

# Color and R.O.I. with JPEG2000 for wireless videosurveillance



Franck Luthon, Brice Beaumesnil

LIUPPA (Computer Science Department, Technical University Institute, Bayonne, France)

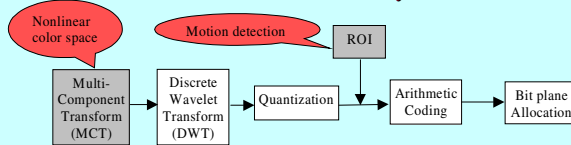
Franck.Luthon@univ-pau.fr

## Wireless videosurveillance

- real-time video traffic surveillance :
  - portable PC104 video module (for highway patrolmans)
  - static camera ; acquisition rate : 8 img/s
  - wireless transmission to distant control center
  - GSM 9600 bauds  $\Rightarrow$  **very low bit-rate** : 1.2 ko/s
- current prototype :
  - color image RGB 24 bits 420x255 ~ 300 ko
  - JPEG compression 1:30  $\Rightarrow$  size ~ 10 ko
  - transmission rate : 8s / img = 0.125 img/s
- objective** 1 img/s : **very high compression  $\geq 1:240$**
- packet errors, loss of Intra-coded images  $\Rightarrow$  ~~MPEG4~~

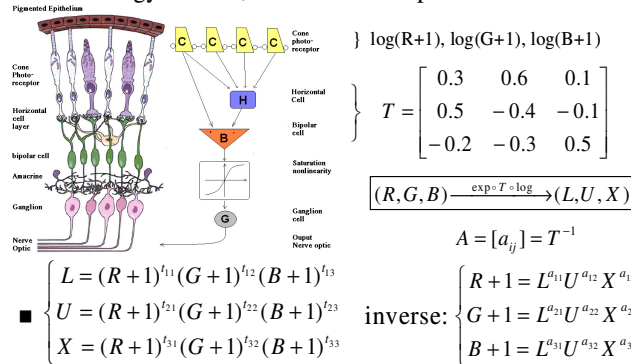
## JPEG2000 features

- choice of MCT color transform :
  - non linear LUX transform**  $\neq$  linear RGB, YUV, YCrCb
- discret wavelet transform : DWT  $\neq$  DCT
- arithmetic bit-plane coding : EBCOT  $\neq$  Huffman
- compression gain : typ. x 2
  - quality JPEG 1:30  $\Leftrightarrow$  JPEG2000 1:60
- robustness w.r.t. packet errors (in mobile applications)
- ROI (region of interest) **extracted by motion detection**



## Non linear color transform LUX

- cf. mathematics : **Logarithmic** Image Processing LIP
- cf. biology : cones, horizontal & bipolar cells in **HVS**

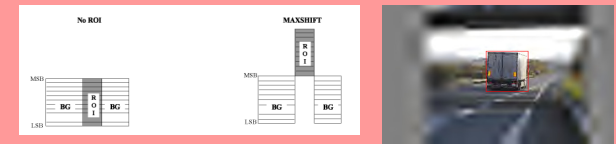


## Better color rendering

- Original Image**
  - BMP
  - 315ko
- JPEG 1:90**
  - 3.5ko
  - blocking artifacts
- JPEG2000 + YUV 1:90**
  - 3.5ko
  - red lights vanish!
- JPEG2000 + LUX 1:90**
  - 3.5ko
  - red lights reappear!

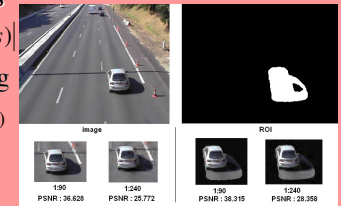
## ROI from motion detection

- maxshift technique (binary shift on wavelet coeff.)
  - advantage : no spatial info needed at the decoder side



- detection of mobile areas
  - observ.  $o(s) = |L_t(s) - L_{t-1}(s)|$
  - temporal change labelling

$$l(s) = \begin{cases} 1 & \text{if } o(s) \geq \theta \text{ (mobile ROI)} \\ 0 & \text{if } o(s) < \theta \text{ (static BG)} \end{cases}$$



- Intra-coded ROI mask

## Discussion

- better color rendering : LUX transform
- compression gain JPEG2000+ROI vs. JPEG : **x 8**
- implementation cost JPEG2000 vs. JPEG:
  - C/C++ packages: JasPer, Kakadu
  - memory : x 40** ; R/W access : x 1.9
  - coding time : x 34** ; decoding time : x 8
- codec Motion-JPEG2000 with reference image RI
  - RI updated at lower rate, boundary artifacts
  - JPEG2000 compliant vs. non compliant ?
- robustness to transmission errors ...
- GSM  $\Rightarrow$  GPRS (x5), UMTS (x5)  $\Rightarrow$  25 img/s

