

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.

I run the player that you provided to me and make a snapshot of the specified sequence at the specific time.



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.

Use any space you need

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.

I run the player that you provided to me and make a snapshot of the specified sequence at the specific time.



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.

Use any space you need

Qn.1C**Frame Size of source file recording used in Qn.1A**

1008 x 767 pixels

Frame Size of source file recording used in Qn.1B

720 x 594 pixels

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 use Amped five

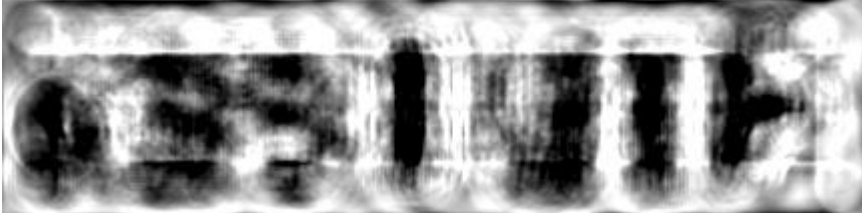
- Sequence loader(249 frames)
- Resize 3
- Choose frame 109
- Frame Average
- Super resolution
- Frame snapshot

I use adobe Photoshop software

- Crop the number plate frame
- Resize the image pixel as 118 pixel/cm
- Save image as jpeg

I use smart blur software

- Open saved picture of Adobe Photoshop
- Using the out of focus tool make radius 4.5
- Make it black and white.
- Save image as jpeg



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?.....) Use any space you need 1.

- 2.
 - 3.
 - 4.
 - 5.
- Etc

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. Use any space you need

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

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

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"

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.

Amped FIVE Report

Report Generation: 2015-04-30 10:44:13 Project Name: Author: Description: Amped FIVE
version info: Build date: 20141029 Revision: 6579 Platform: Microsoft Windows, 32 bit
TestP_7mDistance_MidElevation.dav-converted.afp **Project File:**

Exported Images

Chain 1

1. Video Loader: *Loads a video from file. (File)*
2. Rotate: *Rotates the image.*
3. Super Resolution: *Merges all frames to improve the resolution of the image.*
4. Resize: *Resizes the image.*

Details:

Summary:

Chain 1

1. **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:** Not used.

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

2. 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.

3. 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:** 2

Zoom factor for the output image.

- **Iterations:** 10

Number of deblurring steps.

- **Selection:** 141 99 41 98

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>

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:** 2091, 1707

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.

Amped FIVE Report

Report Generation: 2015-04-30 08:48:37 Project Name: Author: Description: Amped FIVE
version info: Build date: 20141029 Revision: 6579 Platform: Microsoft Windows, 32 bit

Project File:

Exported Images

Chain 1

1. Image Loader: *Loads an image from file. (File)*
2. Crop: *Crops a region of interest of the image.*
3. Super Resolution: *Merges all frames to improve the resolution of the image.*
14. Crop: *Crops a region of interest of the image.*
15. Rotate: *Rotates the image.*
16. Super Resolution: *Merges all frames to improve the resolution 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:** TestP_7mDistance_MidElevation-150430082615.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: 1536 1142 1477 2133

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. **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:** 2

Zoom factor for the output image.

- **Iterations:** 10

Number of deblurring steps.

- **Selection:** 519 352 442 1214

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>

14. 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: 1102 2869 869 259

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

15. 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:** -3

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.

16. 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:** 2

Zoom factor for the output image.

- **Iterations:** 10

Number of deblurring steps.

- **Selection:** 110 82 635 132

Region of the image to optimize.

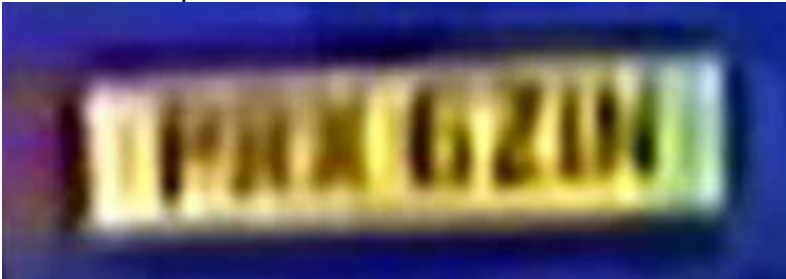
References:

- 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>

1. 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: 1, 2, 3, 4, or 5



Selected no. plate: 1



Selected no. plate: 2



Selected no. plate: 3



Selected no. plate: 4



Selected no. plate: 5



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

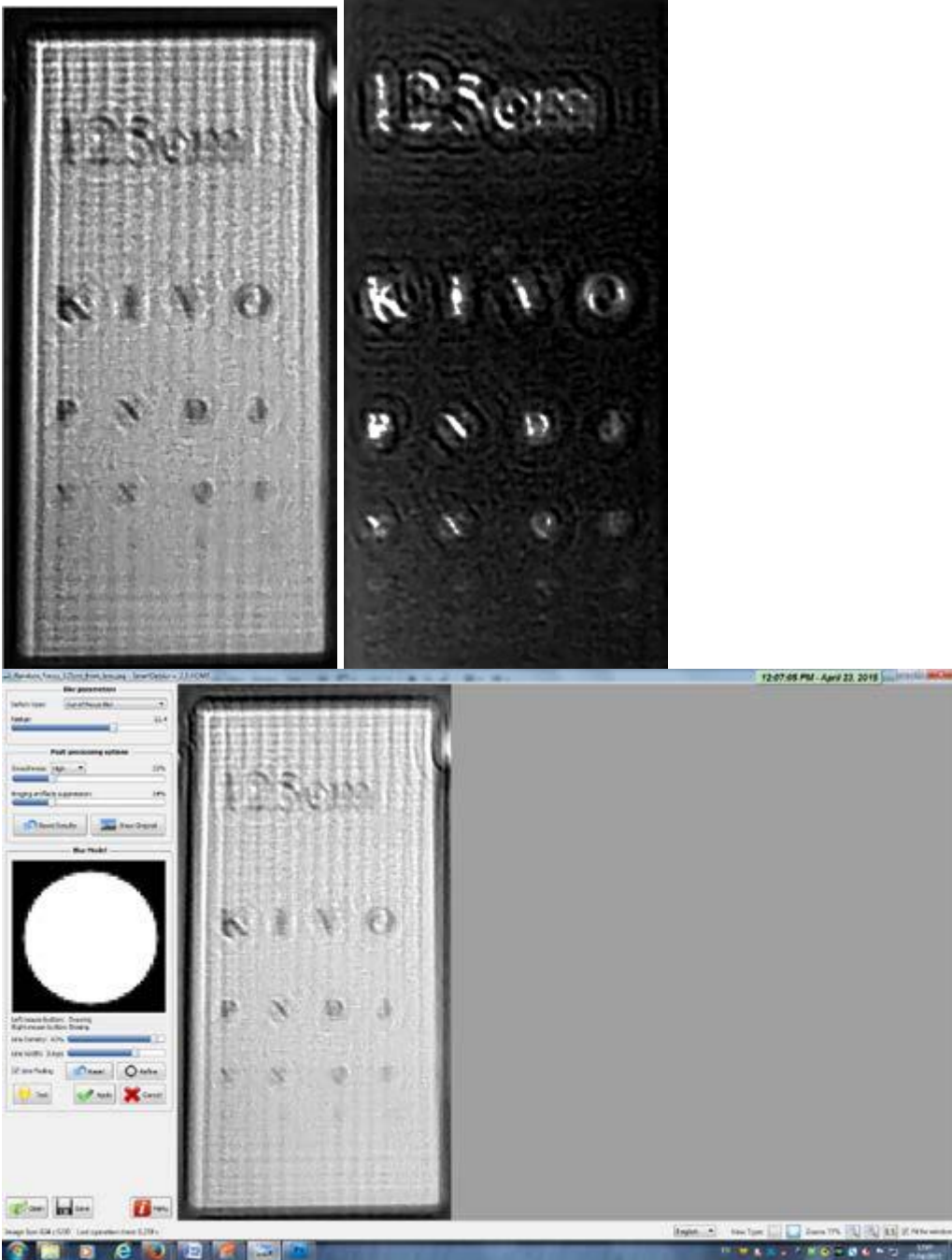
Please specify (i) all software tools or processing steps, (ii) all enhancement filters used (in order) and (iii) all specific parameter settings. The information you provide should have sufficient detail so that anyone could independently reproduce your results. **I use adobe Photoshop software**

- Crop every boxfile label frame
- Resize the image pixel as 118 pixel/cm
- Save image as jpeg

I use smart deblur software

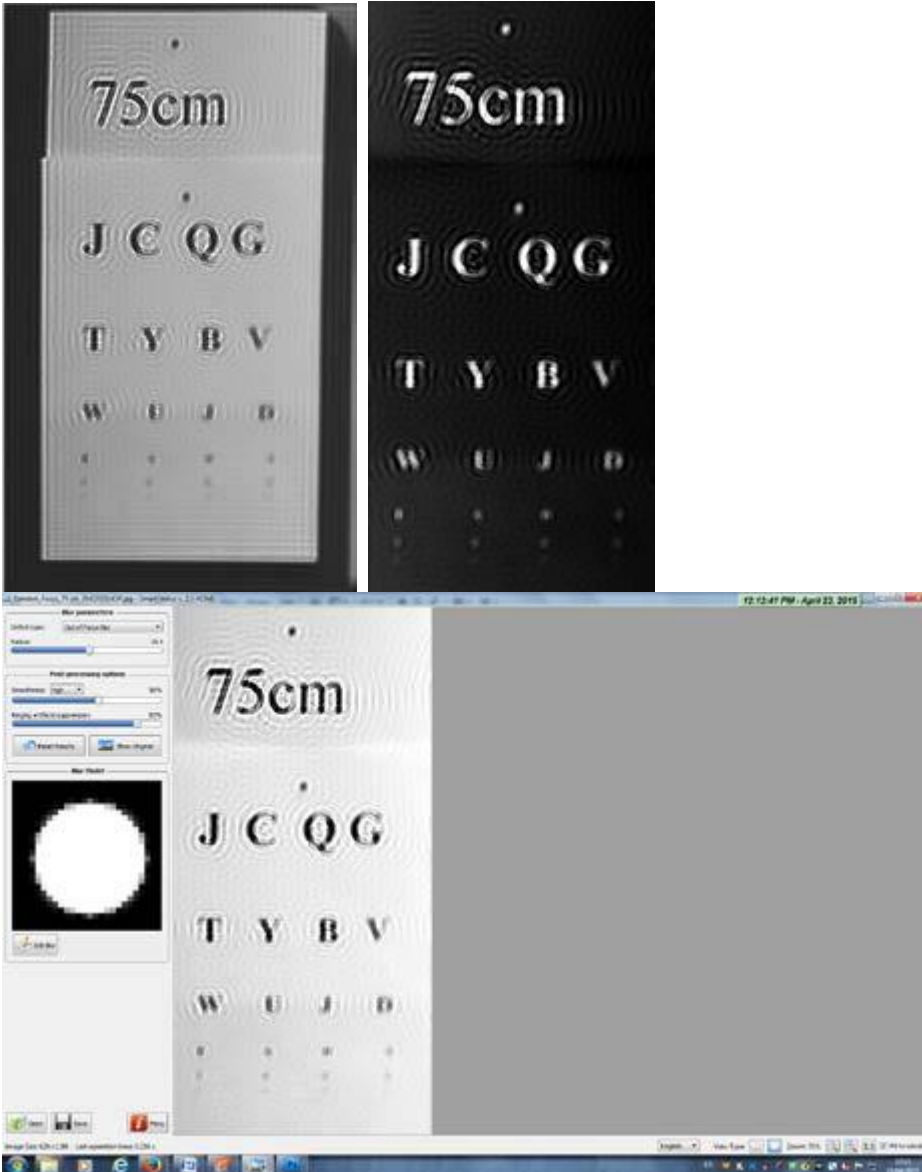
- Open every saved picture of Adobe Photoshop
- Using the out of focus tool
- Make it black and white.
- Save image as jpeg

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



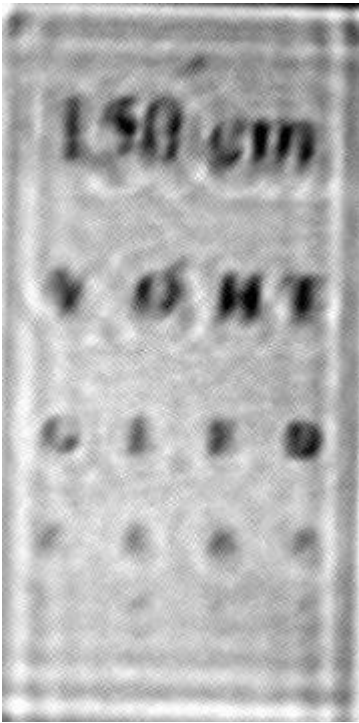
75 cm, 4th line:

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



any other results: optional:

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



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: coordinates and/or thumbnail:

Amped FIVE Report

Report Generation: 2015-04-30 11:34:24 Project Name: Author: Description: Amped FIVE version info: Build date: 20141029 Revision: 6579 Platform: Microsoft Windows, 32 bit

Qn4A-150422140200.jpg.afp **Project File:**

Exported Images

Chain 16

16. Image Loader:

Loads an image from file. (File)

31. Motion Deblurring:

Corrects the blur caused by moving objects.

Details:

Summary:

Chain 16

16. 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.

31. 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:** 7

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.



Crop 1

Amped FIVE Report

Report Generation: 2015-04-30 11:28:48 Project Name: Author: Description: Amped FIVE
version info: Build date: 20141029 Revision: 6579 Platform: Microsoft Windows, 32 bit
[Qn4A-150422135839.jpg.afp](#) **Project File:**

Exported Images

Chain 16

- | | |
|--------------------------------|---|
| 16. <u>Image Loader</u> : | <i>Loads an image from file. (File)</i> |
| 25. <u>Motion Deblurring</u> : | <i>Corrects the blur caused by moving objects.</i> |
| 26. <u>Crop</u> : | <i>Crops a region of interest of the image.</i> |
| 27. <u>Resize</u> : | <i>Resizes the image.</i> |

Details:

Summary:

Chain 16

16. 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.

25. 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:** 7

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.

26. 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: 13 775 387 225

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

27. 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:** 1161, 675

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.



Crop 2

Amped FIVE Report

Report Generation: 2015-04-30 11:36:50 Project Name: Author: Description: Amped FIVE
version info: Build date: 20141029 Revision: 6579 Platform: Microsoft Windows, 32 bit
Qn4A-150422135917.jpg.afp **Project File:**

Exported Images

Chain 16

- | | |
|--------------------------------|--|
| 16. <u>Image Loader</u> : | <i>Loads an image from file. (<u>File</u>)</i> |
| 25. <u>Motion Deblurring</u> : | <i>Corrects the blur caused by moving objects.</i> |
| 28. <u>Crop</u> : | <i>Crops a region of interest of the image.</i> |
| 29. <u>Resize</u> : | <i>Resizes the image.</i> |

Details:

Summary:

Chain 16

16. 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.

25. 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:** 7

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.

28. 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: 250 1399 787 255

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

29. 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* samples using pixel area relation. - *Lanczos* uses a Lanczos interpolation to resample pixel data.

Parameters:

- **Size:** 2361, 765

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.



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: coordinates and/or thumbnail:

I use smart deblur software

- Open every saved picture of Adobe Photoshop
- Using the motion deblur tool
- Save image as jpeg

