which has a higher attention score.

Finally, the total attention score is displayed in a meter at the bottom of the screen. The score is displayed as the amount of attention out of the total possible score, so a full bar means that all faces in the image have maximum attention, where as a partial bar means some or all of them do not.

To read these variables into Flash, simply use the following function:

```
loadVariabesNum("attout.txt")
```

See the included Flash script att_flash_demo.fla for an example.

3.c) Streaming TCP/IP with NetCat

The output sent to the text file is also printed to std out. If you would like to make your attention-based sensor useable over the web, we recommend using netcat (http://www.vulnwatch.org/netcat/). A command script, "attention meter remote daemon.cmd", is provided which will start a simple attention meter, provided you have netcat installed. Simply change the port number in this file (default 5001) to the one you would like to use.