

# **Color Image Segmentation Based On Levellings**

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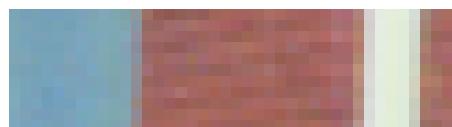
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# Global Scheme



⇒



⇒

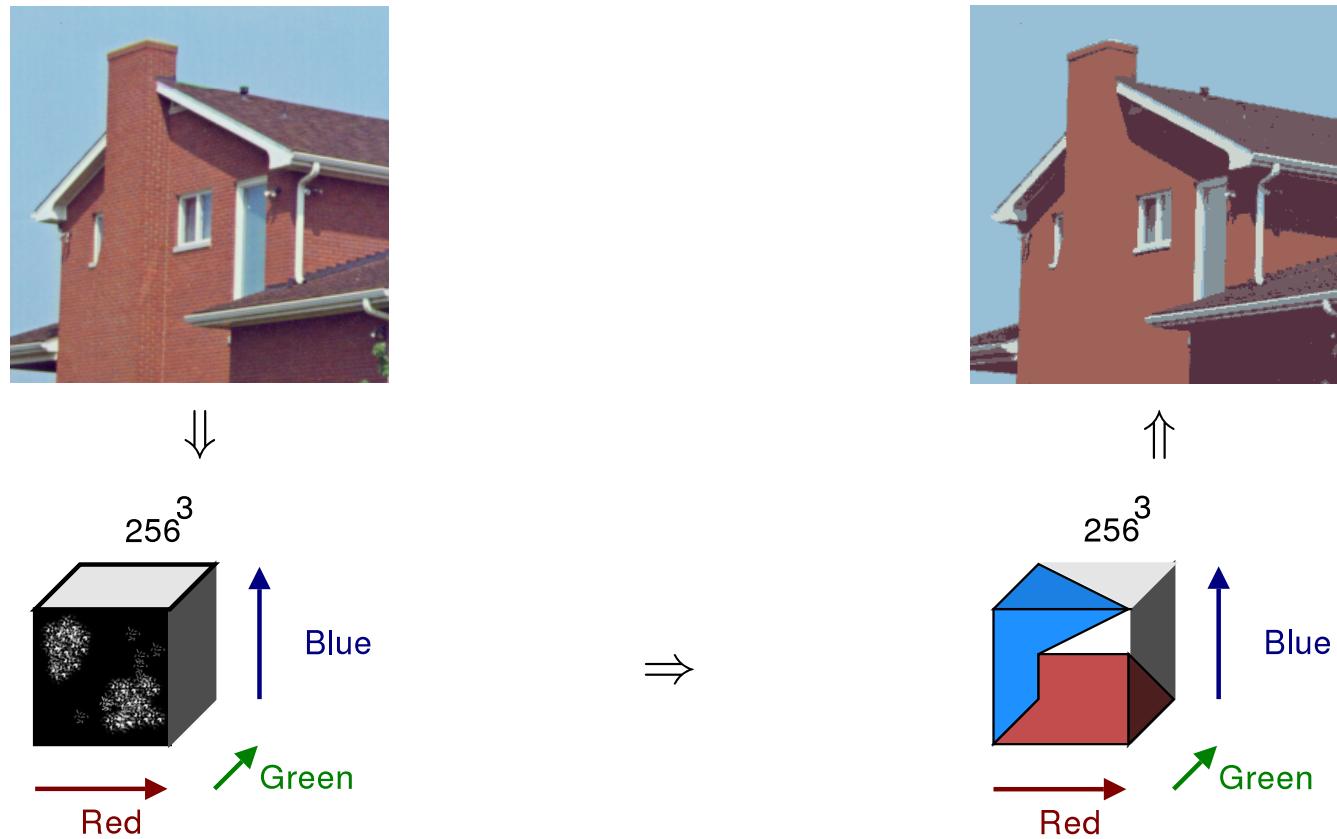


Color image (8x3 bits)

⇒

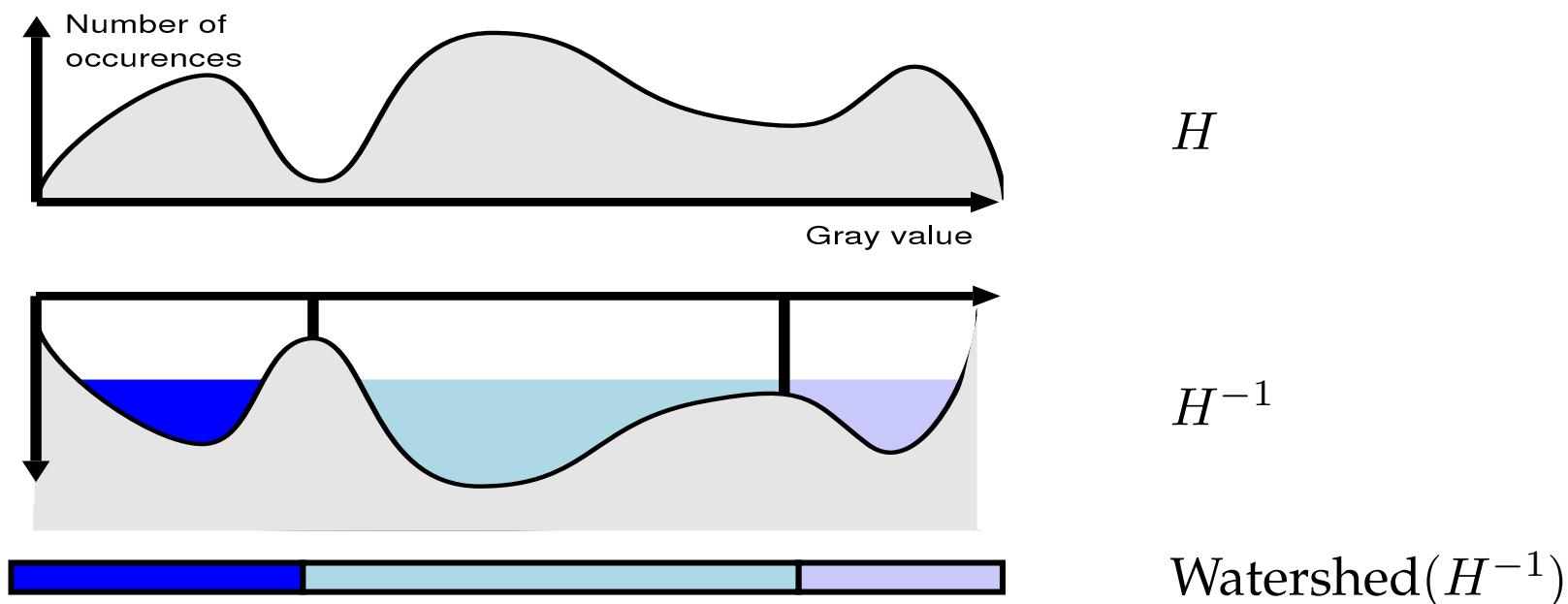
{Sky, wall, shadow of the roof,  
roof, white paint, door}

# Histogram segmentation

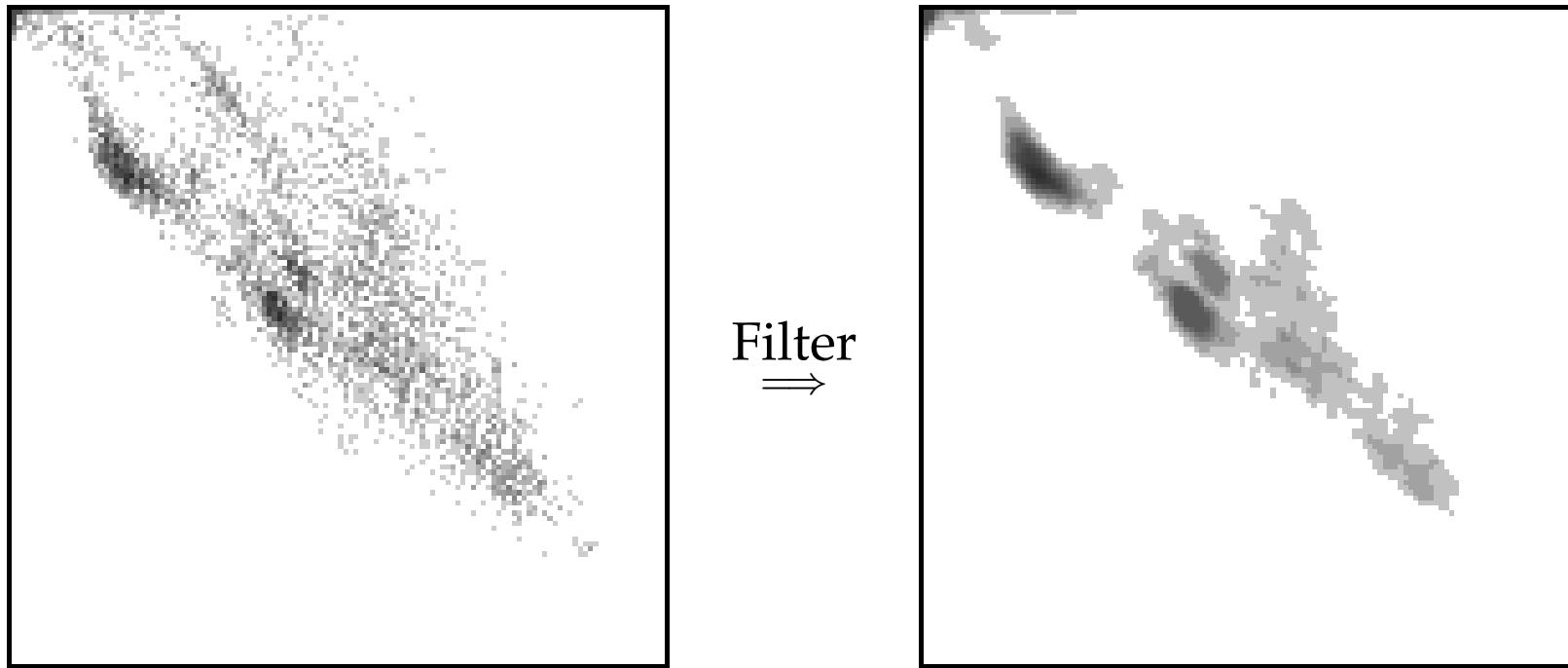


# Watershed

- The watershed algorithm computes the catchment basins,
- one catchment basin per minimum  $\iff$  one label in the partition.

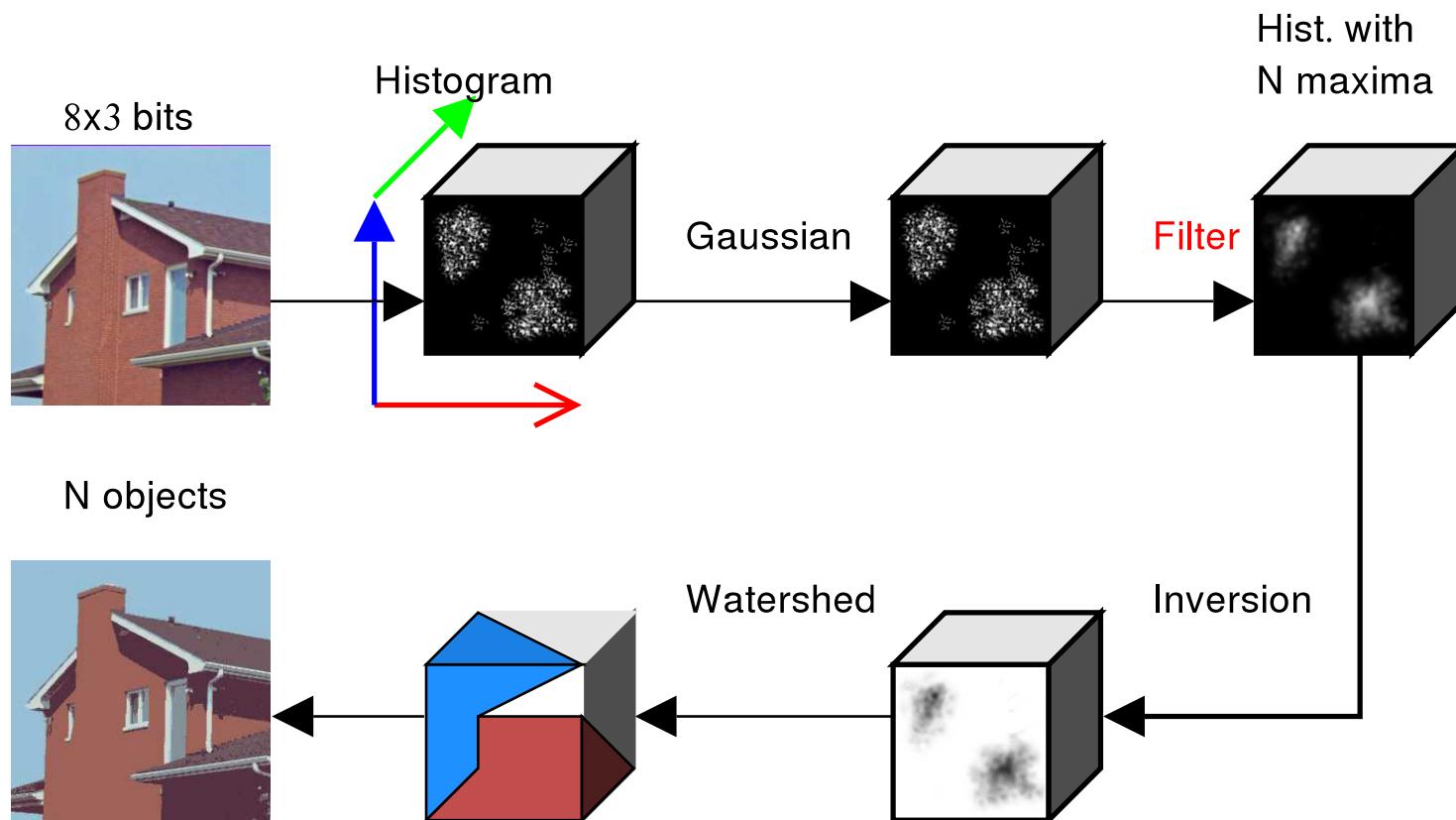


## Filter / Invert



- Gaussian filter for regularization,
- Filter which suppresses inconsistent maxima.

# Classification scheme



# Levellings

- Connected filters
- Levellings
- Volume levelling

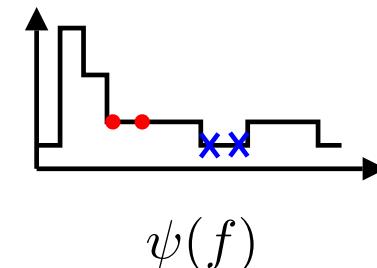
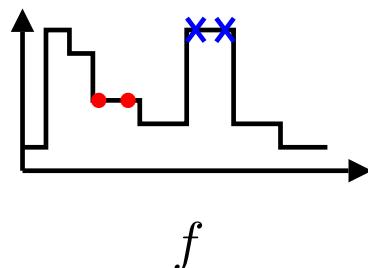
## Connected filters

- The contours preservation property:

$$\forall f : P \rightarrow K, \forall p \in P, \quad C_p(f) \in C_p(\psi(f))$$

where  $C_p$  gives the flat zone in the image  $f$  that contains the point  $p$

- connected filters do not create new transitions,
- flat zones are not sliced.



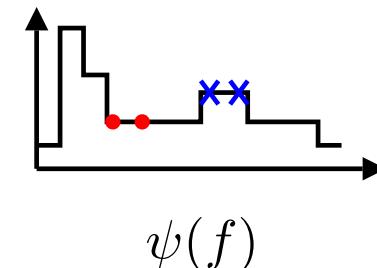
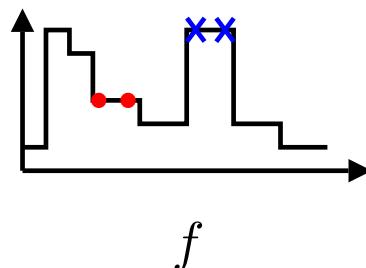
# Levellings

- Connected filters,
- regional extrema preservation property:

$$\forall(x, y) \quad y \in N(x), \quad f(x) \leq f(y) \Rightarrow \psi(f)(x) \leq \psi(f)(y)$$

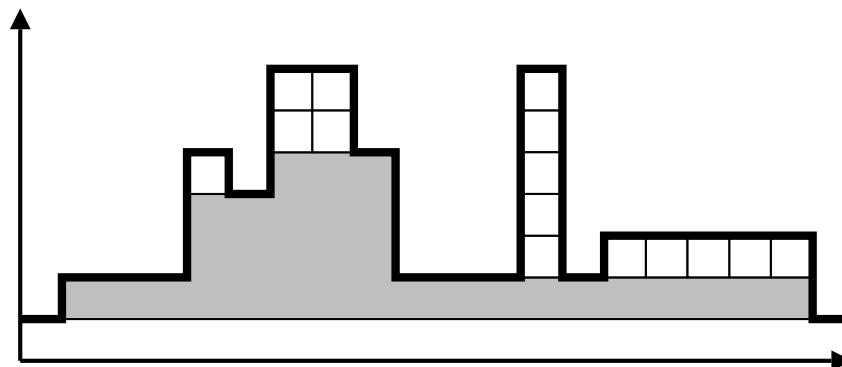
where  $N(x)$  is the neighborhood of  $x$

- do not create new transitions and keep their directions.



## Volume Levelling

- Presented by C. Vachier,
- removes maxima which have a volume smaller than a given threshold ( $\lambda$ ).

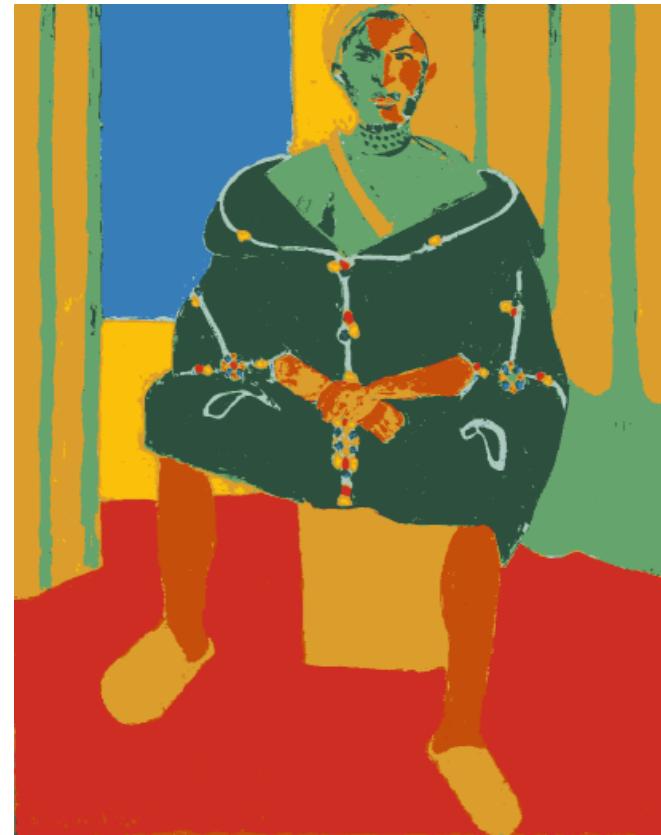


Volume levelling with  $\lambda = 6$  (gray) of the function  $f$  (bold).

# Results



Original image



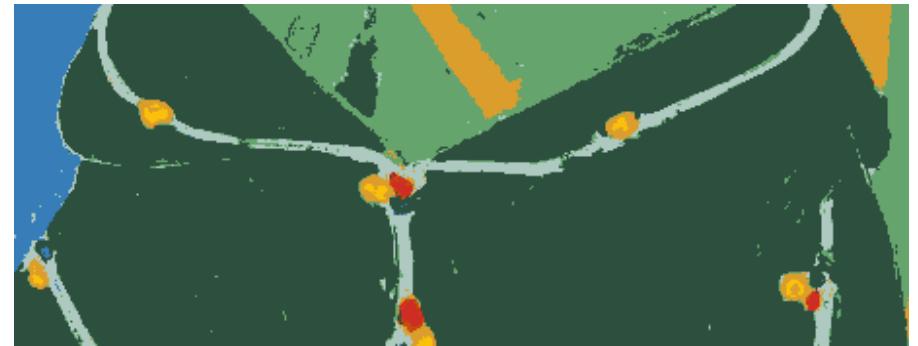
Our method (8 colors)

## Results

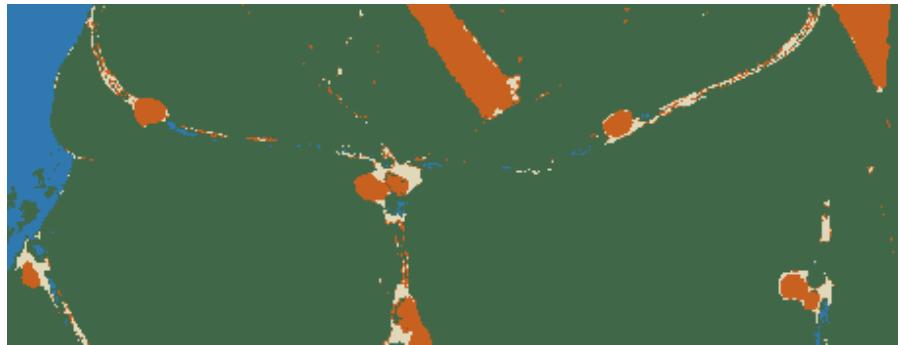
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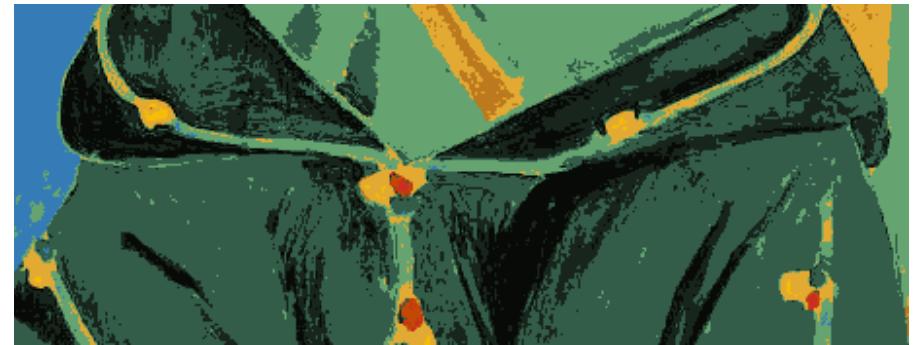
Original image



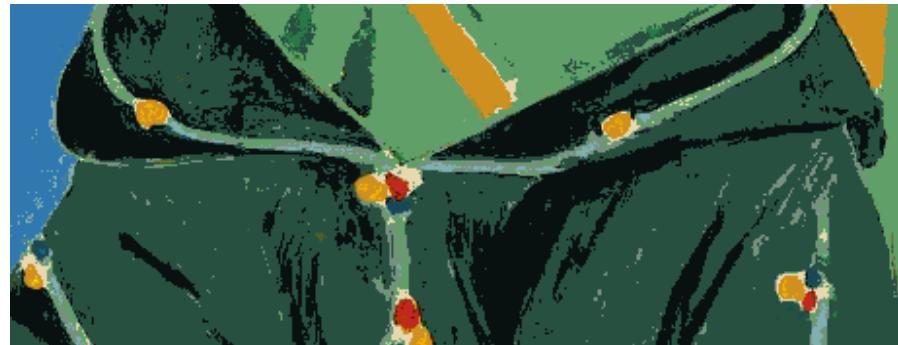
Our method (8 colors)



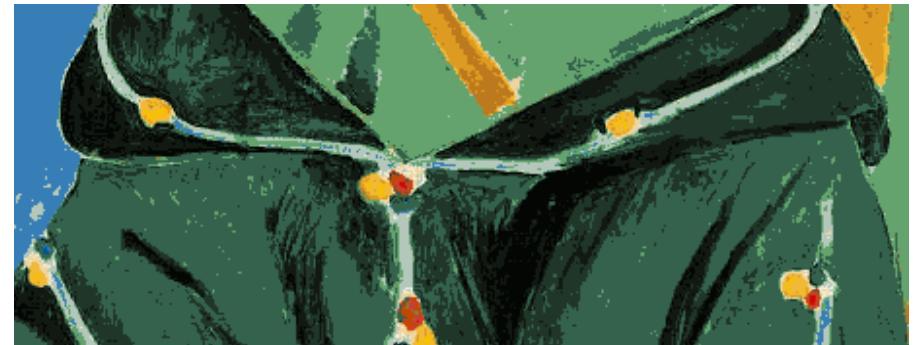
Postaire93 (5 colors)



Geraud2001 (10 colors)



Zhang94 (109 colors)



Park98 (20 colors)

## Conclusion

- Relevant results
- Intuitive choice of the 2 parameters
- Fast: 0.5s on a 1.7GHz computer

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