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

note 111 views

HW5: Structured Light

Finally! It is here: Homework assignment 5.
I hope it will live up to your expectations!

Your goal is to reconstruct a scene from multiple structured light scannings of it.

- Calibrate projector with the “easy” method
- - Use ray-plane intersection
  - Get 2D-3D correspondence and use stereo calibration
  - We did this work for you...
- Get the binary code for each pixel - this you should do, but it's super easy
- Correlate code with (x,y) position - we provide a "codebook" from binary code -> (x,y)
- With 2D-2D correspondence
- - Perform stereo triangulation (existing function) to get a depth map
  - You do this too

HW5StructredLight.zip
Due: Tuesday 11/21 9am.

Update Nov 19
Bonus Points - 10 points

- Add color to your 3D cloud
- When finding correspondences, take the RGB values from "aligned001.png"
- Add them later to your reconstruction
- Output a file called "output_color.xyzrgb" with the following format
  - `"%d %d %d %d %d %d\n"%(x, y, z, r, g, b)`
  - for each 3D+RGB point

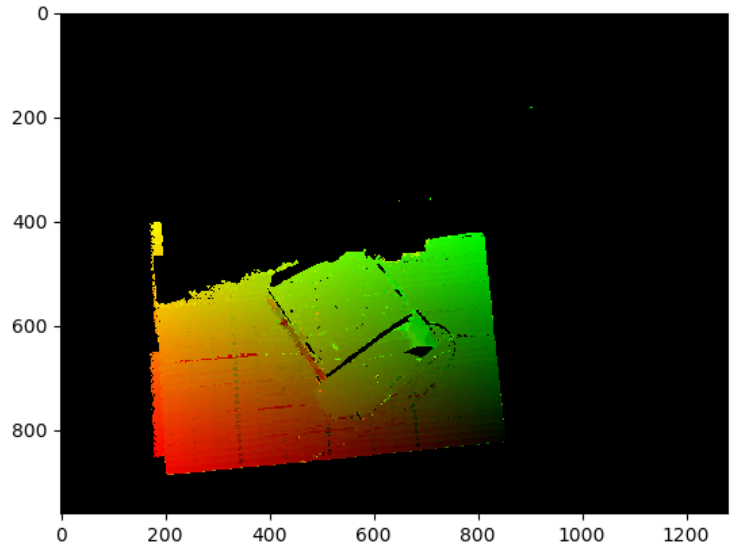
Update Nov 16 2017
Note: We have compiled a new dataset of images - it is much more aligned and results in a lot less outliers.
New image dataset: images_new.zip
New reference reconstruction: sample_output_new.xyz
Also, if you're interested in how we did the projector-camera calibration, I've written a blog post about it: http://www.morethantechnical.com/2017/11/17/projector-camera-calibration-the-easy-way/

You will be given:

- Stereo calibration
- - K and distortion for projector and camera
  - R, and t between projector and camera
- Images of binary codes pattern
- - For depth scanning
- Skeleton code
  - It has "TODO"s that guide you through (part of) the process of S-L stereo reconstruction
- Example output to match with

All is in the assignment zip file.

To aid in your work, the correspondences between camera and projector should look somewhat like so:



In this figure Red and Green channels are (x,y) position in the projector space (0,0)->(1280,800).

There are going to be a lot of errors decoding the patters.
Add this filtering after you the x_projector and y_projector within the loop:

```
    for x in range(w):
        for y in range(h):
            if not proj_mask[y,x]:
                continue # no projection here
            if scan_bits[y,x] not in binary_codes_ids_codebook:
                continue # bad binary code
            # ...
            # ... obtain x_p, y_p - the projector coordinates from the codebook
            if x_p >= 1279 or y_p >= 799: # filter
                continue

# ...
# after cv2.triangulatePoints and cv2.convertPointsFromHomogeneous
# apply another filter on the Z-component
mask = (points_3d[:,:,2] > 200) & (points_3d[:,:,2] < 1400)
```

Submission Details
Submit your codes and output.xyz file in a zip to blackboard.
As always make sure you maintain the proper filename for submission.
The homework can be completed with another 20-30 lines of codes given the skeleton codes.

Folder structure:
Failing to follow the required folder structure will lead to 5 points off. An example folder created specifically for HW5 can be found under "Resources" which is named as "Aragorn_Elessar_111134567.zip"

Submission requirements:
1. Keep the source file name unchanged as "reconstruct.py"
2. Do not submit the images or any other file already given to you
3. ** It is assumed that the folder "images" (containing source images), binary_codes_ids_codebook.pckl, stereo_calibration.pckl are in the same folder as your source file "reconstruct.py" when we test your program
4. Do **NOT** change main function or write_3d_points()

Update Nov 14 2017
The write function for 3d points should be

```
f.write("%d %d %d\n"%(p[0,0],p[0,1],p[0,2]))
```

The sample output.xyz produced with the previous write function is not correct.

Update Nov 19 2017 ***IMPORTANT***
Please also submit the correspondence image under "Results" folder (name it as ***correspondence.jpg***). The correspondence image and output.xyz will each carry **half points** for HW5. It is highly recommended to visualize your output.xyz (with meshLab or CloudCompare). The correct sample output.xyz will shortly be uploaded. Please make sure to filter the outlier points.
output.xyz

Update Nov 20 2017
The provided output.xyz is for you to get a rough idea how the result should look like. It is not there to be compared. We will make a new one when grading and release it for your reference later.

#pin

hw5

Updated 1 month ago by Fan Wang and Roy Shilkrot

followup discussions *for lingering questions and comments*

Resolved Unresolved

Anonymous 1 month ago
Professor,
Can we please have time until Saturday at least to finish the assignment? Friday 5 pm is not even full 5 days. We have many other deadlines as well in other subjects. Most of us won't mind if we get another assignment released on Saturday itself. Instead of keeping gaps, can you please give us some time?

Thank You,

Roy Shilkrot 1 month ago Due date is now Tue 21st 9am.
Assignment HW6 will be given that day.

Anonymous 1 month ago Thanks a lot for this!

Resolved Unresolved

Anonymous 1 month ago

No bonus opportunity this time Professor?

Roy Shilkrot 1 month ago I'm trying to figure that out still. If time allows I will add a bonus option within the next couple of days.

Resolved Unresolved

Xiaofei Sun 1 month ago
I found there exist both Tab and 4 space as the indent. Can we just replace Tab with 4 space?

Sergey Madaminov 1 month ago According to the @12 you actually should do that.

Fan Wang 1 month ago Yeah, of course.

Resolved Unresolved

Xuan Li 1 month ago
In the function write_3d_points, there is a line:

```
f.write("%d %d %d\n"%(p[0,1],p[0,1],p[0,2]))
```

I think this should be :

```
f.write("%d %d %d\n"%(p[0,0],p[0,1],p[0,2]))
```

And the sample_output.xyz has x=y in the data. Is this a mistake?

Fan Wang 1 month ago Yes, it is a typo.

Xuan Li 1 month ago Can you provide a new version of sample_output.xyz to us?

Anonymous 1 month ago And also, the number of rows in sample_output.xyz the same as expected number of rows in our output?
Kindly clarify. Thanks.

Resolved Unresolved

Anonymous 1 month ago
Will a bonus question be given before the submission deadline?

Anonymous 1 month ago The Bonus question has been updated on 19th.

Resolved Unresolved

Xuan Li 1 month ago
Should we delete camera_points, projector_points in the return of write_3d_points?

Or should we make them global?

Anonymous 1 month ago I think we can delete it as it is not being used

Fan Wang 1 month ago Yes

Resolved Unresolved

Anonymous 1 month ago
What do you exactly mean by add color to your 3D cloud?

Anonymous 1 month ago Output a file called "output_color.xyzrgb" with the following format

- `"%d %d %d %d %d %d\n"%(x, y, z, r, g, b)`

Anonymous 1 month ago Do we have to take rgb values right from the beginning or we can append it later once we find 3d points?

Resolved Unresolved

Xuan Li 1 month ago
Can we add color variable to reconstruct_from_binary_patterns' return
and add color variable to write_3d_points' input?

Fan Wang 1 month ago You may add another output output_rgb.xyz if you want, but be sure to also have the uncolored one which is output.xyz

Xuan Li 1 month ago I mean, can we change the argument or return list of some functions. For example, can we add colors to the list.

Xuan Li 1 month ago Is the process of grading related with the code structure?

Fan Wang 1 month ago Not really, but be sure to leave interfaces intact.

Resolved Unresolved

Raju Khanal 1 month ago The new images provided and the previous have different names(aligned vs pattern). What should we change to? Also there is additional folder called images_new inside the images_new folder. How many layers of folders are to be kept and should the original code be revised?

Anonymous 1 month ago You can rename the images_new folder to "images" and change "pattern" to "aligned", wherever u are reading the images in the code. so your read statement would be of the sort "images/aligned001.jpg"
I think this should be fine.

Raju Khanal 1 month ago I know we can do that. Just how will the TA check? We do not want some syntax error while our code is being compiled during checking because we do not provide sample images

Anonymous 1 month ago Yes i think its better if Fan answers regarding this.

Fan Wang 1 month ago Please follow the original folder layout, i.e. do not change the image reading codes inside the program. I will put a image folder under the root folder of the program testing where all your programs will be ran with a batch program.

Shubhanga Narasimha 1 month ago Yes, we will not change the folder names. However, the next question is will the input image names during grading be patternXXX.png or alignedXXX.png?

Fan Wang 1 month ago As I said multiple times, simply keep the image reading codes intact, unchanged. That will suffice.

Anonymous 1 month ago But shall we change the filenames in the new image dataset from 'aligned' to 'pattern'?

Anonymous 1 month ago Also in new image dataset the file format is '.jpg' but in the old one it was '.png'? do we need to take care of that also along with the image file name?

please confirm

Fan Wang 1 month ago That is ***NOT*** necessary as you are not required to submit the data. Simply do not change the codes because the dataset is consistent throughout the testing.

Anonymous 1 month ago Fan, this means we shall keep our image reading part as images/patternXXX only, correct?

Resolved Unresolved

Anonymous 1 month ago
Can the software like meshlab or cloudcompare be installed in our containers?

Fan Wang 1 month ago Can you specify the reason for this? All software are free for download, you can download and play for yourself.

Resolved Unresolved

Anonymous 1 month ago
This is very confusing. Should we submit the results from the 'pattern' dataset or 'aligned' dataset?

Fan Wang 1 month ago Please do submit from the ***latest dataset*** which gives better results. I don't see reasons why people would want use a dataset which produces worse results.

Anonymous 1 month ago So for this sample code:
ref_white = cv2.resize(cv2.imread(**"images/aligned000.jpg"**, cv2.IMREAD_GRAYSCALE) / 255.0, (0,0), fx=scale_factor,fy=scale_factor)

Should it be:
1. **images/aligned000.jpg**
2. **images_new/aligned000.jpg**
3. **images/pattern000.jpg**
or:
4. **images_new/pattern000.jpg**

Anonymous 1 month ago confused +1

Bhavya Ghai 1 month ago I think it will be 3. Read the answer to previous question. TA asked to keep codes intact.

Timothy Zhang 1 month ago It is 3. The original code.

Fan Wang 1 month ago I will answer this same question one more time: keep your codes intact. During the testing, I will make sure the images can be read by your codes. In this way, I only have to change the images once rather than modify your codes 100 times.

Resolved Unresolved

Anonymous 1 month ago
I see that the output given on '# Update Nov 19 2017 ***IMPORTANT*' , contains the points **before** applying '(points_3d[:, :, 2] > 200) & (points_3d[:, :, 2] < 1400)'. But you have asked us to 'Please make sure to filter the outlier points.'.

So , do we need to upload the output.xyz after applying the mask?

Fan Wang 1 month ago Yes and I don't see a connection between the sample output.xyz and your output.

Resolved Unresolved

Anonymous 1 month ago What is the expected resolution for correspondence.jpg? Do we generate it before or after dividing the camera points / 2? I know the difference is just in scale, but I'm concerned of the auto grader.