Surprise bottom-up reduction and control in images and videos

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We have developed a method to reduce the amount of bottom-up driven surprise in images and videos. The primary function of this method is to remove more strictly bottom-up information, which may be distracting to an individual engaged in a top-down driven search task. Additionally, we can use such a tool to help image analysts find items in an image by giving them an image which may be easier to focus top-down attention onto.

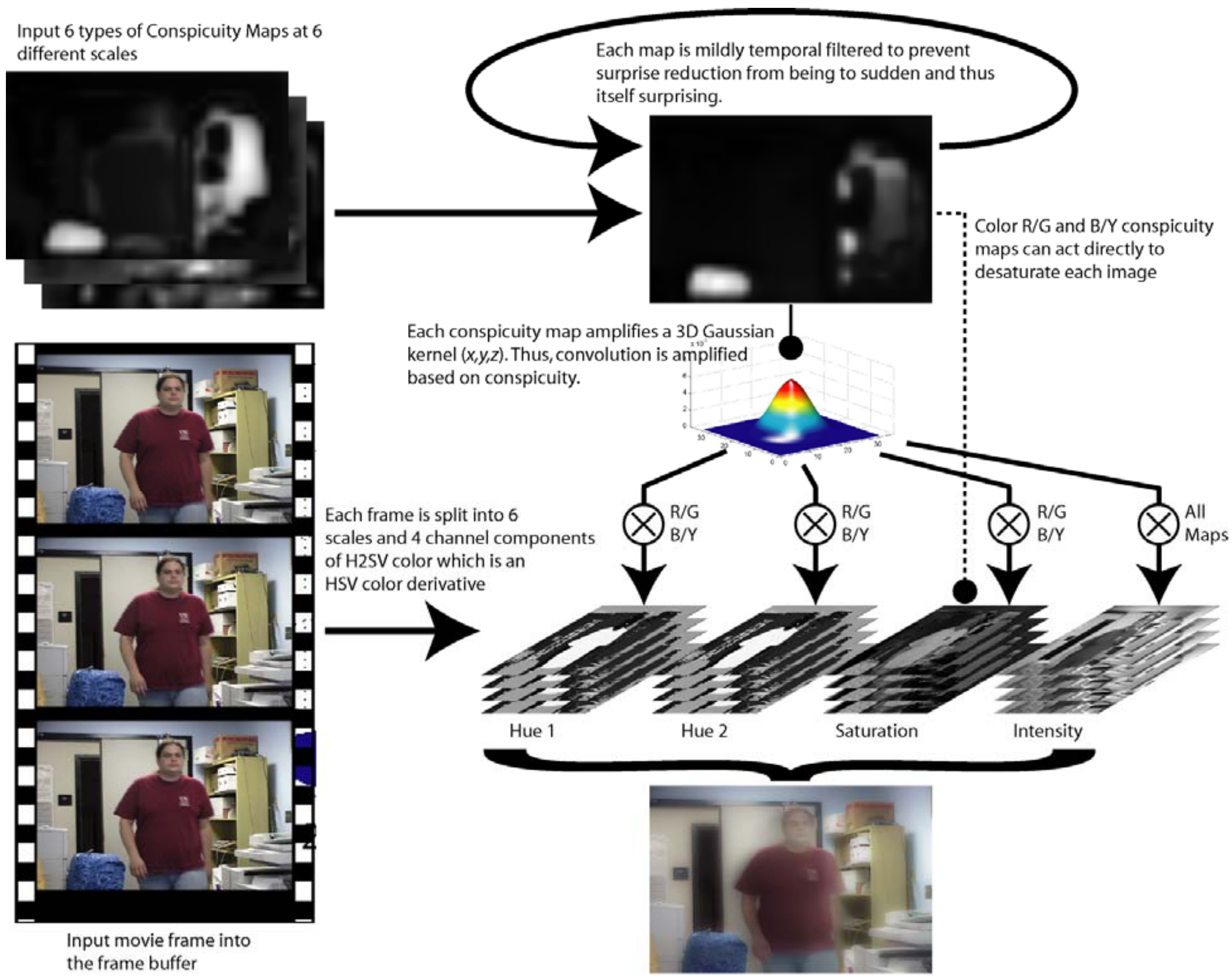

Figure 1. The surprise removal process is shown here. On the left the surprise conspicuity maps and - the original movie are taken in. The conspicuity maps then drive the scale and magnitude of low-pass gaussian filters as well as linear color desaturation.

Our method works by first computing surprise in an image using the iLab Neuromorphic Vision Toolkit's surprise computation software. Using this, we can determine in a biologically driven manner where a persons attention is most likely to focus based on the interaction of image features and the computation of the amount of surprising information one should expect. This gives us conspicuity maps that not only tell us where people are more likely to focus their attention, but what features should be most responsible for them to be attracted to. Using this information, we can focus such instruments as band pass filters directly to regions and features in an image, which give the strongest surprise readings. Thus, we leave parts of an image, which are unsurprising, generally untouched. Additionally, we focus filters to channels related to surprise output. For instance, if surprise is generated by color contrast, then surprise reduction will be focused on color channels.

Testing on video clips shows that a general reduction of about 40% surprise is achieved while maintaining reasonable semantic content of the clip. Additionally surprise reduction across feature types and scales is statistically significant. Thus, we can maintain a reasonable amount of quality in an image or video while removing large amounts of bottom-up surprise.

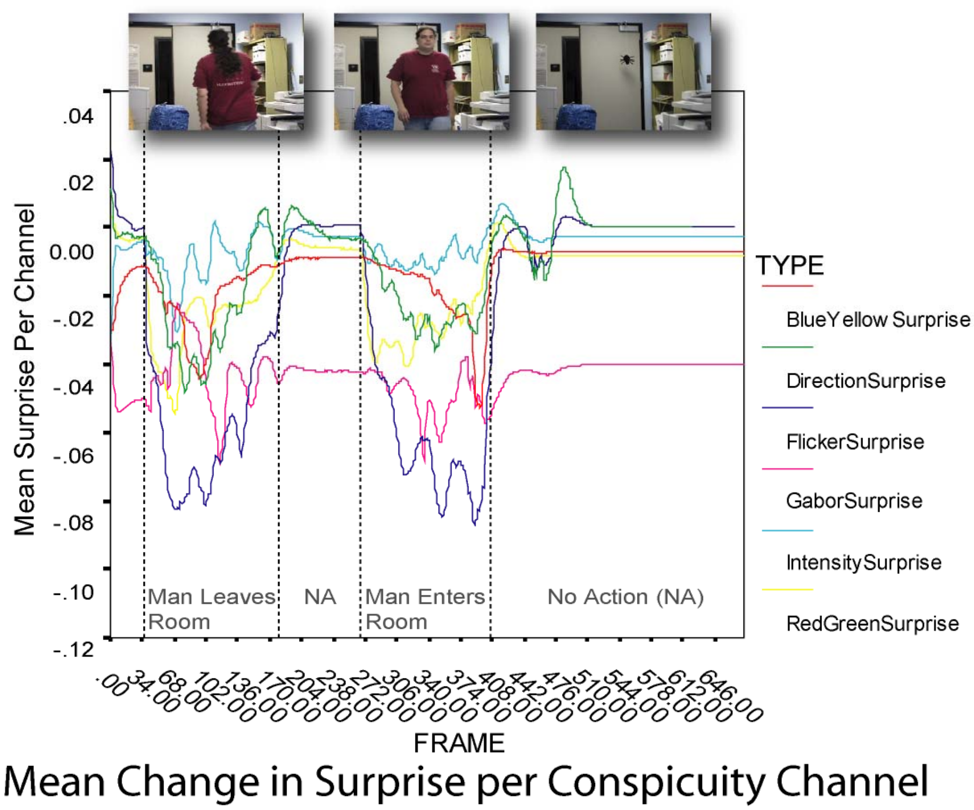

Figure 2. Surprise removal is shown on a video clip in which a man leaves and then enters a room. The lines represent the difference between surprise as measured from the original video clip and the surprise reduced video clip. As can be seen, in general surprise is reduced for all channels. However, some small artifact surprise increases can be noted at some points in the video.