Feedback — Quiz #7

Help Center

You submitted this quiz on **Fri 27 Feb 2015 3:55 PM IST**. You got a score of **7.00** out of **7.00**.

Question 1

Consider the general image inpainting form $\nabla L \cdot \vec{N} = 0$, meaning we propagate the information L in the direction $\vec{N}$, as we have discussed in Video 3 this week. Consider $\vec{N} = (\nabla I)^{\perp}$, meaning the perpendicular $(\perp)$ to the gradient of the image. What will happen if instead of propagating the Laplacian of I as in the video, we propagate the image I itself?

Your Answer		Score	Explanation
The inpainted region will be too smooth.			
The inpainted region will be constant.			
We obtain an inpainted region but the transition between it and its surrounding area is not as smooth.			
Any inpainted region will solve the basic equation $\nabla L \bullet \vec{N} = 0$ for this choice.	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

Since L=I, we have that $\nabla L \cdot \vec{N} = 0$ becomes $\nabla I \cdot \vec{N} = 0$, and for $\vec{N} = (\nabla I)^{\perp}$, we obtain $\nabla I \cdot (\nabla I)^{\perp} = 0$, which by definition holds for every image. Therefore, any inpainted region holds the equation and we don't obtain the desired result.

Question 2

Consider a region to be inpainted with N missing pixels, in an image with M pixels total. In the "smart cut-and-paste" algorithm, how many patch comparisons will need to be performed if a single pixel is inpainted per match? Consider only the order of magnitude, ignoring image boundaries for example.

Your Answer		Score	Explanation
M			
$N \cdot M$	✔	1.00	
N			
M/N			
Total		1.00 / 1.00	

Question Explanation

For each pixel to be inpainted, we have to compare to all patches centered at each one of the M image pixels, and therefore we have a total of $N \cdot M$ searches. Some recent techniques speed-up this by either pre-processing the image or by reducing searchers to pre-specified neighborhoods.

Question 3

For a given image I, $\mathrm{div}(\frac{\nabla I}{|\nabla I|})$ is equal to (div stands for the divergence)

Your Answer		Score	Explanation
The affine curvature.			
The tangent to the image level lines.			
The Euclidean curvature of the image level lines.	✔	1.00	
The Gaussian curvature of the image when considered as a surface.			
Total		1.00 / 1.00	

Question Explanation

This is the Euclidean curvature as we discussed in the previous week when describing basic properties of curves represented as level-lines of surfaces (functions). In video 4 this week we further discussed the use of this term as a way to smoothly continue the edges inside the region being inpainted.

Question 4

Consider that you have an image with a single circle, and a small part of it is covered and needs to be inpainted. What would you use for that?

Your Answer		Score	Explanation
A variational formulation as then one presented in Video 4.			
A Hough transform.	✔	1.00	
A PDE as the one in Video 3.			
A combination of smart cut-and-paste and PDEs.			
Total		1.00 / 1.00	

Question Explanation

While other techniques might do a decent job, if we know the shape of the occluded object, a circle in this case, the best is to use the Hough transform to detect such object (circle) using the un-occluded regions, and once the estimation has been done, then the shape can be completed.

Question 5

Assume you have a fast moving rigid object in a video, that needs to be removed (inpainted). Which one of the following operations is expected to do a good inpainting job? If you think that more than one option is possible, pick the one that will produce the best result and/or is the simplest one.

Your Answer	Score	Explanation

Temporal median filtering: The pixels in the region to be inpainted are replaced by the median of pixels in the same (x,y) spatial location and at different frames t (median of (x,y,t) for t in some time interval with the current frame at its center).	✔	1.00
A cut-and-paste technique.		
A spatial-only inpainting via PDEs.		
Temporal Gaussian/averaging filter: The pixels in the region to be inpainted are replaced by the (weighted) average of pixels in the same (x,y) spatial location and at different frames t (median of (x,y,t) for t in some time interval with the current frame at its center).		
Total		1.00 / 1.00

Question Explanation

If the object is moving then pixels become un-occluded as the object passes by. If the object is moving fast, only a few frames contain the object for a given pixel location, and therefore a median will work since the majority of the pixels are un-occluded for a given time window (the size of the time window depends on the velocity of the moving object). A Gaussian will mix occluded and un-occluded pixels and then will not perform as well. A cut-and-paste technique might work but is too expensive for this simple scenario.

Question 6

How would you detect scratches in an old movie, knowing they are vertical straight lines?

Your Answer		Score	Explanation
With Wiener filtering			
With the Hough transform	✔	1.00	
With Mumford-Shah segmentation			
Total		1.00 / 1.00	

Question Explanation

The Hough transform is ideal for this since we can easily control the orientation.

Question 7

Assume the above scratches are a single pixel wide and appear in relatively uniform areas, how would you inpaint them?

Your Answer		Score	Explanation
PDE-based inpainting			
Simple linear interpolation	✔	1.00	
Simple texture synthesis			
Total		1.00 / 1.00	

Question Explanation

For such scenarios linear interpolation is the simplest thing to do and the most efficient.

Question 8

(Optional Programming Exercises)

- Implement the basic non-local means type of inpainting approach. Do this both for still and for video, where the search for similar patches in the latter is across multiple frames.
- For a given image, compute at every pixel the inner product between the gradient of the Laplacian and the level lines normal, this being the main term in one of the inpainting techniques we learned. Display it and analyze its behavior.
- For a given video, implement a very simple inpainting technique: At every pixel to be filled-in, inpaint it with the median of the values (if available) for pixels at the same spatial position corresponding to N frames before and N frames after, varying the value of N. Extend this to consider camera motion, in particular by exploiting registration techniques as available in Matlab and other packages.

Your Answer	Score	Explanation
Total	0.00 / 0.00	