USING INFORMATION ENTROPY FOR CAMERA SETTINGS

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Time laps microscopy is one of the important measurements in many biological experiments. To describing life cycle of observed culture, cell division, fusion or comunication, both automaticaly or semiautomaticaly evaulation, is crucial to guarantee optimal camera settings, in case of observing long time experiment run by digital capture device. Influence of exposition time and selected shutter can independent human observer interpret differently. We propose using computation of Shannon entropy to select region of values in possible settings space, that guarantee results production with higher information content in captured images. This method is unsupervised, nonparametrised and principaly doesn't require any addition of knowledge about investigated objects.

Information entropy is defined as measure of surprise, and pyrely depend on probability distribution of some event. In this meaning, we are more surprised for event with small probability. Shannon Entropy is defined as: $S = -\sum_{i \in I} p_i \log_2(p_i)$.

In digital images we can use intensity histograms as aproximation of probability distibution of pixel intensities in the image. Images are considered as RGB matrix with coordinates *x,y,v (x,y for position and v for red, green or blue channel)* representing pixel values. Also includes used camera settings in exif attachments. The Histogram function *P (v)* is an intensity function, shows count of pixel *f(x,y)* with the intenzity equal *v* independently on the position *(x,y)*. This function was used for computation of information entropy in the whole image.

Firstly, large set of images under different light conditions, exposition time and shutter were taken. Then was computed entropy for each image and ploted the graphs, that shown how is the information dependent on the camera settings. In case with low light, the entropy rapidly increased with longer exposition time, but never reached the maximal point, because the images were still too dark.

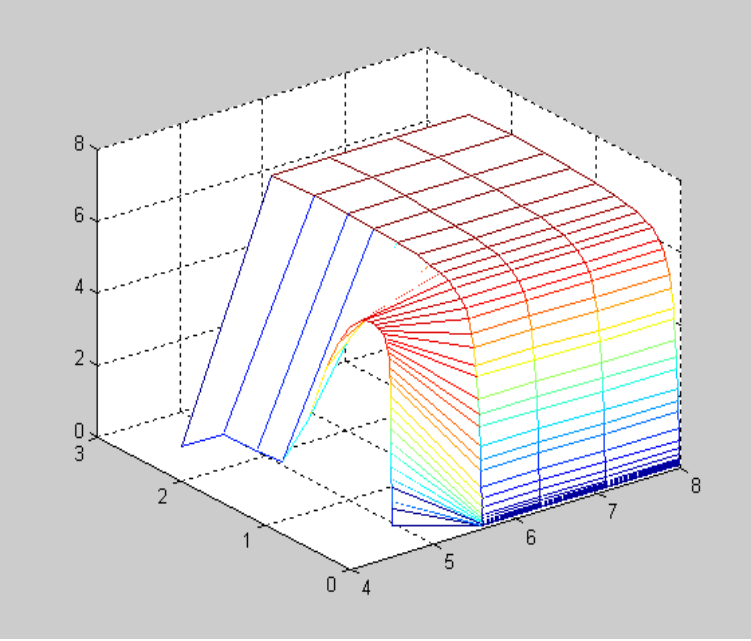

Image 1.: Low light entropy.

On the othe hand, using high light produce very short peak around entropy maximum with short exposition time, but for longer exposure we can not obtain any information, because the images are overlighted.

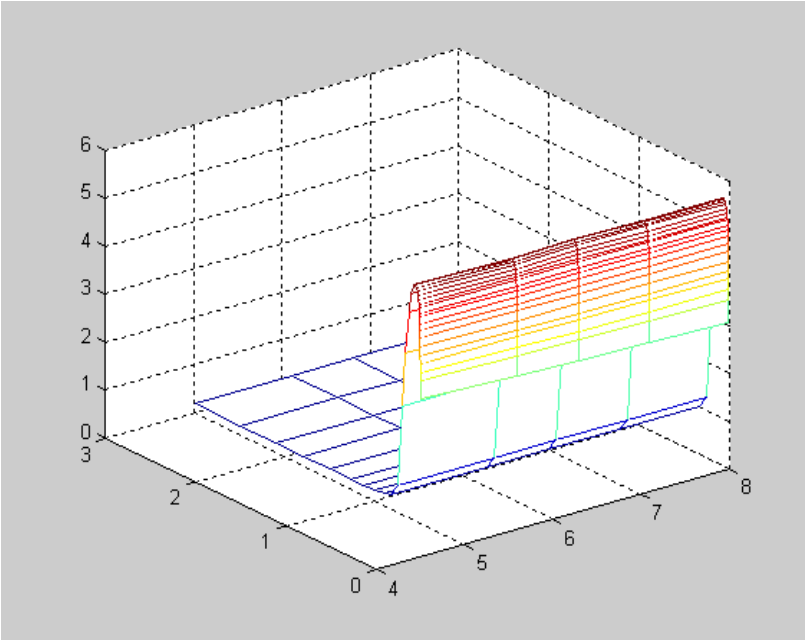

Image 2.: High light entropy.

Finally, in medium light we may observe slow increasing of information from short exposure, reaching the maximum and decreasing again for longer exposition time. The area of exposition time around maximal value is wide and define the possible values of exposition time, optimal for maximal information content in image. Surprislly, there is almost no effect with different shutter settings.

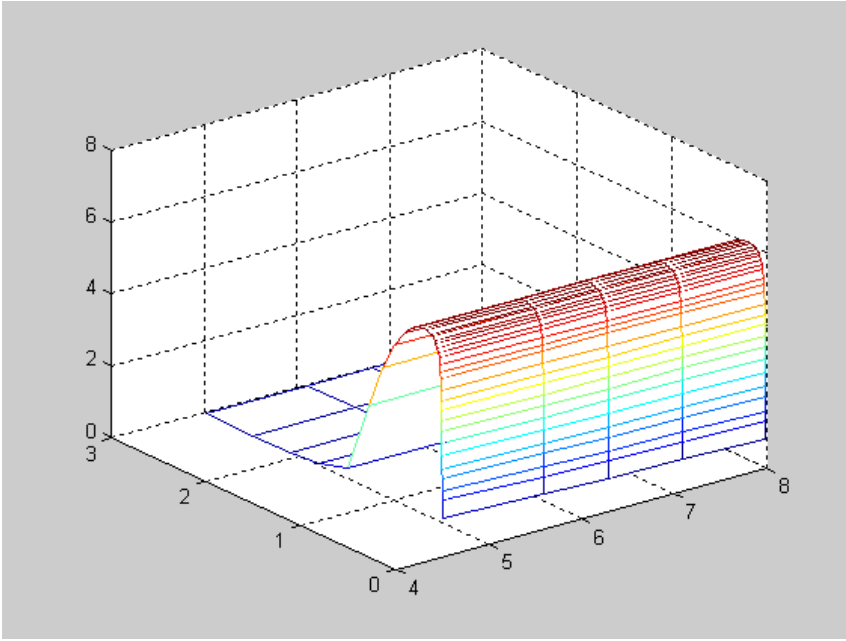

Image 3.: Medium light entropy.

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