

Question 1: Image Extraction at Best Quality

Qn.1A, if you used the supplied replay software:

please save and submit your results using the filename:
'Q1A_ReplayDescribed_YOURINITIALS' or

Please specify (i) the investigation method used to a) examine the video sequence and b) extract and examine the frame, and (ii) all steps executed. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

Use any space you need

Qn.1A, if you used another method:

Please save and submit your results using the filename:
'Q1A_OtherMethod_YOURINITIALS'

Please specify (i) the investigation method used to a) examine the video sequence and b) extract and examine the frame, (ii) all tools used, and (iii) all steps executed. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

Explanation

I checked with the native player, but it was clearly saving what was displayed on screen applying interpolation, hence not suitable for keeping the best quality of the original file.

Next, I tried converting it with the Convert DVR function of Amped FIVE. This function uses FFmpeg command line tool to rewrap the original video stream into a standard AVI (no re-encoding or recompression). Then the first frame of video has been saved as a bitmap to preserve the original pixels and not apply further compression.

The video stream is clearly stretched, but since the task was to keep the original data as much as possible we didn't apply any aspect ratio correction.

Specific answers as requested

- i. Independent conversion of proprietary video format

- a. Amped FIVE DVR Conversion tool (format was known before, originally studied with FFprobe), proprietary player
 - b. Amped FIVE DVR Conversion tool (which uses FFmpeg)
- ii. Amped FIVE (internally uses FFmpeg)
- iii. Following operations in Amped FIVE
 - a. Drag DVR file on Amped FIVE user interface (or use menu File / Convert DVR...)
 - b. Do DVR conversion with default settings (copy stream inside and AVI file if possible)
 - c. Add an Image Writer to save the first frame as BMP.

Qn.1B, if you used the supplied replay software:

Please save and submit your results using the file name:
'Q1B_ReplayDescribed_YOURINITIALS'

Please specify (i) the investigation method used to a) examine the video sequence and b) extract and examine the frame, and (ii) all steps executed. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

Use any space you need

Qn.1B, if you used another method:

Please save and submit your results using the filename
'Q1B_OtherMethod_YOURINITIALS'

Please specify (i) the investigation method used to a) examine the video sequence and b) extract and examine the frame, (ii) all tools used, and (iii) all steps executed. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

Explanation

Here the conversion could be performed similarly than in Q1A or with the given player, which was able to convert the video giving similar results. The complication here was that the requested frame was not the first, but at a certain timestamp, and the metadata was not visible after the conversion.

The only way to get the proper frame was with a Hexadecimal editor, to look for the part of the stream with the requested timestamp.

In fact, the format of the video was MJPEG, so it was possible to extract by hand individual frames looking at the couples of markers FFD9/FFD9. The timestamp is stored inside every image, so it was possible to search for the first occurrence of the timestamp 16:43:30 and get the data starting from the previous FFD8 up to the next FFD9.

Specific answers as requested

- i. Independent conversion of proprietary video format
 - a. Amped FIVE DVR Conversion tool (format was known before, originally studied with FFprobe), proprietary player, HxD (hexadecimal editor)
 - b. HxD
- ii. Amped FIVE (internally uses FFmpeg), HxD
- iii. Following operations in HxD
 - a. Search for the first occurrence of the timestamp 16:43:30 inside the stream
 - b. Search for the previous occurrence of the marker FFD8 before the offset found in a

- c. Search for the next occurrence of the marker FFD9 after the offset found in point a
- d. Copy and paste the selection into a new file.

Qn.1C

Frame Size of source file recording used in Qn.1A				Frame Size of source file recording used in Qn.1B			
720	x	288	pixels	720	x	288	pixels

What are your conclusions about the raw, encoded quality of the provided video frame/sequence in Q1A and Q1B?

The video probably comes from an analogue camera which generates fields instead of frames, thus the image appears stretched (the is the half of what it should be). To reconstruct the proper aspect ratio we should interpolate missing lines. The format of Q1A is H264, of Q1B is MJPEG. Only in the second case is trivial to extract single frames at a certain timestamp.

Question 2: Super-Resolution from supplied sequence of 249 .bmp files

Qn.2A

Please select your best result, i.e.: a single best quality super-resolution image:
Please save and submit your results using filename: "Q2A_SuperRes_YOURINITIALS"

1. How have you ingested the material into your enhancement system and super-resolution software tools?
Please detail all steps of any conversion performed including all software tools and settings used. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

I just dragged the images into Amped FIVE and they have been opened as a "Sequence Loader".

2. Please specify all software tools and all Enhancement Filters used (in order) and specific parameter settings; e.g. Super-Resolution Filter (Method? Zoom factor? Number of Iterations? Interpolation?.....)

The image is basically stable so the actual SR filter is of little use. A very minor shift is given by the aliasing of the pixels.

Amped FIVE Report

Report Generation: 2015-04-23 17:09:29

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q2A_SuperRes_ID14.jpg.afp

Exported Images

Chain 4

- 4. Sequence Loader: *Loads a list of images as video. (File)*
 - 5. Resize: *Resizes the image.*
 - 7. Local Stabilization: *Stabilizes a shaking video by keeping the current selection steady.*
 - 6. Frame Averaging: *Reduces the noise by creating an image which is the average of all the frames.*
 - 8. Optical Deblurring: *Corrects the blur of objects that are out of focus (big blur).*
-

Details:

Summary:

Chain 4

4. Sequence Loader

Loads a list of images as video.

Details:

The *Sequence Loader* tool renders different image files that can be encoded in a variety of formats to a sequence of bitmaps that can be displayed and processed.

Parameters:

- **Files:**
 - seq/SuperRes0000.bmp
 - seq/SuperRes0001.bmp
 - seq/SuperRes0002.bmp
 - [...]
 - seq/SuperRes0247.bmp
 - seq/SuperRes0248.bmp

Path of the images in the list.

- **Fps:** 25

Frame rate, in frames per second, for the resulting video.

5. Resize

Resizes the image.

Details:

The *Resize* tool interpolates the input image by generating an output image of the desired size.

The available interpolation algorithms are:

- *Nearest*: simply copies the value of the closest pixel in the position to be interpolated;
- *Bilinear*: uses a bilinear interpolation to resample pixel data;
- *Bicubic*: uses a bicubic interpolation to resample pixel data.
- *Area* resamples using pixel area relation.
- *Lanczos* uses a Lanczos interpolation to resample pixel data.

Parameters:

- **Size:** 384, 320

Size of output image.

- **Interpolation:** Bicubic

Interpolation algorithm.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 253-255, 1989.
- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 320-322, 1989.
- H.S. Hou and H.C. Andrews, Cubic spline for image interpolation and digital filtering, in IEEE Transactions on Acoustic, Speech, and Signal Processing, vol. 26, pp. 508-517, 1978.

7. Local Stabilization

Stabilizes a shaking video by keeping the current selection steady.

Details:

The *Local Stabilization* tool horizontally and/or vertically shifts the different frames of a video in order to correct instability. The offset to be applied is calculated by finding the maximum of the cross-correlation function between each frame and a template, which is obtained by the reference area copied from the reference frame.

Parameters:

- **Selection:** Static Tracking
Reference Selection(s)
0: 85 117 186 52

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

6. Frame Averaging

Reduces the noise by creating an image which is the average of all the frames.

Details:

Frame Averaging calculates and implements a pixel-by-pixel mean along all the frames of the video.

Parameters: This filter has no parameters.

8. Optical Deblurring

Corrects the blur of objects that are out of focus (big blur).

Details:

Optical Deblurring reduces the blurring effect due to incorrect focus settings during the image acquisition process. The algorithm is based on a Wiener filtering, having a circle of diameter *Size* as point spread function (PSF).

In order to filter out the noise it is possible to set the *Noise* parameter, which represents the estimated noise-to-signal power ratio of the image.

Parameters:

- **Size:** 5

The size of the point spread function.

- **Noise:** 0.0100

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.
-

3. Did you select a "region of interest" for directing the super-resolution tool? If so please specify co-ordinates of the region (if used) in the format given by the tool.

I didn't use super resolution, but set a ROI for the stabilization.

4. Did you select any specific frames or image? If so, please provide details of range of frames or specific frames you used.

I used all the frames.

5. Please provide any other information that would be needed so that others would be able to repeat and reproduce your work.

The Amped FIVE project file is included with the results.

Qn.2B

Please select your best result, i.e.: a single best quality super-resolution image:

Please save and submit your results using filename: "Q2B_SuperRes_YOURINITIALS"

1. How have you ingested the material into your enhancement system and super-resolution software tools?

Please detail all steps of any conversion performed including all software tools and settings used. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

The file has been dragged into Amped FIVE and converted with the DVR conversion tool.

2. Which of the 5 number plates have you concentrated your efforts on (1=closest number plate, ..., 5=most distant) and how did you decide on selecting this number plate?

Selected no. plate: All

Decision reached how:

I can guess some potential results for all of them processing all of them together.

These are my evaluations for the license plate (alternative, less probable, options by parentheses)

1. PRX6ZIN
2. A4V(W)S(5)D(0|O)E(L)N(H|M)
3. WDCL2B(8)3
4. KB97W(U|V)T(I)F(P)
5. DV(U)M1S(5)GJ

1. Please specify all software tools and all enhancement filters used (in order) and specific parameter settings; e.g. Super-Resolution Filter (Method? Zoom factor? Number of Iterations? Interpolation?.....)

In this case I got better results with a process which does a similar (but conceptually different) job than actual super resolution: this process is basically applying stabilization and frame averaging, after they have been resized (hence corresponding to a sub-pixel stabilization if compared to the original frames).

Amped FIVE Report

Report Generation: 2015-04-23 17:10:12

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q2B_SuperRes_Procedure1_PlateAll_ID14.jpg.afp

Exported Images

Chain 2

- 2. Video Loader: *Loads a video from file. (File)*
- 3. Crop: *Crops a region of interest of the image.*
- 8. Rotate: *Rotates the image.*
- 4. Resize: *Resizes the image.*
- 5. Local Stabilization: *Stabilizes a shaking video by keeping the current selection steady.*
- 6. Frame Averaging: *Reduces the noise by creating an image which is the average of all the frames.*
- 9. Optical Deblurring: *Corrects the blur of objects that are out of focus (big blur).*
- 10. Unsharp Masking: *Sharpens the image using an unsharp masking filter.*
- 11. Levels: *Adjusts intensity and color levels.*

Details:

Summary:

Chain 2

2. Video Loader

Loads a video from file.

Details:

The *Video Loader* tool renders an video file that can be encoded in a variety of standard formats to a sequence of bitmaps that can be displayed and processed.

Parameters:

- **File:** TestP_7mDistance_MidElevation.dav-converted.avi

Path of the video to load.

- **Video Engine:** FFMS

Video decoder to use.

- **Original File:**
C:\Users\NAME\Desktop\desk\enfsi\2B\TestP_7mDistance_MidElevation\TestP_7mDistance_MidElevation.dav

Original video file that has been converted from a proprietary DVR format.

3. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 150 79 76 111

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

8. Rotate

Rotates the image.

Details:

The *Rotate* filter rotates the image by the given angle. If the rotation angle is not multiple of 90 degrees, the selected interpolation algorithm is used, otherwise the original pixel values are only transposed.

Parameters:

- **Angle:** 180

Rotation angle.

- **Resize Image to Fit:** true

If unchecked, the image remains of the original size, although part of the actual data could render outside of the visible area.

- **Interpolation:** Bicubic

Interpolation algorithm.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 253-255, 1989.

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 320-322, 1989.
 - H.S. Hou and H.C. Andrews, Cubic spline for image interpolation and digital filtering, in IEEE Transactions on Acoustic, Speech, and Signal Processing, vol. 26, pp. 508-517, 1978.
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4. Resize

Resizes the image.

Details:

The *Resize* tool interpolates the input image by generating an output image of the desired size.

The available interpolation algorithms are:

- *Nearest*: simply copies the value of the closest pixel in the position to be interpolated;
- *Bilinear*: uses a bilinear interpolation to resample pixel data;
- *Bicubic*: uses a bicubic interpolation to resample pixel data.
- *Area* resamples using pixel area relation.
- *Lanczos* uses a Lanczos interpolation to resample pixel data.

Parameters:

- **Size:** 456, 666

Size of output image.

- **Interpolation:** Bicubic

Interpolation algorithm.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 253-255, 1989.
- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 320-322, 1989.
- H.S. Hou and H.C. Andrews, Cubic spline for image interpolation and digital filtering, in IEEE Transactions on Acoustic, Speech, and Signal Processing, vol. 26, pp. 508-517, 1978.

5. Local Stabilization

Stabilizes a shaking video by keeping the current selection steady.

Details:

The *Local Stabilization* tool horizontally and/or vertically shifts the different frames of a video in order to correct instability. The offset to be applied is calculated by finding the maximum of the cross-correlation function between each frame and a template, which is obtained by the reference area copied from the reference frame.

Parameters:

- **Selection:** Static Tracking
Reference Selection(s)
0: 153 522 157 53

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

6. Frame Averaging

Reduces the noise by creating an image which is the average of all the frames.

Details:

Frame Averaging calculates and implements a pixel-by-pixel mean along all the frames of the video.

Parameters: This filter has no parameters.

9. Optical Deblurring

Corrects the blur of objects that are out of focus (big blur).

Details:

Optical Deblurring reduces the blurring effect due to incorrect focus settings during the image acquisition process. The algorithm is based on a Wiener filtering, having a circle of *diameterSize* as point spread function (PSF).

In order to filter out the noise it is possible to set the *Noise* parameter, which represents the estimated noise-to-signal power ratio of the image.

Parameters:

- **Size:** 10

The size of the point spread function.

- **Noise:** 0.0100

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.

10. Unsharp Masking

Sharpens the image using an unsharp masking filter.

Details:

The *Unsharp Masking* filter is implemented as a window-based operator, i.e. it relies on a convolution kernel to perform spatial filtering. The original image is first convolved with a *Radius x Radius* Gaussian kernel to produce its smoothed version, i.e. a low-passed image. The resulting image is then pixel subtracted from the original image in order to produce a description of image edges, i.e. a high-passed image. Only the pixel differences (edges) greater than certain *Threshold* values are retained, so that sharpening of small image details can be suppressed. In order to increase the sharpness of the original image, a percentage (proportional to *Strength*) of the thresholded high-passed image is added back onto the original image.

Parameters:

- **Strength:** 0.5000

Intensity of the sharpening effect: larger values provide increasing amounts of sharpening.

- **Size:** 99

Size of the filter. High resolution images allow higher size. It is better to always sharpen an image at its highest resolution.

- **Threshold:** 0

The minimum difference in pixel values that indicates an edge where sharpen must be applied. So you can protect areas of smooth tonal transition from sharpening, and avoid creation of blemishes in the facial, sky or water surface.

- **Mode:** Intensity

Type of adjustment to be done.

- **Selection:** Whole Image

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 249-250, 1989.

11. Levels

Adjusts intensity and color levels.

Details:

The *Levels* filter maps the values of the input image to the values of output image according to a piece-wise linear transformation controlled by the values of *Highlights*, *Midtones* and *Shadows*. The *Midtones* slider changes the intensity values of the middle range of intensity levels without significantly changing the highlights and shadows in the image. The *Highlights* and *Shadows* sliders set the black point and the white point of the image. Each channel of the input image is configured using the sliders of the corresponding parameter: *Value*, *Red*, *Green* or *Blue*. For each parameter, the histogram of the tonal range of the input image is displayed. If the input image is in grayscale, changing the setting of *Red*, *Green* and *Blue* parameters has no effect on the output image.

Parameters:

- **Value:** 255, 131, 8

Highlights, Midtones and Shadows settings used to map the pixel values of the grayscale converted image.

- **Red:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the red channel of image.

- **Green:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the blue channel of image.

- **Blue:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the green channel of image.

- **Selection:** Whole Image

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 234-241, 1989.

-
3. Did you select a “region of interest” for directing the super-resolution tool? If so please specify co-ordinates of the region (if used) in the format given by the tool.

Around license plate 5 (see before).

4. Did you select any specific frames or image? If so, please provide details of range of frames or specific frames you used.

All frames have been used.

5. Please provide any other information that would be needed so that others would be able to repeat and reproduce your work.

Amped FIVE project file is included with results.

Qn2B. (continued): optional:

As indicated on the Collaborative Exercise webpage you may choose to submit multiple results. If this is the case then please specify how you obtained your results by replicating the previous 6 points for each Procedure/toolset used and/or each possible license plate you focussed on.

For example:

Please save and submit your results using filename:

'Q2B_SuperRes_Procedure1_PlateAll_YOURINITIALS' to indicate the best enhancement result you obtained for all plates using the Procedure1 you will describe using a cut-paste repetition of the 6 previous subquestions above, etc.

and/or

Please save and submit your results using filename:

File name: 'Q2B_SuperRes_Procedure2_Plate1_YOURINITIALS' to indicate the best enhancement result you obtained for Plate 1 using the Procedure2 you will describe using a cut-paste repetition of the 6 previous subquestions above, etc.

and/or

Please save and submit your results using filename:

File name: 'Q2B_SuperRes_Procedure2_Plate2_YOURINITIALS' to indicate the best enhancement result you obtained for Plate 2 using the Procedure2 you will describe using a cut-paste repetition of the 6 previous subquestions above, etc.

etc.

Qn.2C (optional)

Please select your best result, i.e.: a single best quality super-resolution image:
please save and submit your results using filename: "Q2C_SuperRes_YOURINITIALS"

1. How have you ingested the material into your enhancement system and super-resolution software tools?

Please detail all steps of any conversion performed including all software tools and settings used. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

The file has been dragged into Amped FIVE and converted with the DVR conversion tool.

2. Which of the 5 number plates have you concentrated your efforts on (1=closest number plate, ..., 5=most distant) and how did you decide on selecting this number plate?

Selected no. plate: All

Decision reached how:

It was possible to process all the license plates at the same time.

1. ILIJPFE
2. KMV2(Z)124
3. HAVM(H)NUH(M)
4. D(O|0)UCA(0)D3G
5. HSHL?9(3)5(S)

3. Please specify all software tools and all enhancement filters used (in order) and specific parameter settings; e.g. Super-Resolution Filter (Method? Zoom factor? Number of Iterations? Interpolation?.....)

In this case the actual superresolution gives a better result than the process explained in the previous exercise.

Amped FIVE Report

Report Generation: 2015-04-23 17:10:44

Project Name:

Author:
Description:

Amped FIVE version info:
Build date: 20150413
Revision: 6820
Platform: Microsoft Windows, 32 bit

Project File: Q2C_SuperRes_Procedure1_PlateAll_ID14.jpg.afp

Exported Images

Chain 2

- 2. Video Loader: *Loads a video from file. (File)*
- 4. Rotate: *Rotates the image.*
- 5. Crop: *Crops a region of interest of the image.*
- 12. Super Resolution: *Merges all frames to improve the resolution of the image.*

Details:

Summary:

Chain 2

2. Video Loader

Loads a video from file.

Details:

The *Video Loader* tool renders an video file that can be encoded in a variety of standard formats to a sequence of bitmaps that can be displayed and processed.

Parameters:

- **File:** TestH_7mDistance_HighElevation.dav-converted.avi

Path of the video to load.

- **Video Engine:** FFMS

Video decoder to use.

- **Original File:**
C:\Users\NAME\Desktop\desk\enfsi\2C\TestH_7mDistance_HighElevation\TestH_7mDistance_HighElevation.dav

Original video file that has been converted from a proprietary DVR format.

4. Rotate

Rotates the image.

Details:

The *Rotate* filter rotates the image by the given angle. If the rotation angle is not multiple of 90 degrees, the selected interpolation algorithm is used, otherwise the original pixel values are only transposed.

Parameters:

- **Angle:** 180

Rotation angle.

- **Resize Image to Fit:** true

If unchecked, the image remains of the original size, although part of the actual data could render outside of the visible area.

- **Interpolation:** Bicubic

Interpolation algorithm.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 253-255, 1989.
 - Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 320-322, 1989.
 - H.S. Hou and H.C. Andrews, Cubic spline for image interpolation and digital filtering, in IEEE Transactions on Acoustic, Speech, and Signal Processing, vol. 26, pp. 508-517, 1978.
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5. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 157 170 38 62

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

12. Super Resolution

Merges all frames to improve the resolution of the image.

Details:

The *Super Resolution* filter applies a sub-pixel registration to all the frames of a video, then merges the motion corrected frames together, along with a deblurring filtering. If a *Selection* is set, then the selected area will be optimized.

Parameters:

- **Zoom:** 6

Zoom factor for the output image.

- **Iterations:** 45

Number of deblurring steps.

- **Selection:** 0 0 0 0

Region of the image to optimize.

References:

- Hiroyuki Takeda, Peyman Milanfar, Matan Protter, and Michael Elad. 2009. Super-resolution without explicit subpixel motion estimation. *Trans. Img. Proc.* 18, 9 (September 2009), 1958-1975. DOI=10.1109/TIP.2009.2023703 <http://dx.doi.org/10.1109/TIP.2009.2023703>

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4. Did you select a "region of interest" for directing the super-resolution tool? If so please specify co-ordinates of the region (if used) in the format given by the tool.

No

5. Did you select any specific frames or image? If so, please provide details of range of frames or specific frames you used.

All

6. Please provide any other information that would be needed so that others would be able to repeat and reproduce your work.

Amped FIVE project file is included with results.

Qn2C. (continued): optional:

As indicated on the Collaborative Exercise webpage you may choose to submit multiple results. If this is the case then please specify how you obtained your results by replicating the previous 6 points for each Procedure/toolset used and/or each possible license plate you focussed on.

For example:

Please save and submit your results using filename:

'Q2C_SuperRes_Procedure1_PlateAll_YOURINITIALS' to indicate the best enhancement result you obtained for all plates using the Procedure1 you will describe using a cut-paste repetition of the 6 previous subquestions above, etc.

and/or

Please save and submit your results using filename:

File name: 'Q2C_SuperRes_Procedure2_Plate1_YOURINITIALS' to indicate the best enhancement result you obtained for Plate 1 using the Procedure2 you will describe using a cut-paste repetition of the 6 previous subquestions above, etc.

and/or

Please save and submit your results using filename:

File name: 'Q2C_SuperRes_Procedure2_Plate2_YOURINITIALS' to indicate the best enhancement result you obtained for Plate 2 using the Procedure2 you will describe using a cut-paste repetition of the 6 previous subquestions above, etc.

etc.

Question 3: Focal deblur test

Please specify (i) all software tools or processing steps, (ii) all enhancement filters used (in order) and (iii) all specific parameter settings. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

125 cm chart:

Please save and submit your results using filename: 'Q3_125cm_YOURINITIALS' or 'Q3_125cm_LineNUMBER_YOURINITIALS'

Amped FIVE Report

Report Generation: 2015-04-23 17:07:30

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q3_125cm_ID14.jpg.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
2. Crop: *Crops a region of interest of the image.*
3. Motion Deblurring: *Corrects the blur caused by moving objects.*
4. Levels: *Adjusts intensity and color levels.*
5. Grayscale Conversion: *Converts the image to grayscale.*
6. Contrast Brightness: *Adjusts the contrast and brightness values of the image.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Random_Focus_150cm_from_lens.jpg

The path of the file to load.

2. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 1072 254 664 1127

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

3. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener filtering, having a line, long *Size* pixels with an angle of *Angle* degrees, as point spread function (PSF).

Parameters:

- **Size:** 27

Length of the blur, expressed in pixels.

- **Angle:** 59

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0062

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Edge Tapering

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 18

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
 - Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.
-

4. Levels

Adjusts intensity and color levels.

Details:

The *Levels* filter maps the values of the input image to the values of output image according to a piece-wise linear transformation controlled by the values of *Highlights*, *Midtones* and *Shadows*. The *Midtones* slider changes the intensity values of the middle range of intensity levels without significantly changing the highlights and shadows in the image. The *Highlights* and *Shadows* sliders set the black point and the white point of the image. Each channel of the input image is configured using the sliders of the corresponding parameter: *Value*, *Red*, *Green* or *Blue*. For each parameter, the histogram of the tonal range of the input image is displayed. If the input image is in grayscale, changing the setting of *Red*, *Green* and *Blue* parameters has no effect on the output image.

Parameters:

- **Value:** 237, 157, 78

Highlights, Midtones and Shadows settings used to map the pixel values of the grayscale converted image.

- **Red:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the red channel of image.

- **Green:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the blue channel of image.

- **Blue:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the green channel of image.

- **Selection:** Whole Image

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 234-241, 1989.

5. Grayscale Conversion

Converts the image to grayscale.

Details:

Grayscale Conversion produces a single channel (grayscale) image from a 3-channels (usually RGB-color) image.

Each pixel value, Y , of the output image is calculated with the following formula:

$$Y = 0.299 * R + 0.587 * G + 0.114 * B,$$

where R , G and B are respectively the red, green, and blue values of the pixel in the input image.

If the input image is already in grayscale, the output image will be a simple copy of the input one.

Parameters: This filter has no parameters.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, p. 71, 1989.

6. Contrast Brightness

Adjusts the contrast and brightness values of the image.

Details:

Contrast Brightness maps the input image values to the output image values according to a linear transformation. The mapping involves two operations, multiplication and addition with a constant respectively controlled by the *Contrast* and *Brightness* parameters. Increasing (or reducing) the *Contrast* makes the difference between light and dark areas appear sharper (or smoother). Similarly, increasing (or decreasing) the *Brightness* makes the overall image appear lighter (or darker). These changes can improve the definition of excessively dark or light areas in the image, but will tend to saturate the image if taken too far.

Parameters:

- **Contrast:** 26

Extends the intensity difference among pixel (linear gain).

- **Brightness:** 0

Adds or subtracts an offset to image pixels (bias).

- **Selection:** Whole Image

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 234-241, 1989.
-

75 cm, 4th line:

Please save and submit your results using filename: 'Q3_75cm_Line4_YOURINITIALS'

Amped FIVE Report

Report Generation: 2015-04-23 17:06:14

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q3_75cm_Line4_ID14.jpg.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
2. Crop: *Crops a region of interest of the image.*
3. Motion Deblurring: *Corrects the blur caused by moving objects.*
6. Crop: *Crops a region of interest of the image.*
5. Levels: *Adjusts intensity and color levels.*
7. Grayscale Conversion: *Converts the image to grayscale.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Random_Focus_150cm_from_lens.jpg

The path of the file to load.

2. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 352 60 752 1400

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

3. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener

filtering, having a line, long $Size$ pixels with an angle of $Angle$ degrees, as point spread function (PSF).

Parameters:

- **Size:** 13

Length of the blur, expressed in pixels.

- **Angle:** 73

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0160

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 9

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.

6. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 0 1033 749 171

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

5. Levels

Adjusts intensity and color levels.

Details:

The *Levels* filter maps the values of the input image to the values of output image according to a piece-wise linear transformation controlled by the values of *Highlights*, *Midtones* and *Shadows*. The *Midtones* slider changes the intensity values of the middle range of intensity levels without significantly changing the highlights and shadows in the image. The *Highlights* and *Shadows* sliders set the black point and the white point of the image. Each channel of the input image is configured using the sliders of the corresponding parameter: *Value*, *Red*, *Green* or *Blue*. For each parameter, the histogram of the tonal range of the input image is displayed. If the input image is in grayscale, changing the setting of *Red*, *Green* and *Blue* parameters has no effect on the output image.

Parameters:

- **Value:** 215, 163, 112

Highlights, Midtones and Shadows settings used to map the pixel values of the grayscale converted image.

- **Red:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the red channel of image.

- **Green:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the blue channel of image.

- **Blue:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the green channel of image.

- **Selection:** Whole Image

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 234-241, 1989.

7. Grayscale Conversion

Converts the image to grayscale.

Details:

Grayscale Conversion produces a single channel (grayscale) image from a 3-channels (usually RGB-color) image.

Each pixel value, Y , of the output image is calculated with the following formula:

$$Y = 0.299 * R + 0.587 * G + 0.114 * B,$$

where R , G and B are respectively the red, green, and blue values of the pixel in the input image.

If the input image is already in grayscale, the output image will be a simple copy of the input one.

Parameters: This filter has no parameters.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, p. 71, 1989.
-

75 cm, 5th line:

Please save and submit your results using filename: Q3_75cm_Line5_YOURINITIALS'

Amped FIVE Report

Report Generation: 2015-04-23 17:06:35

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q3_75cm_Line5_ID14.jpg.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
2. Crop: *Crops a region of interest of the image.*
3. Motion Deblurring: *Corrects the blur caused by moving objects.*
6. Crop: *Crops a region of interest of the image.*
5. Levels: *Adjusts intensity and color levels.*
7. Grayscale Conversion: *Converts the image to grayscale.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Random_Focus_150cm_from_lens.jpg

The path of the file to load.

2. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 352 60 752 1400

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

3. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener

filtering, having a line, long $Size$ pixels with an angle of $Angle$ degrees, as point spread function (PSF).

Parameters:

- **Size:** 13

Length of the blur, expressed in pixels.

- **Angle:** 73

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0160

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 9

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.

6. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 0 1033 749 171

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

5. Levels

Adjusts intensity and color levels.

Details:

The *Levels* filter maps the values of the input image to the values of output image according to a piece-wise linear transformation controlled by the values of *Highlights*, *Midtones* and *Shadows*. The *Midtones* slider changes the intensity values of the middle range of intensity levels without significantly changing the highlights and shadows in the image. The *Highlights* and *Shadows* sliders set the black point and the white point of the image. Each channel of the input image is configured using the sliders of the corresponding parameter: *Value*, *Red*, *Green* or *Blue*. For each parameter, the histogram of the tonal range of the input image is displayed. If the input image is in grayscale, changing the setting of *Red*, *Green* and *Blue* parameters has no effect on the output image.

Parameters:

- **Value:** 215, 163, 112

Highlights, Midtones and Shadows settings used to map the pixel values of the grayscale converted image.

- **Red:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the red channel of image.

- **Green:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the blue channel of image.

- **Blue:** 255, 127, 0

Highlights, Midtones and Shadows settings used to map the pixel values of the green channel of image.

- **Selection:** Whole Image

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 234-241, 1989.

7. Grayscale Conversion

Converts the image to grayscale.

Details:

Grayscale Conversion produces a single channel (grayscale) image from a 3-channels (usually RGB-color) image.

Each pixel value, Y , of the output image is calculated with the following formula:

$$Y = 0.299 * R + 0.587 * G + 0.114 * B,$$

where R , G and B are respectively the red, green, and blue values of the pixel in the input image.

If the input image is already in grayscale, the output image will be a simple copy of the input one.

Parameters: This filter has no parameters.

References:

- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, p. 71, 1989.
-

any other results: optional:

Please save and submit your results using filenames:
'Q3_DISTANCEcm_LineNUMBER_YOURINITIALS'

I did many other tests, with all the distances. Please check the results folder for images, projects and reports.

Question 4: Motion deblur test

Qn.4A:

Please specify (i) all software tools or processing steps, (ii) all enhancement filters used (in order) and (iii) all specific parameter settings. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

If you wish to provide results for different regions of interest in the image, please specify their coordinates and/or indicate the region in a small thumbnail, and use the filenames: "Q4A_RegionNUMBER_YOURINITIALS".

Region NUMBER 1 (whole image)

Amped FIVE Report

Report Generation: 2015-04-23 17:11:35

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q4A_Region1_ID14.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
4. Motion Deblurring: *Corrects the blur caused by moving objects.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Qn4A.png

The path of the file to load.

4. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener filtering, having a line, long *Size* pixels with an angle of *Angle* degrees, as point spread function (PSF).

Parameters:

- **Size:** 31

Length of the blur, expressed in pixels.

- **Angle:** 5

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0100

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 1

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
 - Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.
-

Region NUMBER 2 (roi 1000 458 871 459)

Amped FIVE Report

Report Generation: 2015-04-23 17:11:48

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q4A_Region2_ID14.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
5. Crop: *Crops a region of interest of the image.*
4. Motion Deblurring: *Corrects the blur caused by moving objects.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Qn4A.png

The path of the file to load.

5. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 1000 458 871 459

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

4. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener filtering, having a line, long *Size* pixels with an angle of *Angle* degrees, as point spread function (PSF).

Parameters:

- **Size:** 30

Length of the blur, expressed in pixels.

- **Angle:** 4

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0089

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 1

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.

Region NUMBER 3 (roi 37 715 871 459)

Amped FIVE Report

Report Generation: 2015-04-23 17:11:54

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q4A_Region3_ID14.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
5. Crop: *Crops a region of interest of the image.*
4. Motion Deblurring: *Corrects the blur caused by moving objects.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Qn4A.png

The path of the file to load.

5. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 37 715 871 459

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

4. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener filtering, having a line, long *Size* pixels with an angle of *Angle* degrees, as point spread function (PSF).

Parameters:

- **Size:** 36

Length of the blur, expressed in pixels.

- **Angle:** 6

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0089

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 1

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.

Region NUMBER 4 (299 1199 871 459)

Amped FIVE Report

Report Generation: 2015-04-23 17:12:09

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q4A_Region4_ID14.jpg.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
5. Crop: *Crops a region of interest of the image.*
4. Motion Deblurring: *Corrects the blur caused by moving objects.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Qn4A.png

The path of the file to load.

5. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 299 1199 871 459

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

4. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener filtering, having a line, long *Size* pixels with an angle of *Angle* degrees, as point spread function (PSF).

Parameters:

- **Size:** 34

Length of the blur, expressed in pixels.

- **Angle:** 6

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0142

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 1

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.

Region NUMBER 5 (1523 1278 568 374)

Amped FIVE Report

Report Generation: 2015-04-23 17:12:18

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q4A_Region5_ID14.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
6. Crop: *Crops a region of interest of the image.*
4. Motion Deblurring: *Corrects the blur caused by moving objects.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Qn4A.png

The path of the file to load.

6. Crop

Crops a region of interest of the image.

Details:

The *Crop* tool produces an output image which is only the selected region of the input image.

Parameters:

- **Selection:** Static Region
Reference Selection(s)
0: 1523 1278 568 374

Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

4. Motion Deblurring

Corrects the blur caused by moving objects.

Details:

Motion Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener filtering, having a line, long *Size* pixels with an angle of *Angle* degrees, as point spread function (PSF).

Parameters:

- **Size:** 32

Length of the blur, expressed in pixels.

- **Angle:** 180

Angle of the blur direction, expressed in degrees with respect to the horizontal.

- **Noise:** 0.0106

Estimate of the noise-to-signal power ratio.

- **Boundary conditions:** Symmetric

Reduce ringing artifacts near the boundaries of the image

- **Mode:** Linear

Selects if using a classical linear PSF or two isolated points to correct replica issues

- **Thickness:** 1

Thickness of the blur, expressed in pixels. This allows to consider also an optical deblurring component.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
- Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.

Qn.4B:

Please specify (i) all software tools or processing steps, (ii) all enhancement filters used (in order) and (iii) all specific parameter settings. The information you provide should have sufficient detail so that anyone could independently reproduce your results.

If you wish to provide results for different regions of interest in the image, please specify their coordinates and/or indicate the region in a small thumbnail, and use the filenames: "Q4A_RegionNUMBER_YOURINITIALS".

Region NUMBER 1: (whole image)

Amped FIVE Report

Report Generation: 2015-04-23 17:13:17

Project Name:

Author:

Description:

Amped FIVE version info:

Build date: 20150413

Revision: 6820

Platform: Microsoft Windows, 32 bit

Project File: Q4B_Region1_ID14.jpg.afp

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
2. Nonlinear Deblurring: *Corrects the blur caused by nonlinear motion.*

Details:

Summary:

Chain 1

1. Image Loader

Loads an image from file.

Details:

The *Image Loader* tool renders an image file that can be encoded in a variety of formats to a bitmap that can be displayed and processed.

Parameters:

- **File:** Qn4B.png

The path of the file to load.

2. Nonlinear Deblurring

Corrects the blur caused by nonlinear motion.

Details:

Nonlinear Deblurring reduces the blurring effect caused by objects moving too fast during the image acquisition process. The algorithm is based on a Wiener filtering, having as point spread function (PSF) a spline created by user selected points.

Parameters:

- **Points:**
1082, 825
1075, 829
1064, 830
1051, 829
1044, 823
1040, 814
1036, 806

List of the points of the blur, expressed in pixels.

- **Noise:** 0.0203

Estimate of the noise-to-signal power ratio.

References:

- J.S. Lim, Two-Dimensional Signal and Image Processing, Englewood Cliffs, Prentice Hall, NY, p. 548, equations 9.44 -- 9.46, 1990.
 - Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, pp. 276-284, 1989.
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