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CS 6475 Final Exam (Fall 2017)

Part 1 of 33 - Prelim

Question 1 of 36

I certify that

- [x] A. I am talking this exam solely and entirely on my own, without any help from
- [x] B. I am aware of the Georgia Tech Honor Code (link) and I affirm to here, as I
- [x] C. I am the student who is enrolled in this class
- [x] D. I will NOT print or save any part of this exam, for any purpose whatsoever.

Feedback: Thanks.

Part 2 of 33 - 1

Question 2 of 36

[CP02a3] Consider an RGB Image where each channel is 8 bits. The resolution of

- ( ) A.52488 Kilobytes
- ( ) B.8192 Megabytes
- (•) C.4299816960 bits
- ( ) D.69984 Kilo Bytes

Feedback: REMEMBER

W x H x BitsPerPixelPerChannel x Number of Channels / 8192

How many channels in an RGB image?
8 BitsPerPixel
8192 is the number of bits in a kilobyte. (Confirm this using your Interet Search

Part 3 of 33 - 2

Question 3 of 36

[CP02b2] Which of the following is an accurate description of an Image Histogram

- [ ] A. This is less useful when using a camera raw image format, as the dynamic
- [x] B. By looking at the histogram for a specific image, one is able to judge the er
- [x] C. Can be separate for each channel.
- [ ] D. Photographers can use them as an aid to show the distribution of intensity
- [x] E. It plots the number of pixels at each intensity value.
- [ ] F. Should not ever be applied to subregions of images separately.

G. It plots the number of intensities for each pixel value.

Feedback: Please review the material in lecture 02-1 and 03-4. Also see the Wik

Part 4 of 33 - 3

Question 4 of 36

[CP02c1] The attached image is the equation of the blend mode "Overlay." Which

$$f_{blend}(a,b) = <$$

- [x] A. It combines the "Lighten" and the "Darken" blend modes depending on the
- [ ] B. It is the reason we see the green effect in the lecture videos.
- [x] C. The parts of the top layer where the base layer is light become brighter, an
- [ ] D. It models the Dodge blend mode, well-known by dark room photographers.
- [x] E. It combines the "Multiply" and the "Screen" blend modes depending on the

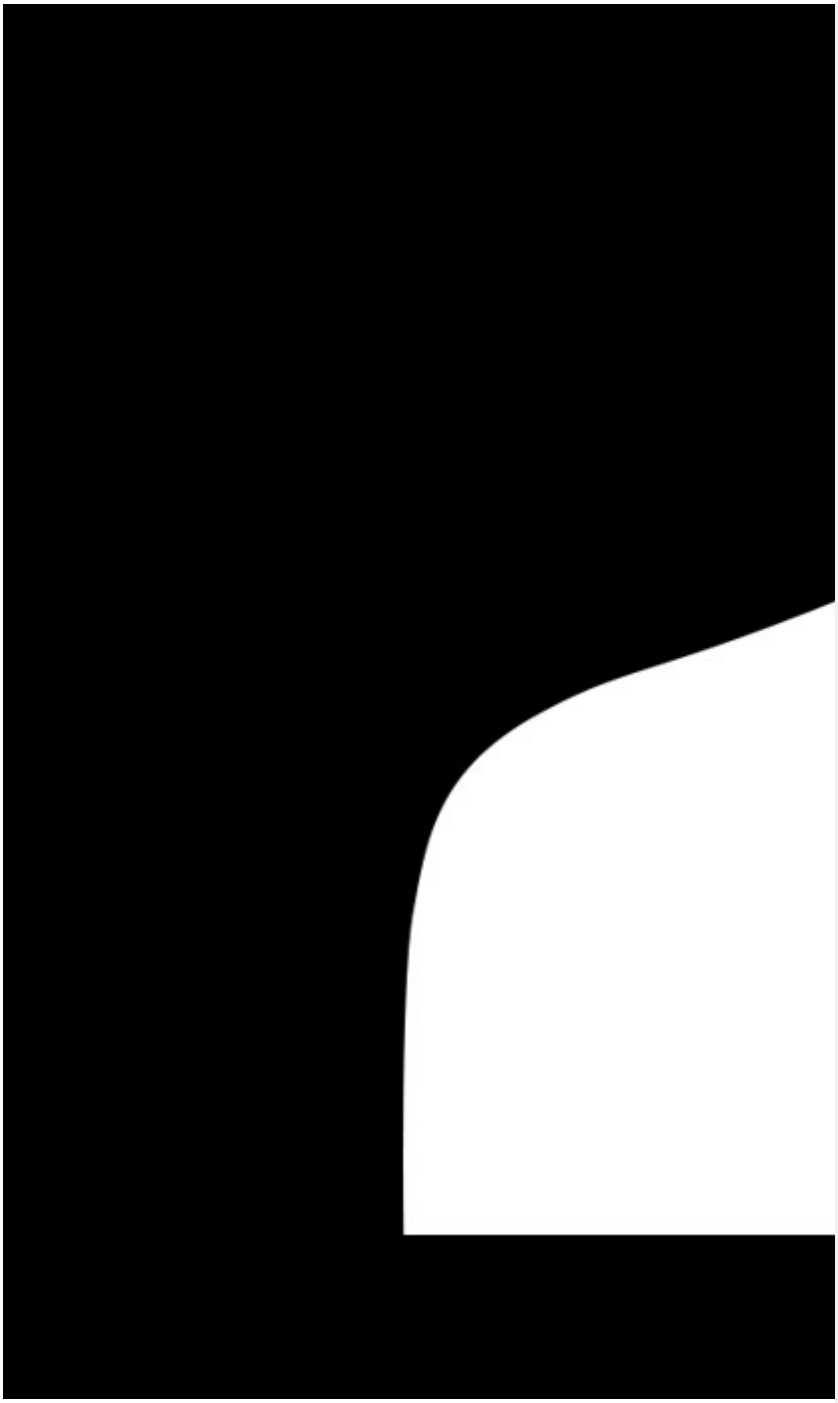
Feedback: Review Lecture "Digital Images" or Lecture 02-3

Part 5 of 33 - 5

Question 5 of 36

[CP02d2] Given $Image_1$, which is simply a background, and $Image_2$, which is exac

By "separates", we mean creates an image with white pixels where the subject is



A.

1. Multiply $Image_2$ by $Image_1$: (Out = $Image_2$ X $Image_1$)
2. Scale output to range 0-255
3. Convert output image to binary, with a threshold: Mask = Binary(Out, thres

B.

1. Add $Image_2$ to $Image_1$: (Out = $Image_2$ + $Image_1$)
2. Scale output to range 0-255
3. Convert output image to binary, with a threshold: Mask = Binary (Out, thre

C.

1. Subtract $Image_2$ from $Image_1$: (Out = $Image_2$ - $Image_1$)
2. Convert output image to binary, with a threshold: Mask = Binary (Out, thres

D.

1. Subtract $Image_2$ from $Image_1$: (Out = $Image_2$ - $Image_1$)
2. Multiply output image by $Image_2$, Mask = Out X $Image_2$

Feedback: Lecture "Digital Images" and Lecture 02-2 explains this.

Part 6 of 33 - 2d1

Question 6 of 36

[CP02d11] Arithmetic overflow and underflow can be avoided by increasing the d

- (•) True
- ( ) False

Feedback: Correct! Changing precision before calculations can address overflow

Part 7 of 33 - 6

Question 7 of 36

[CP02e1] Convolution is ... (select the correct statements)

- [x] A. Commutative: F * G = G * F
- [ ] B. a measure of similarity of two waveforms
- [x] C. an operation that calculates the area of overlap between two functions
- [ ] D. a sliding dot product or sliding inner-product
- [x] E. Associative: (F * G) * H = F * (G * H)
- [x] F. equivalent to cross-correlation when the kernel is symmetric in both x and y

Feedback: Lectures 02-5/6

Part 8 of 33 - 6

Question 8 of 36

[CP02f1] See the attached equation. Select the choices below which are correct,

$$G[i,j] = \frac{}{(2k$$

- [x] A. This is the equation for cross-correlation with uniform weights over a neighl
- [ ] B. This is the general form of an equation for convolution over a neighborhoo
- [ ] C. This equation only applies Gaussian kernels, as weights are distributed ac
- [x] D. This is the equation for convolution with uniform weights over a neighborhc
- [x] E. This equation only applies to square or average smoothing, as weights are

Feedback: See Lectures 02-4/5/6

Part 9 of 33 - 9

Question 9 of 36

[CP03a1] A photograph from a pinhole camera .... (select statements that are co

- [x] A. Usually suffers from low light due to the size of the opening / aperture. Fee
- [x] B. Usually suffers from geometric and diffraction blur. Fee
- [ ] C. Ideally, has a finite depth of field.
- [x] D. Ideally, has virtually no distortion. Straight lines remain straight. Fee

Feedback: See Lecture "Cameras" or Lecture 03-1 on Udacity

Part 10 of 33 - 10

Question 10 of 36

[CP3b1] Consider the following statements about aperture and select the correct

$$Area = \pi \left(\frac{f}{2N} \right.$$

- [x] A. Doubling N reduces Area by 4 times, and therefore reduces light by 4 times
- [x] B. The aperture number, the f-number (N) usually marked on all lenses, is des
- [x] C. A low f-number (N) on a lens usually means it has a BIG lens. This is espe 800mm lens of f-number 4, will have 100mm aperture radius]
- [x] D. The amount of light that falls on a sensor or film in a camera is proportiona is measured in amount of light on a unit area of sensor per second.
- [x] E. The diameter of the opening is simply f/2N (from the above equation of Are

Feedback: Lecture 03-3

Part 11 of 33 - 11

Question 11 of 36

[CP03c1] Select the the following correct statements about lenses.

- [x] A. The Combined Focal length of a combination of lenses can vary and deper
- [ ] B. Focal length is a variable parameter for a lens and can be changed.
- [x] C. A focused image for a lens forms only on a screen placed focal length dista
- [x] D. The field of view (FOV) of a lens depends on Focal Length and Sensor Siz

Part 12 of 33 - 12

Question 12 of 36

[CP04a12] Factors to consider for optimal window size for image blending are ...

- [x] A. Image frequency content should occupy two pyramid levels Feedb
- [x] B. Largest frequency ≤ 2 × size of smallest frequency Feedb
- [x] C. To avoid seams: Window = size of largest prominent “feature” Feedb
- [x] D. To avoid ghosting: Window ≤ 2× size of smallest prominent “feature” Feedb

Feedback: Lecture 04-2.

Part 13 of 33 - 13

Question 13 of 36

[CP04a21] Choose the statement that are CORRECT about a Laplacian Pyramid

- [ ] A. A Laplacian is simply computed using

$L_k = \text{REDUCE}(g_{k-1})$

- [x] B. Each Laplacian Image in the Pyramid is a combination of two consecutive I
- [x] C. A Laplacian Pyramid is a series of “error” images, L_0, L_1, L_2, ...
- [x] D. Each Laplacian is computed using

$L_l = g_l - \text{EXPAND}(g_{l+1})$

Feedback: Please review Lecture "Image Processing" or Lecture 04-3 on Udacity

Part 14 of 33 - 13

Question 14 of 36

[CP04a31] Which of the following statements are TRUE for using Cuts vs. Blendin

- [ ] A. Using Cuts is better when there are too many objects in the image and regi
- [x] B. Seam Carving is not similar in terms of computation to Cuts. Cuts are used completely different.

- [x] C. Cuts are like median filtering, as they give you an actual pixel value, where
- [ ] D. Using Cuts is better when there is motion that causes ghosting, as the sam

Feedback: See Lecture 04-4

Part 15 of 33 - 4a4

Question 15 of 36

[CP04a43] Subsampling in the spatial domain is essentially the same as truncating

- (•) True
- ( ) False

Feedback: Review assignment 6 and and lecture 04-03

Question 16 of 36

The layers below the peak of a Laplacian pyramid approximate a collection of ba

- (•) True
- ( ) False

Feedback: Correct! Blurring is a low-pass filter, so the difference between layer

Part 16 of 33 - 4a5

Question 17 of 36

In Laplacian pyramid blending, pixel intensity G(i, j) near the image borders is af

- ( ) A.G(i, j) = k (an arbitrary constant value)
- ( ) B.G(-i, j) = G(i-1, j)
- ( ) C.G(-i, j) = G(i, j)
- (•) D.G(-i, j) = 2G(0, j) - G(i, j)
- ( ) E.None of the Above

Feedback: Correct!

Part 17 of 33 - 15

Question 18 of 36

[CP04b11] Please select from the following characteristics of Good Features.

- [x] A. Dominant -- Give a strong response to x-correlation
- [x] B. Locality -- Relatively small area of the image; robust to clutter and occlusio
- [x] C. Repeatability/Precision -- Find the same feature despite geometric and pho
- [x] D. Saliency/Matchability -- Distinctive description
- [ ] E. Variability - Variety of metrics that define a feature.

Feedback: Review Lecture "Corners and Features" or Lecture 04-5 on Udacity

Part 18 of 33 - 16

Question 19 of 36

[CP04b21] Which of the following is CORRECT about the Harris Detector?

- [x] A. Harris detectors are NOT Invariant to Image Scale changes. One needs to
- [x] B. Harris detectors are Invariant to Rotation.
- [x] C. Harris detectors are NOT Invariant to Image Scale changes. One needs to
- [ ] D. Harris detectors are Invariant to Image Scale changes
- [x] E. Harris detectors are Invariant to Image Intensity Variations.
- [ ] F. Harris detectors are Invariant to Translation.

Feedback: See Lecture "Corners and Features" or Lecture 04-6 on Udacity

Part 19 of 33 - 19

Question 20 of 36

[CP05b21] Determine which of the following statements are CORRECT about a Ste

- [x] A. The Epipolar constraint for computing disparity makes searching for corres
- [ ] B. A simple stereo system used to compute 3D scene geometry assumes that
- [x] C. The disparity computed from a stereo pair is usually larger for closer surfac
- [ ] D. The Epipolar constraint does not provide any computational efficiency in th

Feedback: See Lecture "Stereo Vision" or Lecture 05-5 on Udacity.

Part 20 of 33 - 5b3

Question 21 of 36

[CP05b31] Planar projection can NOT be used to make panoramas from images ta

- ( ) True
- (•) False

Feedback: Correct!

Part 21 of 33 - 5b4

Question 22 of 36

[CP05b41] Planar projection panoramas use a parametric motion model consistin

- ( ) A.Simple 2D transforms
- (•) B.Perspective transforms

C.Nonlinear surface mappings

D.All of the Above

E.None of the Above

Feedback: Correct!

Part 22 of 33 - 22

Question 23 of 36

[CP06c11] Which of the following statements is true about the Video Stabilizatior

A. Cropping is used to crop the view, which avoids problems with a rolling shu

B. Cropping is used to crop the view, which avoids dealing with hole filling. Wh

C. Rolling shutter adds unwanted non-rigid motion in the video due to a delay

D. It is a 2D camera path stabilization method, where only estimates of 2D mc

E. It is a 2D camera path stabilization method, where only estimates of 2D mc

F. It is a 3D camera path stabilization method, where a 3D path is computed a

G. Rolling shutter can be removed by adding median filtering in time.

Feedback: See Lecture 06-3

Part 23 of 33 - 17

Question 24 of 36

[CP05a11] Which of the follow are true statements about Affine Transformation?

A. The leftmost two columns of the transformation matrix need to be computed

B. 2 Point Correspondences Needed

C. 6 Degrees of Freedom

D. 3 Point Correspondences Needed for computation.

E. 4 Degrees of Freedom

F. The top two rows of the transformation matrix need to be computed to mod

Feedback: See Lecture "Image Transformations and Warping" or Lecture 05-1 on

Part 24 of 33 - 18

Question 25 of 36

[CP05b11] Camera Calibration: Select the statements that are correct about Cam

A. In Radiometric/Photometric Camera Calibration, the goal is to extract how

B. In lieu of accurate radiometric camera calibration, we can get good estimat camera, and using data/curve fitting to estimate the response curve of a camera fo

C. To forgo accurate modeling of geometric camera calibration, we can get go solve for an overdetermined linear system.

- [x] D. In Radiometric/Photometric Camera Calibration, the goal is extract how se
- [ ] E. In Geometric Camera Calibration, we only need to extract the location and
- [x] F. In Geometric Camera Calibration, the goal is to extract extrinsic (location, o captured in photographs.
- [ ] G. Homography calculation in support of Camera Calibration can work well wi

Feedback: See Lecture "Panoramas" and "Image Processing and Warping" OR Lect

Part 25 of 33 - 5b5

Question 26 of 36

[CP05b51] How many terms of the response curve g and the irradiance E does the

- ( ) A.255
- ( ) B.256
- (•) C.NP + Zmax - Zmin + 1
- ( ) D.N(P-1) + Zmax - Zmin
- ( ) E.None of the Above

Feedback: Review “Recovering High Dynamic Range Radiance Maps from Photog

Part 26 of 33 - 5b6

Question 27 of 36

Digital camera sensors typically respond linearly to irradiance E.

- (•) True
- ( ) False

Feedback: Correct! Nonlinearities in the response curve (such as those that occu

Part 27 of 33 - 8

Question 28 of 36

[CP02g1] Image Gradients (select the correct statements)

- [ ] A. Gradient vectors point in the direction of most rapid increase in the intensity
- [x] B. Gradient Magnitude at any point in the image provides edge strength.
- [ ] C. Image Gradient is a change in the image function in *x*, *y* and *t*
- [x] D. Image Gradient is the change in the image function in *x* and *y*
- [x] E. An edge in an image is usually aligned with the Gradient direction (rememb

Feedback: See lecture "Groups of Pixels" and Lecture 02-6 on Udacity

Part 28 of 33 - 20

Question 29 of 36

[CP6a1] What is the resolution of a video clip that has a frame rate of 15 fps, a w

- A.262,144 pixels
- B.12,000 pixels
- C.409,600 pixels
- D.6,144,000 pixels

Part 29 of 33 - 21

Question 30 of 36

[CP6b1] Select the statements from the following which are correct for the conce

- A. Video textures only work well when there is repetition in the video, hence th
- B. Video textures require the entire image to compute similarity, and it is not p
- C. Crossfading, blending and cutting can be used with video textures to create
- D. The primary concept supporting Video Texture analysis is that similar objec
- E. Only L1 and L2 similarity metrics can be used to generate video textures.

Feedback: See lecture 06-02

Part 30 of 33 - 23

Question 31 of 36

[CP7b11] Which of the following statements are correct about Epsilon or Coded P

- A. Coded photography uses a "code" to encode variations in an image (or vid
- B. Epsilon Photography assumes that multiple images are taken and then con
- C. Low light and image resolution are not artifacts of adding coding to apertur
- D. Coded Photography is akin to Bayer Patterns. It encodes a code with an im
- E. A coded aperture essentially changes the aperture to provide variations in
- F. Coded Photography cannot be used to take a 'standard' picture

Part 31 of 33 - 24

Question 32 of 36

[CP7b21] Which of the following statements are CORRECT about a Light field Can

- A. Typical examples of light-field cameras use an array of cameras to capture
- B. A plenoptic or light field camera attempts to capture a light field, rather thar
- C. A hologram does not have anything to do with a Light Field.
- D. One can build a light field camera, capable of depth from defocus estimatic

Feedback: See 07-2

Part 32 of 33 - 25

Question 33 of 36

[84] Which of the following applies the "Seam Carving" approach from Module 8-4

- [x] A. A key insight is use of an Image Energy Measure and removing seams with
- [x] B. Image retargeting to new aspect ratios is achieved by repeatedly carving ou
- [ ] C. A key insight is the use of an Image Energy Measure and removing seams
- [x] D. Seam carving strikes the best balance between the demands for energy pr

Feedback: See module 08-4

Question 34 of 36

[85] Consider the paper on "Poisson Image Editing" in module 08-4. Which of the f

- [x] A. Using this approach, the color, texture, or illumination of an object, for the t
- [x] B. A system is introduced to edit an image via a sparse set of its edge elemer
- [x] C. Spots and blemishes are removed from fur images by separating out the br brightness at the selection boundary.
- [x] D. The mathematical tool at the heart of the approach is the Poisson partial differential equation with Dirichlet boundary conditions which speci

Feedback: See module 08-5

Question 35 of 36

[81] Select the statements that are correct for the "Interactive Photomontage" ap

- [ ] A. It works on a stack of images, along the lines of Epsilon Photography
- [x] B. Cuts are used to merge and generate a new image
- [x] C. Gradient-domain image fusion in the color space is used to align the colors
- [x] D. Alignment of images if NOT required for the processing of images.
- [x] E. Images are blended to generate a new image

Feedback: See module 08-1

Part 33 of 33 - 26

Question 36 of 36

[Closing] Reminder and recertification on closing:

I certify that

- [x] A. I took this exam solely and entirely on my own, without any help from any c
- [x] B. I am aware of the Georgia Tech Honor Code (link) and I affirm it here as I ta

- [x] C. I am the student who is enrolled in this class.
- [x] D. I will not copy or print this exam for any reason!

Feedback: Thanks.