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

Qn.1A, if you used another method:
Please save and submit your results using the filename:
'Q1A_OtherMethod_YOURINITIALS'

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

We look at the files and their metadata. We look in the cctvcodec database to find alternative players.

Vidéo - [000001].drv
Research on http://cctvcodec.com

DVR-Player version 1.0.3.0	drv	Ernitec	Download
Ness DVR Player	drv		Download

Metadata- [000001].sig
-----BEGIN PGP SIGNATURE-----
Version: GnuPG v1.2.6 (GNU/Linux)

iD8DBQBTa9C4VjzHBgdWO+gRAjNtAJ9HCyET2eEeXCJih3ZwprtHruQ6BACeOSmT
bXg+ohNVSfsovBY8ILDJHNk=
=HuIT
-----END PGP SIGNATURE-----

We try the replay software but they only provide screen captures at display resolution with limited precision on the frame selection.

Screen capture only, Aspect ratio is not correct
The DVR Player does not allow pausing and navigating frame by frame

Playback with Forevid: does not work but provides info on the codec.

General
File ---- Work/[000001].drv
Format : AVC
Format/Info : Advanced Video Codec
File size : 8.28 MiB
Video
Format : AVC
Format/Info : Advanced Video Codec
Format profile : Baseline@L4.0
Format settings, CABAC : No
Format settings, ReFrames : 1 frame
Width : 720 pixels
Height : 288 pixels
Display aspect ratio : 2.500
Color space : YUV
Chroma subsampling : 4:2:0
Bit depth : 8 bits
Scan type : Progressive

Playback with Amped Five 6262
Conversion to avi, 720 x 288, Write Frame 1 in TIFF format
Correct aspect ratio
This frame is the result.

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

Qn.1B, if you used another method:
Please save and submit your results using the filename
'Q1B_OtherMethod_YOURINITIALS'

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

We extract the frame 4:43:30 PM GMT with DM-observer-1.18.59.exe
The software does not work properly. The following formats can be used for extraction:

-JPEG => image deformation (720 x 594) with indications on 22 top pixels
-PDF => Image deformation and text in a document
-RTF => Image deformation and text in a document

These are not convenient because of ratios and deformations.

We calculate the frame number in order to select the right frame.
FrameNum: 00017031 - FrameNum: 00016791 = 240 is the frame of interest
Total = FrameNum: 00017158 - FrameNum: 00016791 = 367

We playback and extract with Amped Five 6262
Conversion to avi, 720 x 288, 365 frames in total
Write Frame 240 in TIFF format
Size 720 x 288 pixels

Qn.1C

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

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

The real life aspect ratio might be 720 x 576 pixels. The format orientation is unusual. The images are compressed along the small axis, probably during the signal transmission and recording. The recorded image has an aspect ratio of 288 x 720 pixels. Maybe the signal is intended to be sent to a multiplex system. More details about the format, size, bit depth, video compression and other parameters of the files are hereafter.

Q1A ---- File ---- [000001].drv
FileName   : [000001].drv
Directory   : .
FileSize   : 8.3 MB
FileModifyDate   : 2014:05:08 19:45:16+02:00
FilePermissions   : rw-rw-rw-
---- ExifTool ----

---- Forevid ----
File ---- Work/[000001].drv
Format : AVC
Format/Info : Advanced Video Codec
File size : 8.28 MiB
Video
Format : AVC
Format/Info : Advanced Video Codec
Format profile : Baseline@L4.0
Format settings, CABAC : No
Format settings, ReFrames : 1 frame
Width : 720 pixels
Height : 288 pixels
Display aspect ratio : 2.500
Color space : YUV
Chroma subsampling : 4:2:0
Bit depth : 8 bits
Scan type : Progressive

Q1B ---- File ----   TestE_7mDistance_HighElevation.PAR
FileName   : TestE_7mDistance_HighElevation.PAR-converted.avi
Directory   : .
FileSize   : 6.8 MB
FileModifyDate   : 2015:04:01 19:10:18+02:00
FilePermissions   : rw-rw-rw-
FileType   : AVI
MIMEType   : video/x-msvideo
ImageWidth   : 720
ImageHeight   : 288
Planes   : 1
BitDepth   : 24
Compression   : MJPG
ImageLength   : 622080

```
PixelsPerMeterX          : 0
PixelsPerMeterY          : 0
NumColors                : Use BitDepth
NumImportantColors        : All
---- RIFF ----
FrameRate                : 50
MaxDataRate               : 0 kB/s
FrameCount               : 739
StreamCount              : 1
ImageWidth               : 720
ImageHeight              : 288
StreamType               : Video
VideoCodec               : MJPG
VideoFrameRate            : 50
VideoFrameCount           : 739
Quality                : Default
SampleSize                : Variable
Software                 : Lavf55.33.100
```

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.

   Amped Five 6262, with direct import (sequence loader) of all the files and the super-resolution algorithm. There are all the details about the operations performed.

Amped Five version info:
Build date: 20140604
Revision: 6262
Platform: Microsoft Windows, 32 bit
Project File: 2A_SuperRes0238.afp

Exported Images
Chain 1
1. Sequence Loader: Loads a list of images as video. (File)
4. Super Resolution: Merges all frames to improve the resolution of the image.
5. Image Writer: Writes the current image to a new file. (File)

Chain 1
1. 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:
SuperRes0000.bmp
SuperRes0001.bmp
SuperRes0002.bmp
SuperRes0003.bmp
SuperRes0004.bmp
…..
SuperRes0245.bmp
SuperRes0246.bmp
SuperRes0247.bmp
SuperRes0248.bmp
Fps: 25
Frame rate, in frames per second, for the resulting video.

4. 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: 100

Number of deblurring steps.

Selection: 11 15 22 6

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

5. Image Writer

Writes the current image to a new file.

Details:

The Image Writer tool encodes the current frame to the specified file with the chosen format.

Parameters:

File: SuperRes0248-150401194411.tif

Path of the image to save.

Format: Tiff

Format used to encode the image file.

Quality: 90

Quality of the image to save (the bigger is the better is).

Frame Position: 0

Position of the saved frame in the input video.

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?......)

See the details above

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.

No

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

    No

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

    See the details above

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.

   Amped Five 6262, with direct import (video loader) of the video file, all the details about the parameters are provided here.

Amped FIVE Report

Report Generation: 2015-04-02 16:16:31
Project Name:
Author:
Description:
Amped Five version info:
Build date: 20140604
Revision: 6262
Platform: Microsoft Windows, 32 bit
Project File: 2B_Super_Resolution_TestP_7mDistance_MidElevation_dav-converted.afp

Exported Images

Chain 2
2. Video Loader: Loads a video from file. (File)
8. Range Selector: Selects frames of the video within an interval with an optional step.
4. Crop: Crops a region of interest of the image.
10. Local Stabilization: Stabilizes a shaking video by keeping the current selection steady.
11. Super Resolution: Merges all frames to improve the resolution of the image.
13. Image Writer: Writes the current image to a new file. (File)
12. Image Writer: Writes the current image to a new file. (File)
14. Correct Perspective: Removes the perspective effect on a plane of interest in the image.
15. Image Writer: Writes the current image to a new file. (File)

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\ID17\Desktop\S-FIVE\Qn2b\TestP_7mDistance_MidElevation.dav

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

8. Range Selector

Selects frames of the video within an interval with an optional step.

Details:

The Range Selector tool outputs a video of specific frames that are part of the input video.

Parameters:

First Frame: 0

First frame of the selection of interest.

Last Frame: 1249

Last frame of the selection of interest.

Step: 1

Take only one frame every Step frames.

4. 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: 168 92 38 93

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

10. 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: Dynamic Tracking

Reference Selection(s)

1010: 0 0 38 93

Output Selection(s)

0: 0 0 38 93

1: 0 0 38 93

2: 0 0 38 93

…..

1245: 0 0 38 93

1246: 0 0 38 93

1247: 0 0 38 93

1248: 0 0 38 93

1249: 0 0 38 93

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

11. 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: 3
Zoom factor for the output image.
Iterations: 100
Number of deblurring steps.
Selection: 0 0 38 93
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

13. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: TestP_7mDistance_MidElevation.dav-converted-150401201040.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

12. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: TestP_7mDistance_MidElevation.dav-converted-150401200914.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

14. Correct Perspective
Removes the perspective effect on a plane of interest in the image.
Details:
Correct Perspective maps a desired quadrangular region to a rectangular one, which allows seeing the plane of interest as the plane of the image
were parallel to it. Pixel values are interpolated with a bicubic algorithm. The ratio between width and height of the region is not kept fixed, but is
chosen by the user with the proper selection.
Parameters:
Source Points: 15, 8 - 89, 5 - 101, 252 - 8, 256
Quadrilateral to transform into a rectangle.
Target Selection: 8 5 94 252

Target rectangle to map the source points to.
References:
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.
15. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: TestP_7mDistance_MidElevation.dav-converted-150401200914-150402104721_2b.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

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: 1, 2, 3, 4, and 5 (all of them)

   Decision reached how:
   We try to enhance all the plates

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 following steps are detailed above (point 1):

2. Video Loader: Loads a video from file. (File)
8. Range Selector: Selects frames of the video within an interval with an optional step.
4. Crop: Crops a region of interest of the image.
10. Local Stabilization: Stabilizes a shaking video by keeping the current selection steady.
11. Super Resolution: Merges all frames to improve the resolution of the image.
13. Image Writer: Writes the current image to a new file. (File)
12. Image Writer: Writes the current image to a new file. (File)
14. Correct Perspective: Removes the perspective effect on a plane of interest in the image.
15. Image Writer: Writes the current image to a new file. (File)

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.

x = 168, y = 92, width = 38, height = 93, see details above

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

All except the last frame that was blurred (more details above)

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

See the details on point 1.

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.

    Amped Five 6262, with direct import (video loader) of the video file, all the details about the parameters are provided here.

Amped FIVE Report

Report Generation: 2015-04-02 16:31:03
Project Name:
Author:
Description:
Amped Five version info:
Build date: 20140604
Revision: 6262
Platform: Microsoft Windows, 32 bit
Project File: Q2c_TestH_7mDistance_HighElevation_dav-converted.afp

Exported Images

Chain 2

2. Video Loader: Loads a video from file. (File)
3. Crop: Crops a region of interest of the image.
4. Local Stabilization: Stabilizes a shaking video by keeping the current selection steady.
6. Super Resolution: Merges all frames to improve the resolution of the image.
7. Image Writer: Writes the current image to a new file. (File)
8. Correct Perspective: Removes the perspective effect on a plane of interest in the image.
9. Image Writer: Writes the current image to a new file. (File)

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\ID17\Desktop\S-FIVE\Qn2c\TestH_7mDistance_HighElevation.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: 146 51 57 71
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. 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: 8 4 42 63
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. 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: 4
Zoom factor for the output image.
Iterations: 100
Number of deblurring steps.
Selection: 9 5 39 62
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

7. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:

File: TestH_7mDistance_HighElevation.dav-converted-150402103721.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

8. Correct Perspective
Removes the perspective effect on a plane of interest in the image.
Details:
Correct Perspective maps a desired quadrangular region to a rectangular one, which allows seeing the plane of interest as the plane of the image
were parallel to it. Pixel values are interpolated with a bicubic algorithm. The ratio between width and height of the region is not kept fixed, but is
chosen by the user with the proper selection.
Parameters:
Source Points: 60, 28 - 150, 21 - 163, 237 - 48, 243
Quadrilateral to transform into a rectangle.
Target Selection: 48 21 116 223
Target rectangle to map the source points to.
References:
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.

9. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: TestH_7mDistance_HighElevation.dav-converted-150402103721-150402104118.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

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: 1, 2, 3, 4, and 5 (all of them)

   Decision reached how:
   We try to enhance all the plates

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 following steps are detailed above (point 1):

2. Video Loader: Loads a video from file. (File)
3. Crop: Crops a region of interest of the image.
4. Local Stabilization: Stabilizes a shaking video by keeping the current selection steady.
6. Super Resolution: Merges all frames to improve the resolution of the image.
7. Image Writer: Writes the current image to a new file. (File)
8. Correct Perspective: Removes the perspective effect on a plane of interest in the image.
9. Image Writer: Writes the current image to a new file. (File)

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.

x = 146, y = 51, width = 57, height = 71, see details above

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

See the details on point 1.

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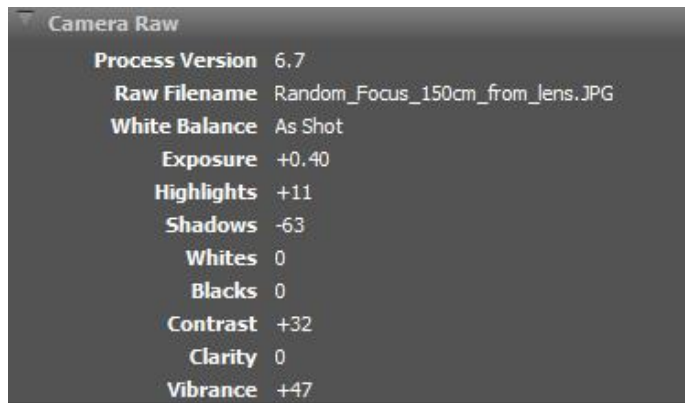
Please save and submit your results using filename:
File name: 'Q2C_SuperRes_Procedure2_Plate1_YOURINITIALS' to indicate the best enhancement result you obtained for Plate 1 using the Procedure2 you will describe using a cut-paste repetition of the 6 previous subquestions above, etc.

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

For all the charts, we use Camera Raw 8.7.1 and Adobe Photoshop CS6 to enhance the image and save it in TIFF format (8 bits per channel). The settings are saved with the file. These are as follows:

Camera Raw	
Process Version	6.7
Raw Filename	Random_Focus_150cm_from_lens.JPG
White Balance	As Shot
Exposure	+0.40
Highlights	+11
Shadows	-63
Whites	0
Blacks	0
Contrast	+32
Clarity	0
Vibrance	+47

The following chains of operations are tried with Amped Five 6262. The parameters are listed for each operation. Finally, the TIFF file processed as explained above is loaded and the Chain 17 is applied to obtain the final results.

Chain 17 (more details hereafter)
17. Image Loader: Loads an image from file. (File)
20. Color Deconvolution: Maximizes the differences between specific colors in the image.
21. Image Writer: Writes the current image to a new file. (File)

Amped FIVE Report
Report Generation: 2015-04-02 13:21:29
Project Name:
Author:
Description:
Amped Five version info:
Build date: 20140604
Revision: 6262
Platform: Microsoft Windows, 32 bit
Project File: Random_Focus_150cm_from_lens_Deblur.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. Optical Deblurring: Corrects the blur of objects that are out of focus (big blur).
5. Blind Deconvolution: Corrects the blur of objects out of focus with blind deconvolution (little blur).
15. Color Deconvolution: Maximizes the differences between specific colors in the image.
16. Image Writer: Writes the current image to a new file. (File)
Chain 17
17. Image Loader: Loads an image from file. (File)
20. Color Deconvolution: Maximizes the differences between specific colors in the image.
21. Image Writer: Writes the current image to a new file. (File)

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: ../../../../Desktop/S-FIVE/Q3/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: 1166 340 506 1101
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. 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 radius Radius 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: 15
The diameter of a circle encompassing the blur.
Noise: 0.0212
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.
5. Blind Deconvolution
Corrects the blur of objects out of focus with blind deconvolution (little blur).
Details:
Blind Deconvolution reduces the blurring effect caused by wrong focus settings during the image acquisition process. The filter is based on the

blind deconvolution algorithm, having a circle of diameter equal to Size as point spread function (PSF).

The filter strength is adjusted by the parameter Iterations which indicates the number of times the filter is applied.

In order to reduce the ringing effect, it is possible to set the Noise parameter, which represents the estimated noise-to-signal power ratio of the image.

Parameters:

Size: 6

Point Spread Function (PSF) size of the blur.

Iterations: 10

Number of times the filter is applied.

Noise: 0.0100

Estimate of the noise-to-signal power ratio.

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. 322-323, 1989.

15. Color Deconvolution

Maximizes the differences between specific colors in the image.

Details:

Color Deconvolution allows to separate or extract different colors in an image, changing the standard RGB color space to a new one which maximizes the differences between user selected colors.

Parameters:

Desired Color Point: 56, 476

Coordinates of the point used to sample the desired color to extract

Undesired Color Point: 86, 461

Coordinates of the point used to sample the unwanted color to remove

Background Color Point: 126, 386

Coordiantes of the point used to sample the background color

Size: 1

Size of the window to average to calculate color values.

References:

Berger CE, de Koeijer JA, Glas W, Madhuizen HT, Color separation in forensic image processing, J Forensic Sci. 2006 Jan;51(1):100-2.

16. Image Writer

Writes the current image to a new file.

Details:

The Image Writer tool encodes the current frame to the specified file with the chosen format.

Parameters:

File: ../../../../Desktop/S-FIVE/Q3/Random_Focus_150cm_from_lens-150402111940.tif

Path of the image to save.

Format: Tiff

Format used to encode the image file.

Quality: 90

Quality of the image to save (the bigger is the better is).

Frame Position: 0

Position of the saved frame in the input video.

Chain 17

17. 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: ../../../../Desktop/S-FIVE/Q3/Random_Focus_150cm_from_lensT.tif
The path of the file to load.

20. Color Deconvolution
Maximizes the differences between specific colors in the image.
Details:
Color Deconvolution allows to separate or extract different colors in an image, changing the standard RGB color space to a new one which
maximizes the differences between user selected colors.
Parameters:
Desired Color Point: 336, 547
Coordinates of the point used to sample the desired color to extract
Undesired Color Point: 330, 575
Coordinates of the point used to sample the unwanted color to remove
Background Color Point: 420, 481
Coordiantes of the point used to sample the background color
Size: 1
Size of the window to average to calculate color values.
References:
Berger CE, de Koeijer JA, Glas W, Madhuizen HT, Color separation in forensic image processing, J Forensic Sci. 2006 Jan;51(1):100-2.

21. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: ../../../../Desktop/S-FIVE/Q3/Random_Focus_150cm_from_lensT-150402132109.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

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

Same operations as described above

75 cm, 4th line:

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

Same operations as described above

75 cm, 5th line:
Please save and submit your results using filename: Q3_75cm_Line5_YOURINITIALS'

Same operations as described above

any other results: optional:
Please save and submit your results using filenames:
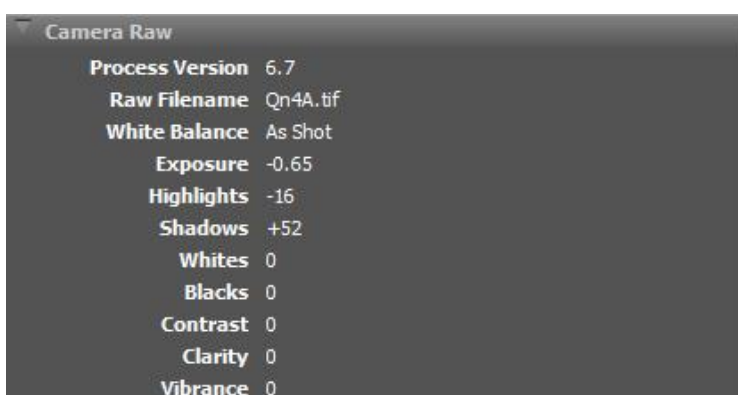'Q3_DISTANCEcm_LineNUMBER_YOURINITIALS'

Use any space you need

Question 4: Motion deblur test

Qn.4A:

Please specify (i) <u>all software tools or processing steps</u>, (ii) <u>all enhancement filters</u> used (in order) and (iii) <u>all specific parameter settings.</u> 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".

For the entire image, we use Camera Raw 8.7.1 and Adobe Photoshop CS6 to enhance the image and save it in TIFF format (8 bits per channel). The settings are saved with the file. These are as follows:

```
▼ Camera Raw
     Process Version  6.7
      Raw Filename  Qn4A.tif
      White Balance  As Shot
          Exposure  -0.65
         Highlights  -16
          Shadows  +52
           Whites  0
            Blacks  0
          Contrast  0
            Clarity  0
          Vibrance  0
```

Region 1: coordinates and/or thumbnail: x = 93, y = 819
Chain 1 is applied on this region.

Region 2: coordinates and/or thumbnail: x = 398, y = 1488
Chain 6 is applied on this region.

Region 3: coordinates and/or thumbnail: x = 1671, y = 1445
Chain 11 is applied on this region.

Region 4: coordinates and/or thumbnail: x = 1181, y = 1655
Chain 19 is applied on this region.

Region 5: coordinates and/or thumbnail: x = 1105, y = 698
Chain 27 is applied on this region.

The following chains of operations are performed with Amped Five 6262. The details of operations and parameters of each chain are detailed hereafter.

Amped FIVE Report

Report Generation: 2015-04-02 14:09:02
Project Name:
Author:
Description:
Amped Five version info:
Build date: 20140604
Revision: 6262
Platform: Microsoft Windows, 32 bit
Project File: Qn4AT_t.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. Color Deconvolution: Maximizes the differences between specific colors in the image.
5. Image Writer: Writes the current image to a new file. (File)

Chain 6
6. Image Loader: Loads an image from file. (File)
7. Crop: Crops a region of interest of the image.
8. Motion Deblurring: Corrects the blur caused by moving objects.
9. Curves: Adjusts the tone values according to the desired curve.
10. Image Writer: Writes the current image to a new file. (File)

Chain 11
11. Image Loader: Loads an image from file. (File)
12. Crop: Crops a region of interest of the image.
13. Motion Deblurring: Corrects the blur caused by moving objects.
16. Negative: Negative of the image.
17. Curves: Adjusts the tone values according to the desired curve.
18. Image Writer: Writes the current image to a new file. (File)

Chain 19
19. Image Loader: Loads an image from file. (File)
20. Crop: Crops a region of interest of the image.
22. Motion Deblurring: Corrects the blur caused by moving objects.
23. Channel Mixer: Mixes the ratio of color in every channel.
24. Negative: Negative of the image.
25. Curves: Adjusts the tone values according to the desired curve.
26. Image Writer: Writes the current image to a new file. (File)

Chain 27
27. Image Loader: Loads an image from file. (File)
28. Crop: Crops a region of interest of the image.
29. Motion Deblurring: Corrects the blur caused by moving objects.
30. Channel Mixer: Mixes the ratio of color in every channel.
31. Negative: Negative of the image.
32. Correct Perspective: Removes the perspective effect on a plane of interest in the image.
33. Image Writer: Writes the current image to a new file. (File)

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: Qn4AT_t.tif
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: 93 819 185 104
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: 34
Length of the blur, expressed in pixels.
Angle: 3
Angle of the blur direction, expressed in degrees with respect to the horizontal.
Noise: 0.0100
Estimate of the noise-to-signal power ratio.
Mode: Linear
Selects if using a classical linear PSF or two isolated points to correct replica issues
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. Color Deconvolution
Maximizes the differences between specific colors in the image.
Details:
Color Deconvolution allows to separate or extract different colors in an image, changing the standard RGB color space to a new one which
maximizes the differences between user selected colors.
Parameters:
Desired Color Point: 55, 49
Coordinates of the point used to sample the desired color to extract
Undesired Color Point: 52, 63
Coordinates of the point used to sample the unwanted color to remove
Background Color Point: 19, 37
Coordiantes of the point used to sample the background color
Size: 1
Size of the window to average to calculate color values.
References:

Berger CE, de Koeijer JA, Glas W, Madhuizen HT, Color separation in forensic image processing, J Forensic Sci. 2006 Jan;51(1):100-2.

5. Image Writer

Writes the current image to a new file.

Details:

The Image Writer tool encodes the current frame to the specified file with the chosen format.

Parameters:

File: Qn4AT_93_819_1.tif

Path of the image to save.

Format: Tiff

Format used to encode the image file.

Quality: 100

Quality of the image to save (the bigger is the better is).

Frame Position: 0

Position of the saved frame in the input video.

Chain 6

6. 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: Qn4AT_t.tif

The path of the file to load.

7. 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: 398 1488 436 66

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. 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: 33

Length of the blur, expressed in pixels.

Angle: 7

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

Noise: 0.0111

Estimate of the noise-to-signal power ratio.

Mode: Linear

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

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.

9. Curves

Adjusts the tone values according to the desired curve.
Details:
The Curves filter maps the input image values to the output image values according to the drawn curve: the x coordinate of the curve is mapped to
the corresponding y value. Every RGB channel of the image is processed according to the respective color curve. Then all the channels are also
processed in the same way by the Value curve.
Parameters:
Value:
0, 0
41, 26
91, 107
255, 252
Points representing the value transformation curve.
Red:
0, 0
255, 255
Points representing the red transformation curve.
Green:
0, 0
255, 255
Points representing the green transformation curve.
Blue:
0, 0
255, 255
Points representing the blue transformation curve.
Mode: Spline
Interpolation mode for the intensity curve.
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.

10. Image Writer

Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: Qn4AT_398_1488_2.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 100
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

Chain 11

11. 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: Qn4AT_t.tif

The path of the file to load.

12. 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: 1671 1445 275 84

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

13. 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: 0

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

Noise: 0.0100

Estimate of the noise-to-signal power ratio.

Mode: Linear

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

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.

16. Negative

Negative of the image.

Details:

The Negative tool calculates the negative of the image, by subtracting the value of each pixel to the maximum intensity value (255).

Parameters: This filter has no parameters.

References:

Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, p. 238, 1989.

17. Curves

Adjusts the tone values according to the desired curve.

Details:

The Curves filter maps the input image values to the output image values according to the drawn curve: the x coordinate of the curve is mapped to

the corresponding y value. Every RGB channel of the image is processed according to the respective color curve. Then all the channels are also

processed in the same way by the Value curve.
Parameters:
Value:
0, 0
79, 43
197, 196
255, 255
Points representing the value transformation curve.
Red:
0, 0
255, 255
Points representing the red transformation curve.
Green:
0, 0
255, 255
Points representing the green transformation curve.
Blue:
0, 0
255, 255
Points representing the blue transformation curve.
Mode: Spline
Interpolation mode for the intensity curve.
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.
18. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: Qn4AT_16671_1445.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 100
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

Chain 19
19. 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: Qn4AT_t.tif
The path of the file to load.
20. 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: 1181 1155 201 261
Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

22. 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: 3
Angle of the blur direction, expressed in degrees with respect to the horizontal.
Noise: 0.0100
Estimate of the noise-to-signal power ratio.
Mode: Linear
Selects if using a classical linear PSF or two isolated points to correct replica issues
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.

23. Channel Mixer
Mixes the ratio of color in every channel.
Details:
Channel Mixer allows to map in a custom mode the proportion of amount of every color in every channel.
The value of each RGB components of every pixel in the output image is calculated weighting the value of RGB components of the same pixel in
the input image accordingly to the parameters value specified for every channel, or for Value if setting Mode to Grayscale. The value is then
multiplied for the Constant specified for the channel.
Parameters:
Mode: Grayscale
Color mode: Value settings work only in Grayscale mode; Red, Green and Blue settings work only in Color mode.
Value Red: 23
Percentage of the Red value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Green: 72
Percentage of the Green value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Blue: -23
Percentage of the Blue value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Constant: 8
Percentage of the combination of colors which will be added to the overall value.

Red Red: 67
Percentage of the Red value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Green: 0
Percentage of the Green value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Blue: 0
Percentage of the Blue value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Constant: 0
Percentage of the combination of colors which will be added to the overall red value.
Green Red: 0
Percentage of the Red value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Green: 79
Percentage of the Green value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Blue: 0
Percentage of the Blue value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Constant: 0
Percentage of the combination of colors which will be added to the overall green value.
Blue Red: 0
Percentage of the Red value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Green: 0
Percentage of the Green value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Blue: 90
Percentage of the Blue value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Constant: 0
Percentage of the combination of colors which will be added to the overall blue value.
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.

24. Negative
Negative of the image.
Details:
The Negative tool calculates the negative of the image, by subtracting the value of each pixel to the maximum intensity value (255).
Parameters: This filter has no parameters.
References:
Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, p. 238, 1989.

25. Curves
Adjusts the tone values according to the desired curve.
Details:
The Curves filter maps the input image values to the output image values according to the drawn curve: the x coordinate of the curve is mapped to
the corresponding y value. Every RGB channel of the image is processed according to the respective color curve. Then all the channels are also

processed in the same way by the Value curve.
Parameters:
Value:
0, 0
48, 59
204, 199
255, 255
Points representing the value transformation curve.
Red:
0, 0
255, 255
Points representing the red transformation curve.
Green:
0, 0
255, 255
Points representing the green transformation curve.
Blue:
0, 0
255, 255
Points representing the blue transformation curve.
Mode: Spline
Interpolation mode for the intensity curve.
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.
26. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: Qn4AT_1181_1155.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 100
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

Chain 27
27. 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: Qn4AT_t.tif
The path of the file to load.
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: 1105 698 234 431
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. 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: 4
Angle of the blur direction, expressed in degrees with respect to the horizontal.
Noise: 0.0100
Estimate of the noise-to-signal power ratio.
Mode: Linear
Selects if using a classical linear PSF or two isolated points to correct replica issues
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.

30. Channel Mixer
Mixes the ratio of color in every channel.
Details:
Channel Mixer allows to map in a custom mode the proportion of amount of every color in every channel.
The value of each RGB components of every pixel in the output image is calculated weighting the value of RGB components of the same pixel in
the input image accordingly to the parameters value specified for every channel, or for Value if setting Mode to Grayscale. The value is then
multiplied for the Constant specified for the channel.
Parameters:
Mode: Grayscale
Color mode: Value settings work only in Grayscale mode; Red, Green and Blue settings work only in Color mode.
Value Red: 49
Percentage of the Red value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Green: 54
Percentage of the Green value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Blue: -3
Percentage of the Blue value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Constant: 5
Percentage of the combination of colors which will be added to the overall value.

Red Red: 100
Percentage of the Red value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Green: 0
Percentage of the Green value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Blue: 0
Percentage of the Blue value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Constant: 0
Percentage of the combination of colors which will be added to the overall red value.
Green Red: 0
Percentage of the Red value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Green: 100
Percentage of the Green value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Blue: 0
Percentage of the Blue value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Constant: 0
Percentage of the combination of colors which will be added to the overall green value.
Blue Red: 0
Percentage of the Red value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Green: 0
Percentage of the Green value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Blue: 100
Percentage of the Blue value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Constant: 0
Percentage of the combination of colors which will be added to the overall blue value.
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.

31. Negative
Negative of the image.
Details:
The Negative tool calculates the negative of the image, by subtracting the value of each pixel to the maximum intensity value (255).
Parameters: This filter has no parameters.
References:
Anil. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, p. 238, 1989.

32. Correct Perspective
Removes the perspective effect on a plane of interest in the image.
Details:
Correct Perspective maps a desired quadrangular region to a rectangular one, which allows seeing the plane of interest as the plane of the image
were parallel to it. Pixel values are interpolated with a bicubic algorithm. The ratio between width and height of the region is not kept fixed, but is

chosen by the user with the proper selection.
Parameters:
Source Points: 38, 23 - 178, 10 - 185, 386 - 22, 400
Quadrilateral to transform into a rectangle.
Target Selection: 22 10 164 391
Target rectangle to map the source points to.
References:
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.
33. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: Qn4AT_1105_698.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
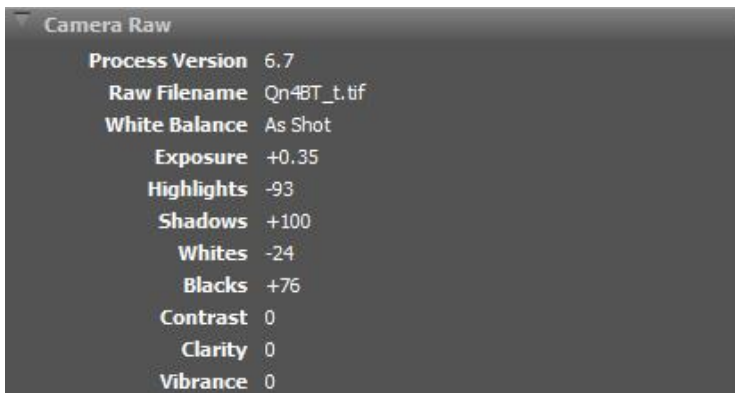Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

Qn.4B:

Please specify (i) <u>all software tools or processing steps</u>, (ii) <u>all enhancement filters</u> used (in order) and (iii) <u>all specific parameter settings.</u> 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".

For the entire image, we use Camera Raw 8.7.1 and Adobe Photoshop CS6 to enhance the image and save it in TIFF format (8 bits per channel). The settings are saved with the file. These are as follows:

```
Camera Raw
        Process Version  6.7
        Raw Filename  Qn4BT_t.tif
        White Balance  As Shot
            Exposure  +0.35
          Highlights  -93
            Shadows  +100
             Whites  -24
             Blacks  +76
           Contrast  0
            Clarity  0
           Vibrance  0
```

Region 1: coordinates and/or thumbnail: x = 1666, y = 894
Chain 1 is applied on this region.

Region 2: coordinates and/or thumbnail: x = 25, y = 1265
Chain 2 is applied on this region.

Region 3: coordinates and/or thumbnail: x = 526, y = 786
Chain 3 is applied on this region.

The following chains of operations are performed with Amped Five 6262. The details of operations and parameters of each chain are detailed hereafter.

Amped FIVE Report

Report Generation: 2015-04-02 15:34:19
Project Name:
Author:
Description:
Amped Five version info:
Build date: 20140604
Revision: 6262
Platform: Microsoft Windows, 32 bit
Project File: Qn4BT_t.afp

Exported Images

Chain 1
1. Image Loader: Loads an image from file. (File)
11. Nonlinear Deblurring: Corrects the blur caused by nonlinear motion.
4. Crop: Crops a region of interest of the image.
12. Correct Perspective: Removes the perspective effect on a plane of interest in the image.
13. Channel Mixer: Mixes the ratio of color in every channel.
14. Image Writer: Writes the current image to a new file. (File)

Chain 2
15. Image Loader: Loads an image from file. (File)
27. Curves: Adjusts the tone values according to the desired curve.
16. Nonlinear Deblurring: Corrects the blur caused by nonlinear motion.
17. Crop: Crops a region of interest of the image.
34. Image Writer: Writes the current image to a new file. (File)

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: Qn4BT_t.tif
The path of the file to load.
11. 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 a as point spread function (PSF) a spline created by user selected points.
Parameters:
Points:
1771, 1522
1777, 1524
1784, 1558
1789, 1569
1796, 1574
1807, 1574
List of the points of the blur, expressed in pixels.
Noise: 0.0100
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.
4. 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: 1666 894 245 412
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. Correct Perspective
Removes the perspective effect on a plane of interest in the image.

Details:
Correct Perspective maps a desired quadrangular region to a rectangular one, which allows seeing the plane of interest as the plane of the image
were parallel to it. Pixel values are interpolated with a bicubic algorithm. The ratio between width and height of the region is not kept fixed, but is
chosen by the user with the proper selection.
Parameters:
Source Points: 7, 11 - 182, 9 - 245, 371 - 65, 378
Quadrilateral to transform into a rectangle.
Target Selection: 7 11 227 368
Target rectangle to map the source points to.
References:
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.

13. Channel Mixer
Mixes the ratio of color in every channel.
Details:
Channel Mixer allows to map in a custom mode the proportion of amount of every color in every channel.
The value of each RGB components of every pixel in the output image is calculated weighting the value of RGB components of the same pixel in
the input image accordingly to the parameters value specified for every channel, or for Value if setting Mode to Grayscale. The value is then
multiplied for the Constant specified for the channel.
Parameters:
Mode: Grayscale
Color mode: Value settings work only in Grayscale mode; Red, Green and Blue settings work only in Color mode.
Value Red: 21
Percentage of the Red value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Green: 59
Percentage of the Green value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Blue: 26
Percentage of the Blue value of the input image which will be mixed in Value of the output pixel for Grayscale mode.
Value Constant: 13
Percentage of the combination of colors which will be added to the overall value.
Red Red: 100
Percentage of the Red value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Green: 0
Percentage of the Green value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Blue: 0
Percentage of the Blue value of the input image which will be mixed in the Red value of the output pixel for Color mode.
Red Constant: 0
Percentage of the combination of colors which will be added to the overall red value.
Green Red: 0

Percentage of the Red value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Green: 100
Percentage of the Green value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Blue: 0
Percentage of the Blue value of the input image which will be mixed in the Green value of the output pixel for Color mode.
Green Constant: 0
Percentage of the combination of colors which will be added to the overall green value.
Blue Red: 0
Percentage of the Red value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Green: 0
Percentage of the Green value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Blue: 100
Percentage of the Blue value of the input image which will be mixed in the Blue value of the output pixel for Color mode.
Blue Constant: 0
Percentage of the combination of colors which will be added to the overall blue value.
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.
14. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: Qn4BT_1666_894.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

Chain 2
15. 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: Qn4BT_tT1.tif
The path of the file to load.
27. Curves
Adjusts the tone values according to the desired curve.
Details:

The Curves filter maps the input image values to the output image values according to the drawn curve: the x coordinate of the curve is mapped to
the corresponding y value. Every RGB channel of the image is processed according to the respective color curve. Then all the channels are also
processed in the same way by the Value curve.
Parameters:
Value:
0, 0
34, 30
118, 90
231, 174
255, 255
Points representing the value transformation curve.
Red:
0, 0
121, 120
255, 255
Points representing the red transformation curve.
Green:
0, 0
255, 255
Points representing the green transformation curve.
Blue:
0, 0
119, 117
255, 255
Points representing the blue transformation curve.
Mode: Spline
Interpolation mode for the intensity curve.
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.

16. 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 a as point spread function (PSF) a spline created by user selected points.
Parameters:
Points:
133, 1292
137, 1293
138, 1297
142, 1315
144, 1322
179, 1315
List of the points of the blur, expressed in pixels.
Noise: 0.0100
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.

17. 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: 25 1265 184 80
Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.

34. Image Writer
Writes the current image to a new file.
Details:
The Image Writer tool encodes the current frame to the specified file with the chosen format.
Parameters:
File: Qn4BT_25_1265.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.

Chain 3
36. 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: Qn4BT_tT1.tif
The path of the file to load.
37. 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: 526 786 237 91
Selection where the filter is applied. It may be the whole image, a static region, or a region containing a tracked object of interest.
42. Color Deconvolution
Maximizes the differences between specific colors in the image.
Details:
Color Deconvolution allows to separate or extract different colors in an image, changing the standard RGB color space to a new one which
maximizes the differences between user selected colors.

Parameters:

Desired Color Point: 126, 62

Coordinates of the point used to sample the desired color to extract

Undesired Color Point: 115, 34

Coordinates of the point used to sample the unwanted color to remove

Background Color Point: 172, 36

Coordiantes of the point used to sample the background color

Size: 1

Size of the window to average to calculate color values.

References:

Berger CE, de Koeijer JA, Glas W, Madhuizen HT, Color separation in forensic image processing, J Forensic Sci. 2006 Jan;51(1):100-2.

43. Curves

Adjusts the tone values according to the desired curve.

Details:

The Curves filter maps the input image values to the output image values according to the drawn curve: the x coordinate of the curve is mapped to

the corresponding y value. Every RGB channel of the image is processed according to the respective color curve. Then all the channels are also

processed in the same way by the Value curve.

Parameters:

Value:

0, 0

23, 34

82, 77

135, 146

206, 191

255, 255

Points representing the value transformation curve.

Red:

0, 0

255, 255

Points representing the red transformation curve.

Green:

0, 0

255, 255

Points representing the green transformation curve.

Blue:

0, 0

255, 255

Points representing the blue transformation curve.

Mode: Spline

Interpolation mode for the intensity curve.

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.

44. Image Writer

Writes the current image to a new file.

Details:

The Image Writer tool encodes the current frame to the specified file with the chosen format.

Parameters:

File: Qn4BT_526_786.tif
Path of the image to save.
Format: Tiff
Format used to encode the image file.
Quality: 90
Quality of the image to save (the bigger is the better is).
Frame Position: 0
Position of the saved frame in the input video.