ROBUSTNESS AND REPEATABILITY OF SALIENCY MODELS SUBJECTED TO VISUAL DEGRADATIONS

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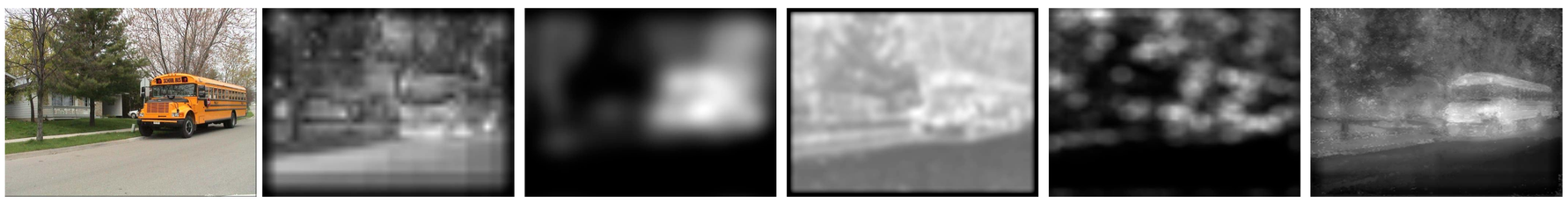
Abstract:The present study investigates the sensitivity of computational models of visual attention when subjected to visual degradations. One hundred and twenty natural color pictures were degraded using 6 filtering operations. By using different settings, five state-of-the-art models are used to compute 11400 saliency maps. The comparison of these maps to human saliency maps indicates that the tested models are robust to most of the visual degradations they were subjected to. These findings have implications on saliency-based applications, such as quality assessment and coding. A last point concerns the high repeatability of saliency models that might be used in a context of image retrieval.

Objective

To test whether model-predicted saliency is invariant to visual degradations

To evaluate whether it make sense to compute a saliency map on a degraded pictures

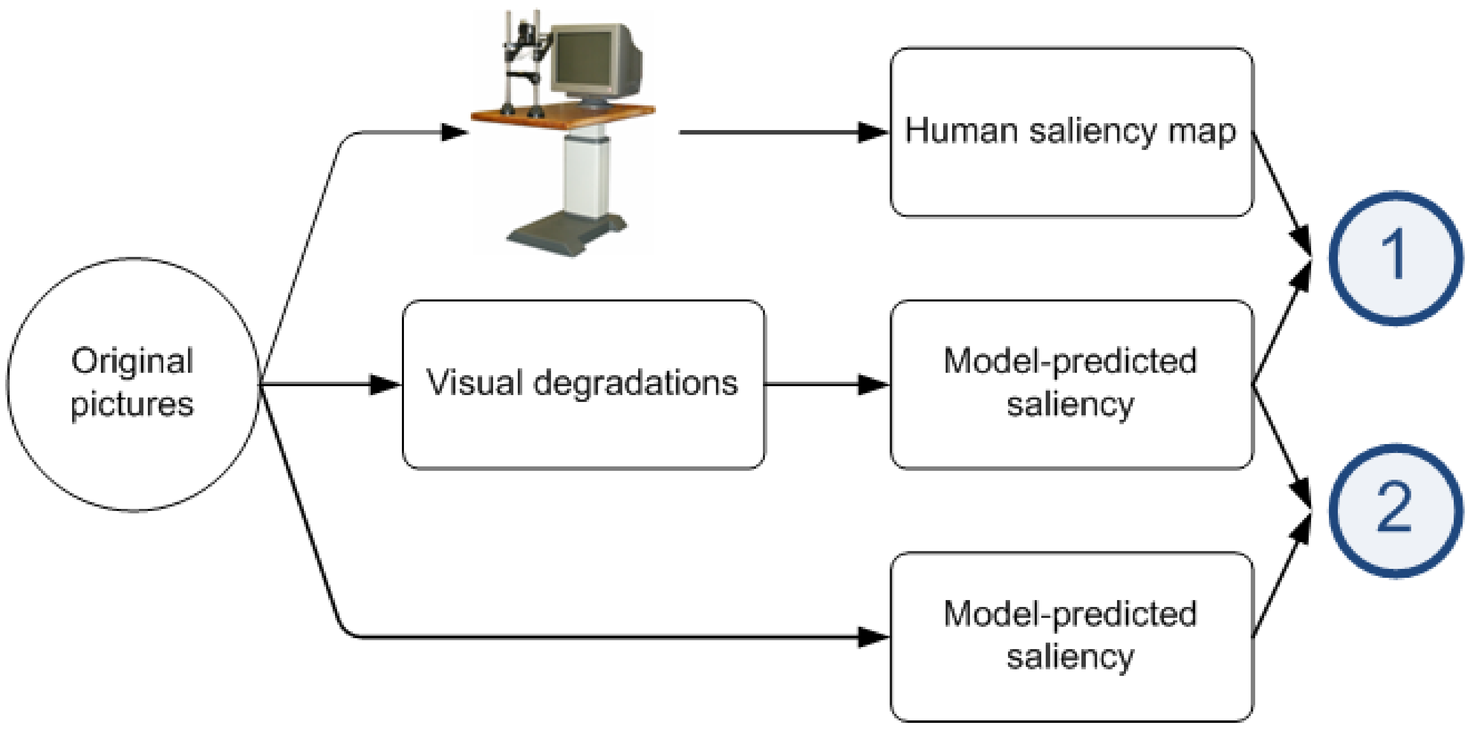
Five state-of-the-art models are tested: Itti, Le Meur, Bruce, Hou and Judd



Model	average±SEM	median
Itti	0.68±0.009	0.69
Le Meur	0.73±0.01	0.75
Bruce	0.72±0.009	0.73
Hou	0.68±0.01	0.69
Judd	0.76±0.007	0.77

Performance: AUC values (average+/-SEM and median) for the five models (Bruce's eye tracking database)

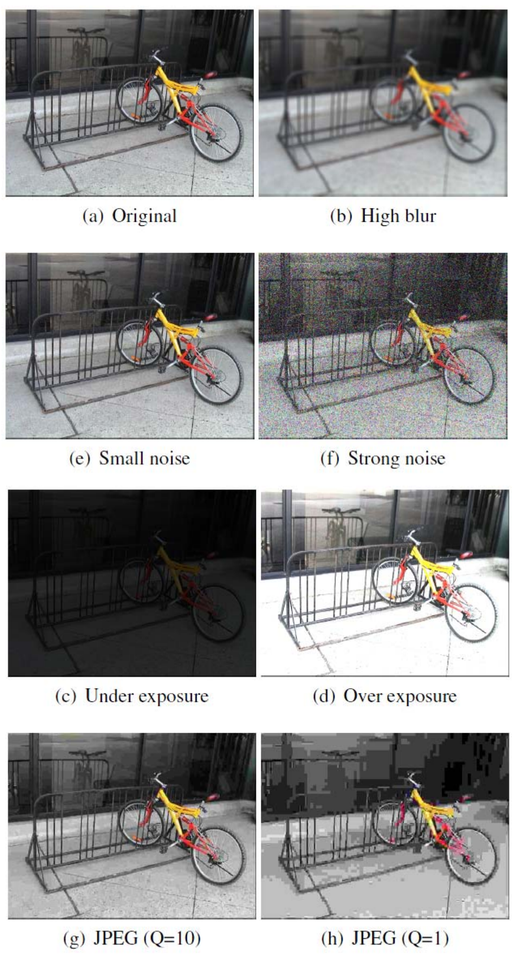
How to evaluate the robustness and repeatability of saliency models?



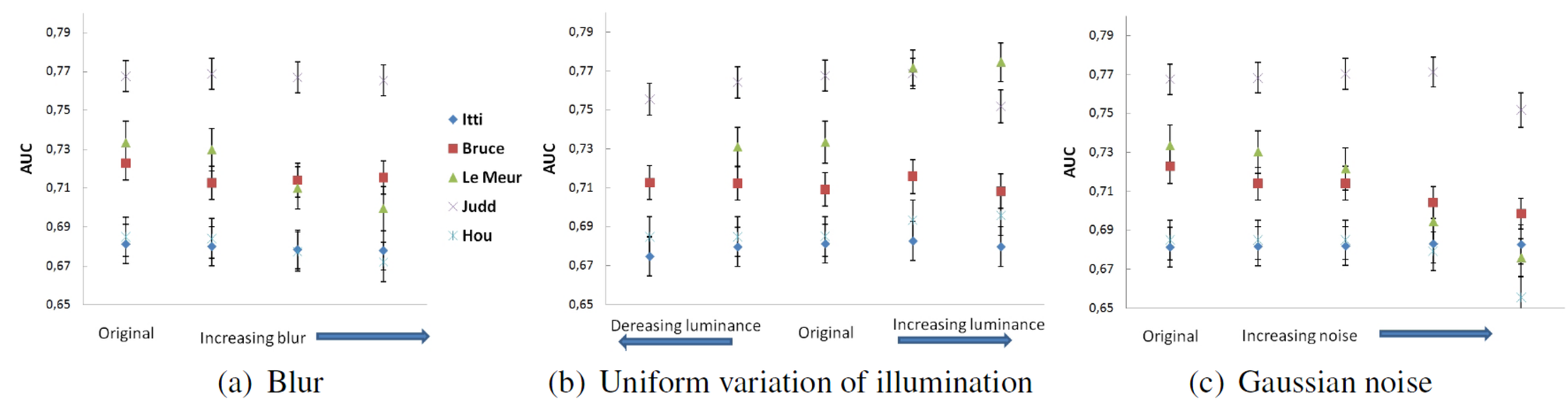
Visual degradations

- Gaussian blur (3 levels)
- Uniform variation of illumination (4 levels)
- Gaussian noise (4 levels)
- Flip (right/left and up/down directions)
- Rotation (4 angles)
- JPEG coding (3 quality factors)

- A total of 2280 pictures
- 22805 saliency maps



1 Robustness refers to the ability of saliency models to detect salient areas in different impairment conditions



(a) Blur (b) Uniform variation of illumination (c) Gaussian noise

Computational models of visual attention are not sensitive to visual impairments.

2 Repeatability refers to the ability of saliency models to provide similar results in different impairment conditions

Model	Blur $\sigma^2 = 8$	Luminance Under	Luminance Over	Noise $\sigma^2 = 0.1$	JPEG $Q = 1$
Itti	0.99	0.94	0.92	0.96	0.94
Le Meur	0.91	–	0.92	0.84	0.91
Bruce	0.97	0.99	0.82	0.95	0.95
Hou	0.99	0.99	0.88	0.88	0.96
Judd	0.97	0.88	0.92	0.86	0.90
Avg/Deg.	0.96	0.95	0.89	0.89	0.93
Avg/Model	0.95	0.89	0.93	0.94	0.90

The repeatability of computational model is very high.

Conclusion:
Overall, the results indicate that the tested computational models of visual attention are almost invariant to visual degradations. These models are robust and repeatable.

For applications that would require saliency information at the user-side, it is not necessary to transmit the corresponding saliency map. It can be safely recomputed at the user end, thus saving bandwidth.

More details on http://www.irisa.fr/temics/staff/lemeur/

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