Prediction of the Inter-Observer Visual Congruency (IOVC) and Application to Image Ranking

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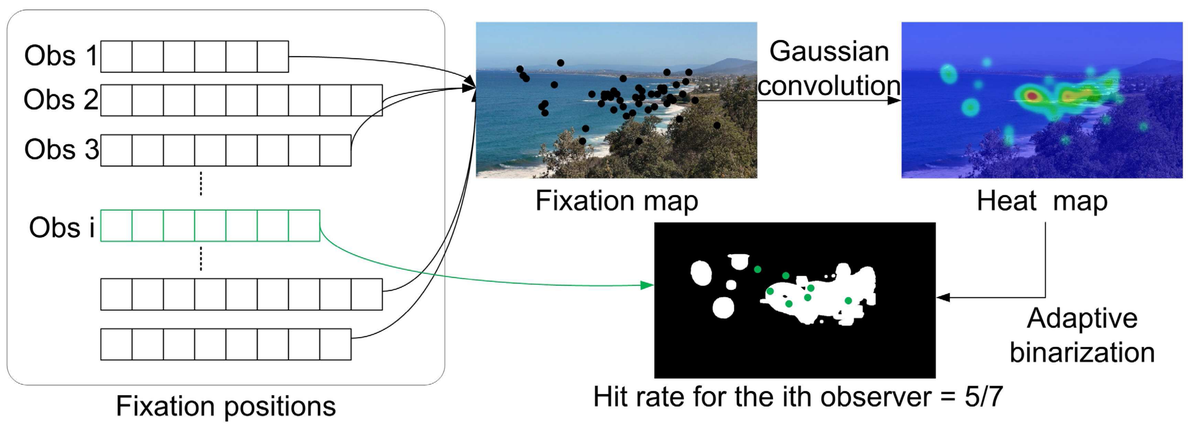
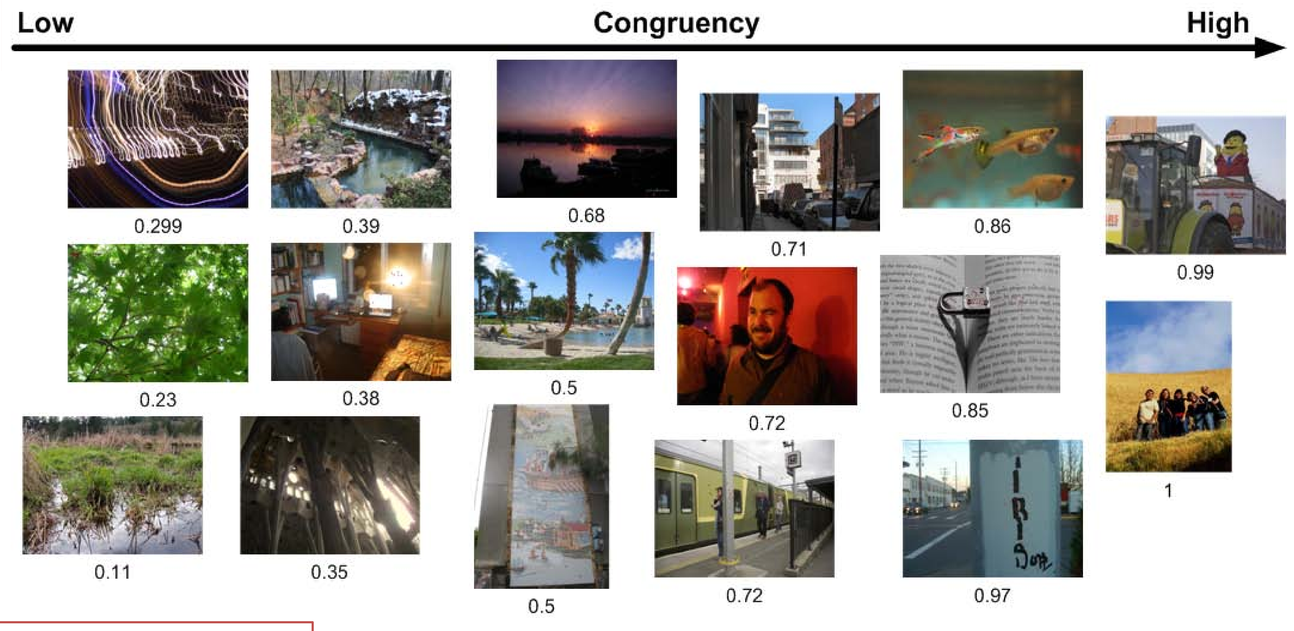
This paper proposes an automatic method for predicting the inter-observer visual congruency (IOVC). It reflects the congruence or the variability among different subjects looking at the same image.

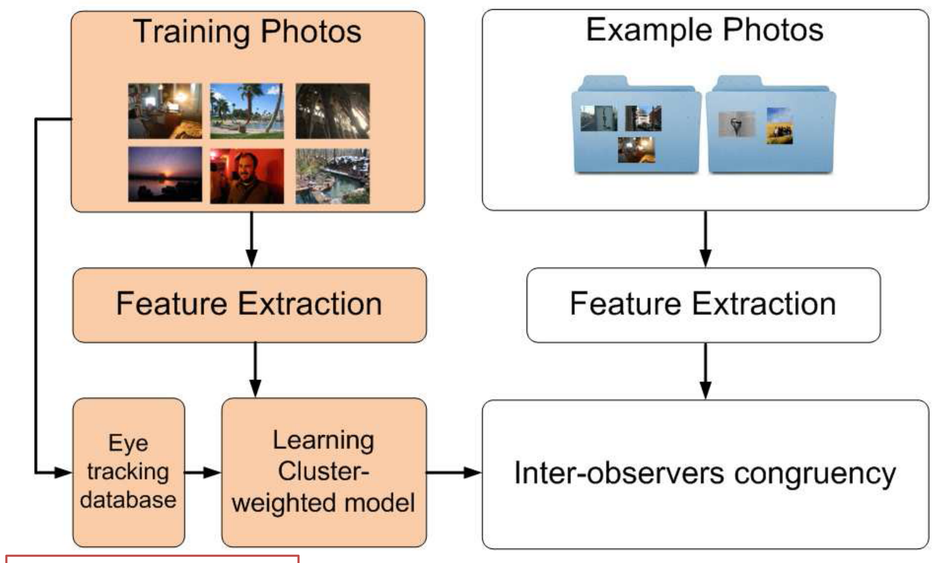
A. Measuring the inter-observer congruency

Eye tracking experiment:





B. System overview



C. Feature extraction

1. Face detection
2. Color Harmony [1]
3. Depth of Field
4. Scene complexity
   - Entropy
   - Number of regions
   - Amount of contours

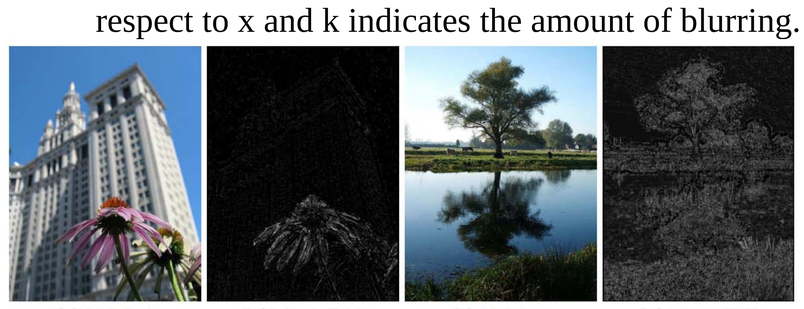
Idea: the shape of the horizontal/vertical derivatives histogram is modified after a blurring operation.

We measure the dissimilarity between the original distribution and the distribution of the blurred picture:

$$DoF = \sum_{(i,j)\in I} \sum_{k} D_k(i,j)$$

with $$D_k(i,j) = \sum_{(i,j)\in W_{ij}} KL(p_{xk} \,|\, p_{x1})(n,m) + KL(p_{yk} \,|\, p_{y1})(n,m)$$

p_{xk} and p_{yk} are the distributions of the first derivative with respect to x and k indicates the amount of blurring.



(a) Original (b) DoF=0.12 (c) Original (d) DoF=0.75

D. Results

Pearson correlation coefficient between predicted values and ground truth (MIT database [2]):

- r(2004)=0.34, p<0.001

For the Visual Clutter [4], r(2004)=-0.08, p<0.04

Pearson correlation coefficient (Le Meur database [3]):

- r(54)=0.24, p<0.17

For the Visual Clutter, r(54)=-0.15, p<0.43

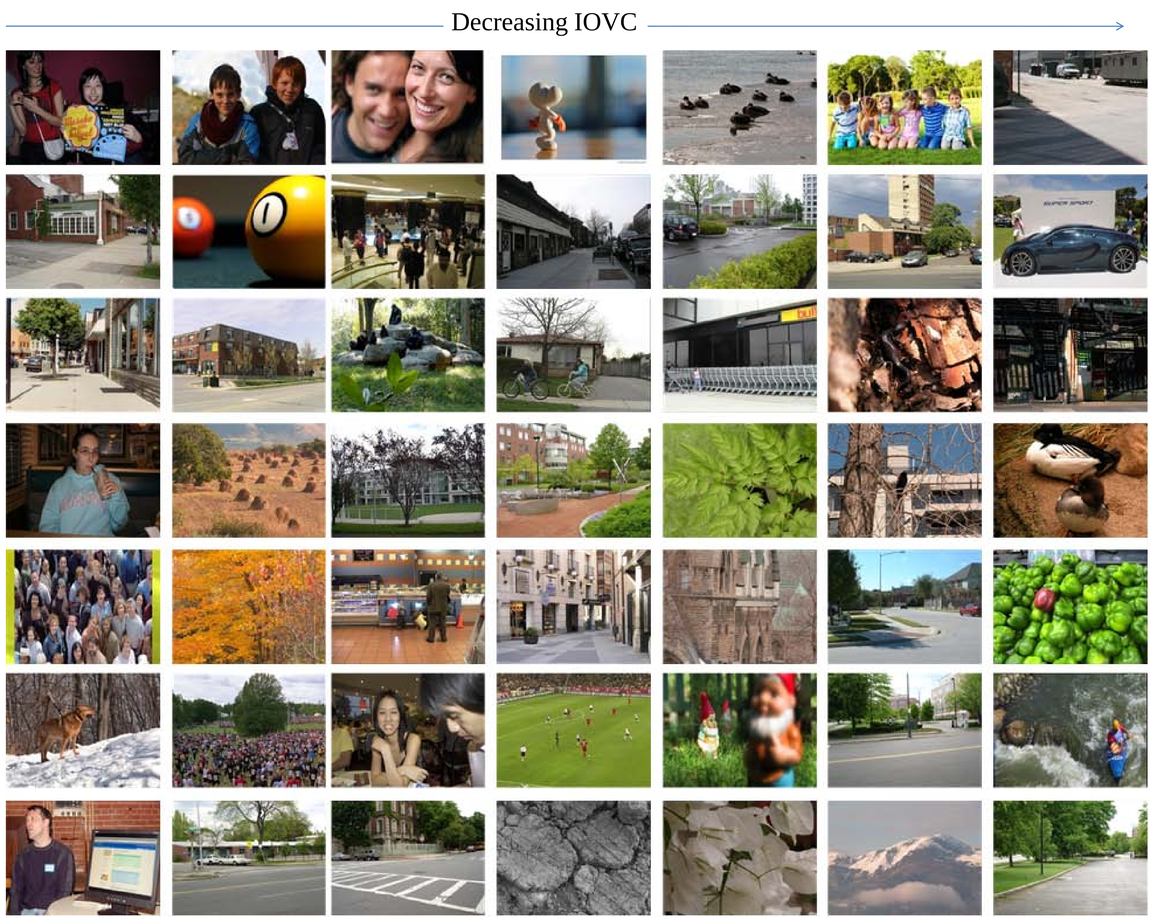
Predicted saliency maps computed by [5].

Limitations:

- no time dependency
- limited accuracy of the detector we use
- just for free viewing task….

E. Application to image ranking

Goal: use the predicted IOVC to organize a collection of picture. Below 49 pictures ranked according to the predicted IOVC.



We proposed a new criterion to automatically estimate the visual congruence between observers. We have evaluated our method qualitatively and quantitatively. The predicted IOVC can be used in image processing applications where the visual perception of a picture matters such as website design, advertisement. For instance, we considered ranking personalized photograph: pictures are sorted out in function of their predicted IOVC.

[1] D. Cohen-Or, O. Sorkine, R. Gal, T. Leyvand, and Y. Xu. Color harmonization. In ACM Transactions on Graphics (Proceedings of ACM SIGGRAPH), volume 56, pages 624–630, 2006.
[2] MIT database: http://people.csail.mit.edu/tjudd/WherePeopleLook/index.html
[3] Le Meur database: http://www.irisa.fr/temics/staff/lemeur/
[4] R. Rosenholtz, Y. Li, and L. Nakano. Measuring visual clutter. Journal of Vision, 7(2), March 2007.
[5] O. Le Meur, P. Le Callet, D. Barba and D. Thoreau, A coherent computational approach to model the bottom-up visual attention, IEEE Trans. on PAMI, Vol. 28, N°5, May 2006.

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