**Master ST Computer Science option ISM**

UE AIVI

**University Bordeaux**
**Faculty S&T**
academic year 2017 – 2018

**Lab 1**
**(4 hours, evaluated)**

# Study of information content of video sequences - Introduction to OpenCV

**Purpose:** Study and measure different metrics of information content of motion image sequence:
- MSE between frames: characterizes contrasts and motion between sequences. Can be strong in case of noisy video content.
- PSNR (Peak Signal to Noise Ratio): computed on the basis of MSE, characterizes the difference between frames of a motion image sequence. Is used for assessment of motion compensation and coding methods. We study raw PSNR between the frames of an original sequence.
- Entropy: the measure of amount of information in a system. We study the entropy of an original motion picture sequence and of the error sequence which is the difference between consecutive fraes of a motion image sequence.

During this lab, the students get accustomed with the most popular open source framewrok for image and video analysis: OpenCV.

**Work environment**: Linux, C++, OpenCV, Gnuplot.

**1. Introduction to OpenCV**

*OpenCV documentation is available here:* ***http://docs.opencv.org/2.4.9***

*Get video files from:*
*h**ttp://dept-info.labri.fr/~mansenca/AIVI2017/MotionEstimationDataSet/***

*Get skeleton code here: h**ttp://dept-info.labri.fr/~mansenca/AIVI2017/Lab1_code.tar.gz***

*Using C++ API of OpenCV, code a program that does the following:*

*1.1) Loads a movie file given as parameter, displays its frames, saves its frames to disk.*
*- first work on RGB frames*
*- then work only with Y plane of YCrCb frames*

*1.2) Computes the following measures: MSE, PSNR, Entropy, and the Error Image*
- between two consecutive frames: I(t) et I(t-1)
- between two frames with temporal distance Δt (given as parameter): I(t) et I(t-Δt)

We consider images are of size M*N.
Here are the various formulae:

Mean Square Error (MSE) : $MSE=\frac{1}{N*M}\cdot\sum\left(I(p,t)-I(p,t-\Delta t)\right)^2$

Peak Signal-to-Noise Ratio (PSNR): $PSNR=10\log_{10}(\frac{255^2}{MSE})$

Entropy: $Ent(X)=-\sum p(x_i)\log_2 p(x_i)$

The error image: $E(p,t)=I(p,t)-I(p,t-\Delta t)$

and the displayable error image: $E(p,t)=min(255, max(0, I(p,t)-I(p,t-\Delta t)+128))$

1.3) Add an option to the program to save these measures and plot them with **gnuplot**.

Display curves of different metrics (MSE, PSNR, Entropy) with gnuplot.
For the Entropy, trace on the same graphics the entropy for the original sequence and the entropy for the error image sequence.
Explain the curves with regards to the video content.

**Send an archive with your code and pictures of measures curves, named YourName_Lab1.tar.bz2, to : boris.mansencal@labri.fr**