



Master in Artificial Intelligence (UPC-URV-UB)

Master's Thesis Proposal

General Information

Master's Thesis Title: *Frame interpolation in video sequences for slow motion*

Publication Date: 11/02/11

Expiry Date:

Modality: **research work**

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Observations:

Student's Name:
(if already known)

M.Sc. Thesis Description

Brief Description: (a 4-5 lines long paragraph)

Frame interpolation in video sequences consists in generating intermediate frames between existing (known) video frames. The interpolated frames have to be generated in such a way that the movement between successive frames is pleasant to the viewer. In this thesis we propose to tackle the problem by means of optical flow (motion estimation) computation and non-local means based interpolation, allowing an arbitrary number of frames to be interpolated between any two frames. As a result a video sequence may be reproduced in slow motion. This topic has not been investigated much in the scientific literature due to the complex nature of the problem.

Detailed Description: (a half-page or one-page description, may include a brief task planning)

Frame interpolation in video sequences is a complex problem mainly due to the fact that between two images object may disappear or appear [2]. Different approaches have been proposed to solve the problem, and most of them are based on computing the optical flow (motion estimation) [1] between the two images in-between which the frame has to be interpolated. Classically optical flow is computed using linear models: this model allows to compute two optical flows for the frame interpolation problem, one forward and one backward for the two images in consideration. Newer numerical methods however allow to tackle the problem using non-linear models [3], and as a result more information (optical flows) can be obtained for every pair of images. Indeed, currently with our numerical method up to three optical flows can be obtained: one forward, one backward and one for the image to be interpolated (which is yet not known). The information of the optical flows has to be then combined properly to obtain the interpolated frame. The frame has to be computed in such a way that fading and occlusion effects should be avoided, offering thus – when reproducing the sequence to the user – a pleasant movement. For that issue, interpolation algorithms based on the non-local means algorithm are envisaged [4].

Planning:

(A) Analysis and comprehension of our non-linear minimization framework and the problem of optical flow estimation (this part does not necessarily imply programming since it is already done)

(B) Formulation and implementation of possible ways to create the interpolated frame.

(C) Analysis and comparison of the proposed algorithms with a ground truth database [5]

References: (bibliographical references, relevant web links, etc.)

[1] Horn, B.K.P; Schunck, B.G. “Determining optical flow”, Artificial Intelligence, 1981.

[2] Herbst, E.; Seitz, S.; Baker, S., “Occlusion reasoning for temporal interpolation using optical flow”, Technical Report 2009, Microsoft Research.

[3] Nocedal, J.; Wright, S.J., “Numerical Optimization”, Springer Verlag.

[4] Buades, A.; Coll, B.; Morel, J.M. , “A non-local algorithm for image denoising”, IEEE Conference on Computer Vision and Pattern Recognition, 2005.

[5] Baker, S.; Scharstein, D.; Lewis, J.P., “A database and evaluation methodology for optical flow”, Technical Report 2009, Microsoft Research.

Location and Date: Barcelona,

To the Academic Commission of the Master in Artificial Intelligence (CAIMIA)