! This class has been made inactive. No posts will be allowed until an instructor reactivates the class.

note 112 views

HW4: Segmentation

Your goal is to perform semi-automatic binary segmentation based on SLIC superpixels and graph-cuts:

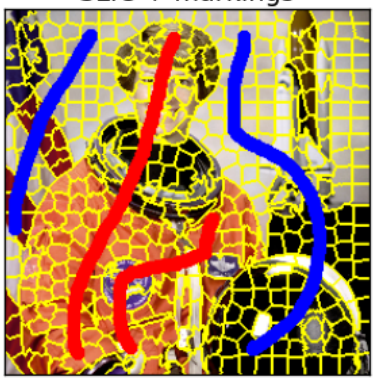
1. Given an image and sparse markings for foreground and background
2. Calculate SLIC over image
3. Calculate color histograms for all superpixels
4. Calculate color histograms for FG and BG
5. Construct a graph that takes into account superpixel-to-superpixel interaction (smoothness term), as well as superpixel-FG/BG interaction (match term)
6. Run a graph-cut algorithm to get the final segmentation

"Wow factor" bonus (20pt):

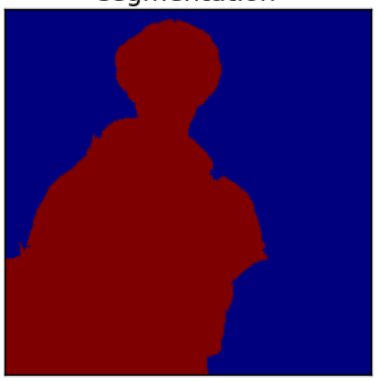
1. Make it interactive: Let the user draw the markings (**carrying 0 pt for this part**)
2. for every interaction step (mouse click, drag, etc.)
    1. recalculate only the FG-BG histograms,
    2. construct the graph and get a segmentation from the max-flow graph-cut,
    3. show the result immediately to the user (should be fast enough).

Due: Thu, Oct 26 9am

SLIC + markings



segmentation



Skeleton Code
HW4Segmentation.zip

You are given a lot of skeleton code to perform this task, so your part is relatively easy.
The following provided functions are essentially all you need to accomplish this:

```
centers, color_hists, superpixels, neighbors = superpixels_histograms_neighbors(img)

fg_segments, bg_segments = find_superpixels_under_marking(img_marking, superpixels)

fg_cumulative_hist = cumulative_histogram_for_superpixels(fg_segments, color_hists)

norm_hists = normalize_histograms(color_hists)

graph_cut = do_graph_cut(fgbg_hists, fgbg_superpixels, norm_hists, neighbors)
```

Submission Details
Use the skeleton codes and provided inputs above.
Output is expected in a PNG image format: mask.png which contains the binary segmentation mask (0 = BG, 255 = FG).
See the example_output.png file to get an idea.

To get the bonus you need to show a working system. A 20-second screen recording will suffice.

Submission as always via Blackboard.
Make sure to have your name and ID proper on the submission zip filename.

Put all your codes for standard question into the skeleton codes main.py. Your program will be tested under VM
using: python main.py astronaut.png astronaut_marking.png ./
A binary mask will be expected as output. Only change the main function to realize the required functionality.
(Get rid of all dependencies and disable all display functions please)

For bonus question, use a ***separate*** file main_bonus.py. Following command will be used to test your program:
python main_bonus.py astronaut.png
An interactive window should pop up and respond to mouse action with results.
You have the freedom to format main_bonus.py as appropriate but keep the interface intact.

Note that you need to have main.py for submission as well even if you do bonus question. Otherwise, you will get only 20 points for bonus provided that your results for bonus are good enough.

Like always, an example folder structure called "Samwise_Gamgee_111175657.zip" is uploaded under "Resources"
It is highly recommended to download that file, replace outputs with your own, zip it, and upload it.

Grading criteria:
- Folder structure -5 points
- An example output with watermark is provided and its RMSD value to the key without watermark is 6.624
  Details will be announced later
- Strict grading scheme will be applied for bonus question, only good enough results receive full credits.
  You will ***not*** get extra credits implementing only the interactive interface (very easy with OpenCV API).

==== Update ====
The video for bonus should be named as bonus.xxx. The format should be mainstream video format.

==== Update ====
Here is how it should look like:

-> First display a clean frame of astronaut.png
-> Draw with mouse on that frame and the drawings must be visible (e.g. blue for foreground, red for background etc ..)
-> When finish one mouse operation (e.g. finish a drag, a click), the result should pop up on another window showing the binary mask
-> Remember you can only start the segmentation operation once you have at least one BG and one FG marking - to build the color histograms
-> It is not required for the mask to update in real time with mouse position change, i.e. the unit for update is per mouse operation, not per mouse position change -- you may nevertheless experiment with real-time update, which would be cool ;)
-> **Show at least two different drawings of markings in the video**
-> **Put the bonus video into Results folder along with mask.png**

About office hours:
I do not hold regular office hours. Office hours are by appointment through emails. Please refrain from sending emails asking to discuss the points you got for some homework or exam.
Unless it is a mistake, I will not create unfairness for the rest of the class by giving you more points without valid reasons.

#pin

hw4

Updated 2 months ago by Fan Wang and Roy Shilkrot

followup discussions *for lingering questions and comments*

Resolved Unresolved

Timothy Zhang 2 months ago
Getting error in VM:

```
Traceback (most recent call last):
  File "main.py", line 10, in <module>
    from skimage.segmentation import slic
ImportError: No module named skimage.segmentation
```

Fan Wang 2 months ago How many of you facing the same problem?

Timothy Zhang 2 months ago Probably everyone, fix using: https://stackoverflow.com/questions/38087558/import-error-no-module-named-skimage

Root and run: `sudo apt-get install python-skimage`

Anonymous 2 months ago Even I am facing.

Roy Shilkrot 2 months ago I will fix it for everyone in a moment.

Resolved Unresolved

Anonymous 2 months ago
Hi TAs,
What is the maximum score for the standard part, 100?

Fan Wang 2 months ago Yes

Resolved Unresolved

Anonymous 2 months ago
Respected Professor,

Can we please get at least one week for this assignment? It's difficult to complete this assignment in 5 days considering we have assignments for other subjects also.

Thanks

Roy Shilkrot 2 months ago I was able to get a working solution using ~5-7 lines of python code.
As it seems to me, a week to write 5-7 lines of code is reasonable.

As of right now there's no extension.
If you have a particular clash with other classes - schedule an office hours appointment and you can explain your case.

Resolved Unresolved

Anonymous 2 months ago
Could you please tell me what are these parameters "fgbg_hists" and "fgbg_superpixels" in do_graph_cut()?

Anurag Arora 2 months ago Just look into the function, you will figure it out.

Fan Wang 2 months ago fgbg_hists: foreground histogram **and** background histogram
fgbg_superpixels: foreground segments **and** background segments

Anonymous 2 months ago Does this mean we have to add the histograms of fg and bg?

Anonymous 2 months ago +1

Anonymous 2 months ago I believe you can figure it out yourself after reading the function do_graph_cut().

Anonymous 2 months ago It is accessing the column fgbg_hists[0] and fgbg_hists[1]. same is the case with fgbg_superpixels. and then it is iterating through each column. This means we have to join the fg and bg into 2d array and access columns each time. Let me know if I incorrect anywhere.

Resolved Unresolved

Anonymous 2 months ago
Do we need to save the output video in any specific format/specific name?

Fan Wang 2 months ago Please see the updates

Resolved Unresolved

Anonymous 2 months ago
I do not think of anywhere to use the output "centers" from function superpixels_histograms_neighbors(). Do we need to use it?

Roy Shilkrot 2 months ago There's no immediate use for it except for visualization.

Resolved Unresolved

Anonymous 2 months ago
What should be our RMSD value in order to be considered for full points?

Fan Wang 2 months ago Still to be decided, possibly announced after deadline. Just give the best result you can

Anonymous 2 months ago It would be good if you can provide the value/cut-off. Since we don't know the optimal, we don't know how much to optimize! We may end up spending time unnecessarily!

Timothy Zhang 2 months ago Optimal is 6.624 my score is ~6.7, I am assuming I'm doing something slightly wrong. Interested to hear if anyone replicated 6.624.

Fan Wang 2 months ago We are not releasing the cut-off value like we did in HW2 to avoid giving marks too harshly or too easily. If most of you do a great work, this value will be very close to 6.624. On the other hand, if it is too hard to get good results, we will use a higher value. So there is nothing called "end up spending time unnecessarily", if you want to submit your current results, then do it at your own risk. In general, we recommend to spend efforts improving your results so you can learn during the process.

Anonymous 2 months ago What parameters can be tweaked to get better RMSD values?

Anonymous 2 months ago My RMSD is 7.12. Visually, my result looks identical to the example output. Should I spend more time optimizing it?

Timothy Zhang 2 months ago It's not clear if we are supposed to tune the hyperparameters or not. With tuning I got 6.69, without tuning I also got 7.12 or so. If you closely look at the 7.12 outputs it's not exactly the sameness as the sample.

Timothy Zhang 2 months ago

Anonymous 2 months ago I am also getting RMSD as 7.12. Shall we do the hyper parameter tuning?

Anonymous 2 months ago @Timothy Zhang, which hyper parameter did you tuned to get RMSD near 6.69? Can you kindly specify?

Thank you.

Timothy Zhang 2 months ago Evidently we can achieve the optimal error without any hyper parameter tuning. So either many of us have some something wrong in the <10 lines of code or there is some system difference between Mac and the VM.

I tuned the compactness parameter.

Resolved Unresolved

Anonymous 2 months ago
For the bonus question, is there any restriction (minimum number of lines) for each segment (background and foreground)? here in the example, two lines are there for background and two for the foreground. Do we have such requirement?

Fan Wang 2 months ago No less than the markings provided along with the homework

Anonymous 2 months ago Should it not work with any number of lines?
Whatever markings you give, it should produce a corresponding output.
For testing this particular case, you can give 2 lines for each fg and bg, but ideally I think it should consider all kind of lines or drags till we are still drawing on it and then when we trigger event to calculate mask, it should calculate mask for that particular drawings by internally calculating fg_bg histograms and fg_bg superpixels and graph cut.

Please correct me if I am wrong.

Resolved Unresolved

Anonymous 2 months ago
Hi Fan,

which all frames we need to include in video for bonus question?

astronaut.png -> astronaut.png+markings ->output mask

We are displaying these 3 frames in the saved output video. First astronaut.png appears in video, then the entire drawing process happens and then the result appears in the video. Is it ok?Thanks.

Anonymous 2 months ago I think the output should appear as the marking process happens. More like a real time observation of how each mouse position change is reflected on the output.

Fan Wang 2 months ago Good question, please see the updated HW4 descriptions.

Anonymous 2 months ago Hi Fan,
Can user control interactively to indicate that mouse operation from his/her end is complete? So that now the result window can pop up with the output mask.

Once we are done drawing valid number of markings(at least 1 bg and 1 fg), we let the user press any button say like 'p' from keyboard, which indicates to program that mouse operation is complete and now the program can calculate and display mask for the drawn marking.

Kindly confirm!

Thanks.

Fan Wang 2 months ago Use keyboard as a 'confirm' button is acceptable

Anonymous 2 months ago Hi Fan,

Just a follow up, I have the following:

1. Image opens up, you draw fg and bg markings.
2. Hit a key
3. Result mask pops up in a new window.

Is this sufficient?

Fan Wang 2 months ago Looks good, be sure to show at least two different markings

Anonymous 2 months ago Sure, thank you.

Resolved Unresolved

Anonymous 2 months ago

Hello ,
For the bonus question, should we save the segmentation result as a png file? if yes what is the output file name.
Also should we put he video in the result folder along with mask.png

Fan Wang 2 months ago No need for png file for bonus.
DO put the video to the Results folder along with mask.png

Resolved Unresolved

Anonymous 2 months ago
Could anyone solve the problem of 7.12 RMSD? Or it's fine?

Resolved Unresolved

Anonymous 2 months ago Fan,

For bonus I have attached the video file to blackboard. hope this is the correct process, as the instruction doesn't ask to have the video file inside the submission zip

And regarding the outcomes of the result, I observed that its depends on How good you draw the markings on the window, it might not be as good as the markings you have provided, so the results would vary a little(wont vary by a large factor, as underlying we are using the same skeleton code with the markings changed)

thanks