Video Magnification Project

ET4283 Advanced Digital Image Processing
Contact: Jan van Gemert, j.c.vangemert@tudelft.nl

1 Project description

Many seemingly static scenes contain subtle changes that are invisible to the naked human eye. It is possible to pull out these small changes from videos through the use of *video magnification* algorithms. Those algorithms give a way to visualize these small changes by amplifying them. Examples include: blood flow in a face, the human pulse and the motion of hot air. In this project you will implement such methods. We ask you to make a report and a presentation that demonstrates understanding, insightful and relevant comparisons. You will run existing Matlab code, record some videos, and implement a video magnification method yourself.

2 Assignments

You will have to make a report and give a presentation about your results and their analysis.

2.1 Getting comfortable

Browse this website on video magnification:
http://people.csail.mit.edu/mrub/vidmag/
Read this paper [2] and download its Matlab code and the corresponding video data which are available here:
http://people.csail.mit.edu/mrub/evm/#code

Assignment 1: Analyze whats going on spatially in [2]. In the Matlab code and in the paper [2] there are several image pyramids used. For each pyramid: 1) Analyze its properties; 2) motivate the reasons why it is used and 3) Compare its properties to others (i.e.: advantages/disadvantages). (The lectures on image pyramids may prove useful here)

Assignment 2: Analyze whats going on temporally in [2]. In the Matlab code and in the paper [2] there are several temporal filters used. For each temporal filter: 1) Analyze its properties; 2) motivate the reasons why it is used and 3) Compare its properties to others (i.e.: advantages/disadvantages).

Assignment 3: Briefly describe the difference between Eulerian and Lagrangian motion. For each method: 1) Analyze its properties and 2) Compare its properties to the other (i.e.: advantages/disadvantages).

Assignment 4: Reproduce the results of [2]. Use the provided software to validate that you can reproduce the results from the paper [2]. Now, make two video recordings yourself: *a*) a color-magnification video and *b*) a motion-magnification video. Demonstrate (how?) and analyze (how?) what the results are on those videos *a* and *b*. Make sure to also show the original videos and to motivate parameter settings.

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2.2 Going to the next phase

Browse the following site and watch the "supplemental video" here:
http://people.csail.mit.edu/nwadhwa/phase-video/
Read this follow up paper [1].

Assignment 5: Analyze whats going on spatially in [1]. In [1] there is a different image pyramid used than in [2]. For the pyramid in [1]: 1) Analyze and describe its properties ; 2) motivate the reasons why it is used and 3) Compare its properties to the pyramids used in [2] (i.e.: advantages/disadvantages).

Assignment 6: Implement [1]. Make your own version of the method of [1], where you may use existing image pyramid implementations. Note that we know that the code of [1] is available on request, and there are some implementations available on the internet.

Assignment 7: Demonstrate the results of [1]. Use your software on the two video recordings that you made yourself: *a*) a color-magnification video and *b*) a motion-magnification video. Demonstrate (how?) and analyze (how?) what the results are on those videos *a* and *b*. Make sure to also show the original videos and to motivate parameter settings and compare against your results of [2] in assignment 4.

References

[1] N Wadhwa, M Rubinstein, F Durand, and W T Freeman. Phase-based video motion processing. *ACM-TOG*, 32(4):80, 2013.

[2] Hao-Yu Wu, Michael Rubinstein, Eugene Shih, John Guttag, Frédo Durand, and William T. Freeman. Eulerian video magnification for revealing subtle changes in the world. *ACM Trans. Graph. (Proceedings SIGGRAPH 2012)*, 31(4), 2012.