

Idea

Reinterpret the inpainting process [1] through the Information Theory [3, 4] and provide a consistent explanation of the filling in of the blind spot [2].

Contribution

We have proposed the concept of *entropy inpainting* to emulate the optical illusion due to the blind spot and complete any image.

This process cares not to create too much novelty as well as not to destroy too much information, *i.e.* it maintains the entropy constant.

Formulation

- X_k : known signal. - \mathcal{D} : dictionary.
- X_u : unknown signal. - H : entropy function

$$\begin{aligned} &\text{minimize} && |H_{\mathcal{D}}(X_u, X_k) - H_{\mathcal{D}}(X_k)| \\ &\text{subject to} && X_k \end{aligned}$$

Algorithm

input : X_k and X_u s.t. $X_k \cap X_u = \emptyset$

output: X_u s.t. $H_{\mathcal{D}}(X_u, X_k) \approx H_{\mathcal{D}}(X_k)$

build a dictionary \mathcal{D} from X_k and calculate $H(X_u)$ and $H(X_k)$;

while X_u is not completed **do**

 define an overlapping layer \mathcal{L} between X_u and X_k ;

while \mathcal{L} is not completed **do**

 define a selection S inside \mathcal{L} ;
 find the compatible words between S and \mathcal{D} ;

if one candidate then

 select this word;

else if several candidates then

 select the word which minimizes the absolute entropy deviation;

else // no candidate

 create a new word compatible with S and \mathcal{D} ;

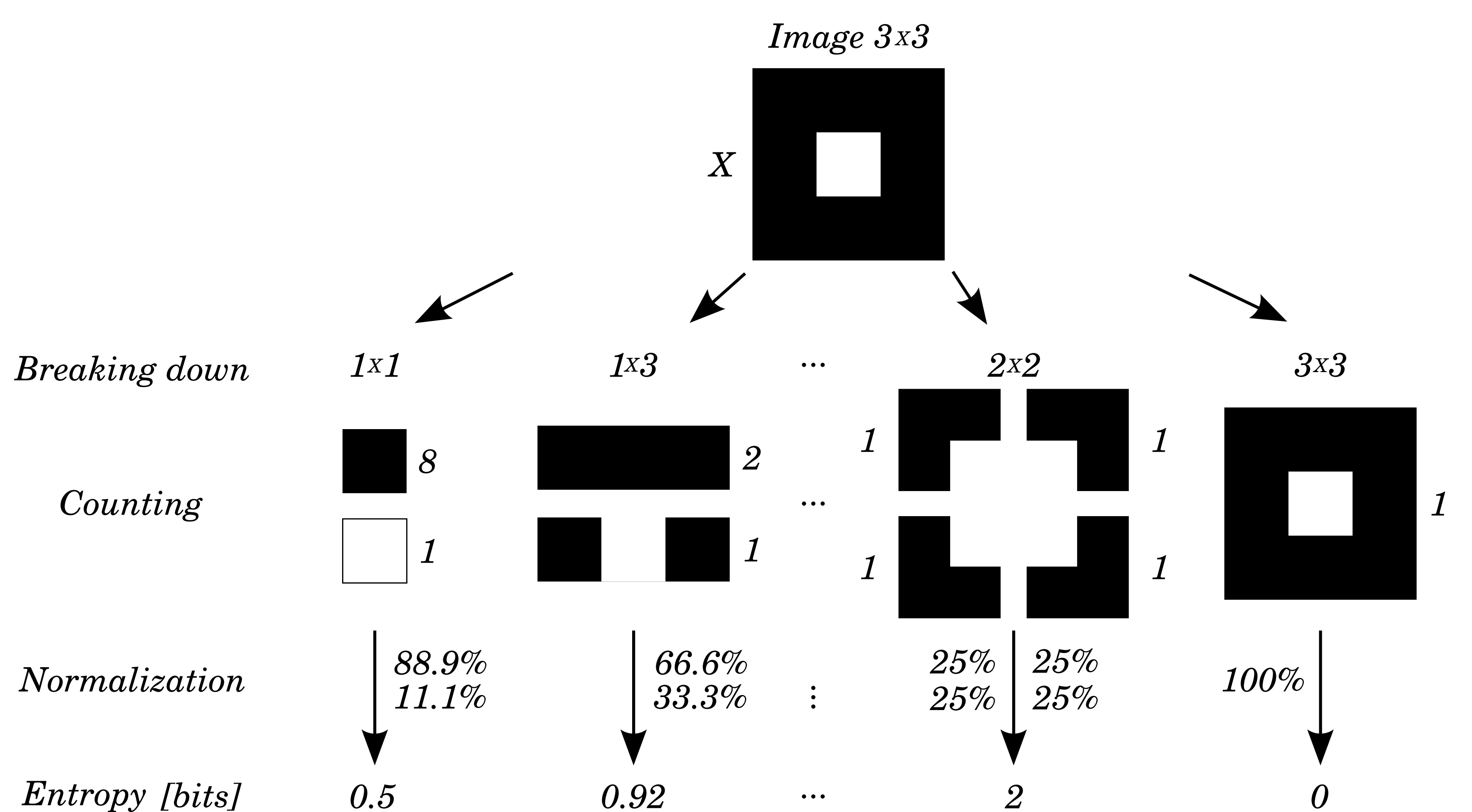
 fill in S with the returned word;
 update X_u , X_k , \mathcal{D} and recalculate $H(X_u)$ and $H(X_k)$;

Blind Spot Demonstration

To make the black dot or the white hole disappear, close your right eye and force your left eye to look at the cross with a slight angle, then slowly move your head back and forth at about 25 cm from the screen.



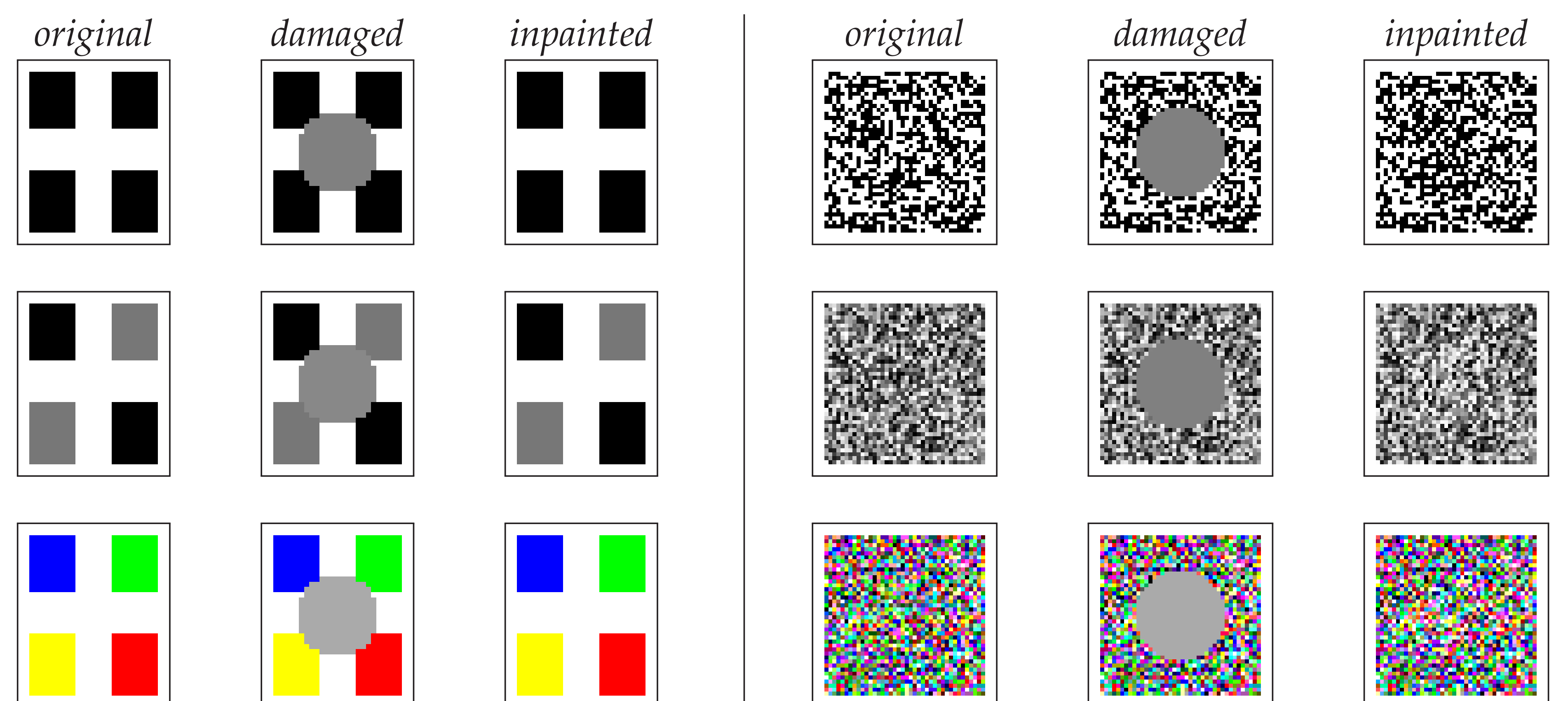
Information Theory



<http://www.lasmea.univ-bpclermont.fr/Personnel/Jean-Marc.Berthomme/>

Results

Entropy inpainting recovering characteristic patterns on binary, grayscale and color images.



cases sensitive to the *creation* of information

cases sensitive to the *destruction* of information

References

- [1] P. Arias, G. Facciolo, V. Caselles, and G. Sapiro. A variational framework for exemplar-based image inpainting. *International journal of computer vision*, 93(3):319–347, 2011.
- [2] Frank H. Durgin. On the filling in of the visual blind spot: some rules of thumb. *Perception*, 24:827–840, 1995.
- [3] D.J.C. MacKay. *Information Theory, Inference, and Learning Algorithms*. Cambridge University Press, 2003.
- [4] C. E. Shannon. A mathematical theory of communication. *Bell System Technical Journal*, 27:379–423, 623–656, 1948.