Master internship M1 / M2 / Ecole d'Ingénieur

Efficient algorithms for video shot detection

Starting date : Any time from January to April 2024

Duration : 4 to 6 months

Place : Université de Lille - CRIStAL, Villeneuve d'Ascq 59655, France

Supervisors :

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Context

The efficient algorithms developed in the context of graphs have had a strong impact in the field of image processing and analysis. In this context, images are classically represented by regular graphs, called grids, in which the pixels are represented by vertices, and neighbor pixels are connected by (weighted) edges, as illustrated in the figure bellow. Similarly, videos can be represented in this same framework, in which frames are represented as a 4-connected graph just like a single image, and pixels of neighboring frames are linked by edges.

One of the main pre-processing tasks when dealing with images is to obtain a partition of the pixels into regions of interests [1], in which each region is homogeneous according to a given criterion (color, texture, ...). Among its several applications, one can cite object detection, recognition and tracking, image compression, and video segmentation [2]. In order to deal with the large amount of data currently available, one has to obtain high efficiency image pre-processing algorithms. In this project, we aim to investigate efficient graph-based algorithms for computing the similarity between neighboring frames in a video. The final goal is to employ those algorithms in the problem of video shot detection, which consists of finding the moment in a video in which the scenario changes.

Tasks

In this internship, the selected student is expected to :

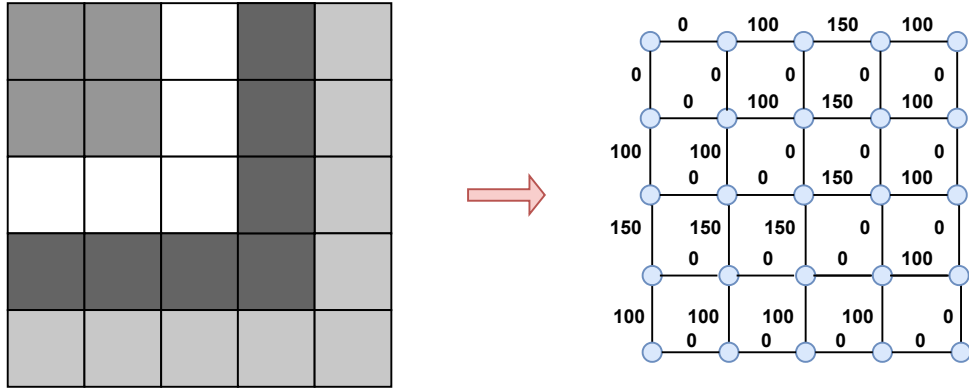- Read and explain the basic bibliography on the two topics (images and graph theory).

Figure 1: 5x5 gray scale image (left) and its representation as a 4-connected edge weighted graph (right), where edge weights represent the dissimilarity between neighbor pixels, *i.e.*, the absolute difference between their gray-levels.

- Test some dissimilarity metrics proposed in the literature on a few sample images.

- Propose and implement (Python) new metrics, and compare them with the ones proposed in the state-of-the-art papers.

- Propose an algorithm for video shot detection based on the proposed metrics.

- The obtained results should be written down at the end of the internship. If the results are good enough, a scientific publication can be expected.

Application

It is expected from a candidate to have some experience with Python and basic notions of image processing. Basic notions of the Python libraries Numpy, OpenCV and Matplotlib would be appreciated.

If you are interested in this internship proposition, please send us your **CV** and **transcripts** to deise.santanamaia@univ-lille.fr and julien.baste@univ-lille.fr. The remuneration for the internship is regulated by French's laws and should be around 540€ a month.

References

[1] Pedro F Felzenszwalb and Daniel P Huttenlocher. Efficient graph-based image segmentation. *International journal of computer vision*, 59:167–181, 2004.

[2] Matthias Grundmann, Vivek Kwatra, Mei Han, and Irfan Essa. Efficient hierarchical graph-based video segmentation. In *2010 ieee computer society conference on computer vision and pattern recognition*, pages 2141–2148. IEEE, 2010.