

EE604: Assignment 2

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Due date: 11th October, 2022
Due time: 07:00AM

Weight: 22%
Submission: MookIT

Introduction

In this work you will learn various image filtering, enhancement and edge detection methods.

0 Holywater: gangajal [conditional 5%]

In Indian subcontinent from the ancient traditions, Gangajal (water of the river Ganga) is considered to be the most sacred and believed to purify oneself by washing away one's sins. This does not directly imply that one can dive into the river and emerge as a sage on the other side. Unintentional sins may be cleansed if one demonstrates worthiness with good *karma*.

Condition *karma* Ψ : Out of 13 questions in the midterm from sec.-II and sec.-III together, has the student received full marks for at least one (any one) question? Thus Ψ is binary.

Credits C : These credits are added to the course's final credits. Let \textcircled{S} be the Sins. (i.e. number of questions lacked your SINcerity and you got them wrong in sec.-II of the midterm), and A_2Q_0 be the marks received out of 5% for this question, then $C = \Psi \cdot \min(0.5 \cdot \textcircled{S}, A_2Q_0)$ ¹.

Question Q_0 : It is evaluated for 5% marks but these will not be added to this assignment's score, one can only receive credits C as above. One can use any library functions, any packages, any pre-trained ML models etc. for Q_0 . Grayscale document images of various classes are provided as shown in Fig. 1. One has to make ML classifier for automatically classifying them. You can see, image edge information is very crucial for solving this document classification problem. Participate in this live competition and as per its website other prizes are also available for winners. Whatever you will submit in this competition (code and report), submit the same for Q_0 and additionally submit the screenshot showing your leaderboard ranking on that competition's submission page. Put all these files in a folder named gangajal. Any other student can also try submitting it. You can take instructor's help, suggestions and guidance for this question.

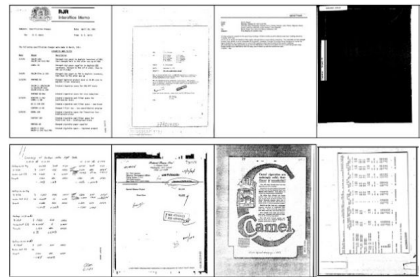


Figure 1: few sample images from various document classes

Competition: Read the details → <https://sites.google.com/view/datathonindoml/home>

¹Sins. of extensive plagiarism can be cleansed by immersing ashes in Ganges, thus by rebirth one can do EE604'23.

1 Gutter Cleaner: gutter [6%]

Roadside gutters are not clogged because of scattered garbage, but because of debris in our minds, which generates the litter in material world in the first place. Even dogs and pigs assist us in clearing out the materially clogged gutters, but how can we help ourselves in purifying our minds? Probably by first processing the pseudo self-images that cast shadows of greed-ego; and then by enhancing our spirit by following the enlightened beings like *Buddha*.

Similarly, the inner margin of books is also referred to as a gutter. Scanning or photocopying the books, magazines or notebooks, casts shadows in the gutter as shown in Fig. 2. Clean the gutters by removing shadows for all 3 provided input images. We will use any one of them for evaluation. Write a python program file `gutter.py`, which accepts command line file path for input image and directly stores the `cleaned-gutter.jpg` file at current location where the linux command `{python gutter.py ./gutters1.jpg}` is being executed.

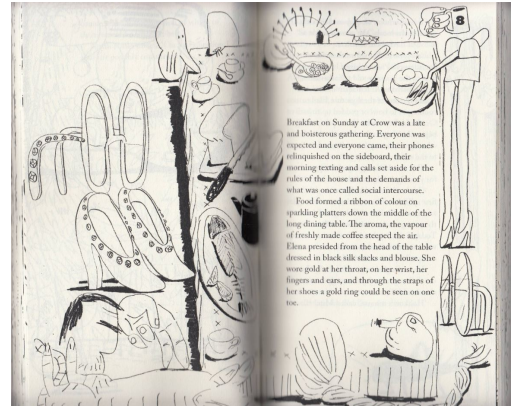


Figure 2: Input gutters2.jpg

2 Livestock Theft: thief [7%]

In remote Indian villages, cattle or livestock theft, such as cattle lifting or raiding, is rampant. Villagers are vigilant during the day, but most robberies occur at night when the environment is poorly lit due to intermittent power outages. After receiving numerous complaints from villagers, the officials have installed few battery powered CCTV cameras spread across places. Even after observing those CCTV footage for a week, the blind officials denied possibility of any theft. Villagers argued, pleaded those official *babus* but it was all in-vein. Only when a ray of light attempts to pierce this darkness, the real investigation unfolds. So, the dejected illiterate villagers with ill-lit lantern and 4 dark CCTV images are looking to you for the ray of hope.

You must process (filter, enhance) these night images in order to discover possible traces of theft or the thief himself; to 'equalize' the arguments of both parties. We will use all images `cctvX.jpg` ($X \in \{1, 2, 3, 4\}$) one after another for evaluation as evidence might not be evident in some images (one sample input is shown in Fig. 3). Your method should produce corresponding `enhanced-cctvX.jpg` file. Write a python program file `thief.py`, which accepts command line file path for input image and directly stores the `enhanced-cctv3.jpg` file when the command `{python thief.py ./cctv3.jpg}` is executed.



Figure 3: Input cctv2.jpg

3 Progress Line: robolin [9%]

You may be familiar with line-following robots used in school competitions where the line that robot must follow is already marked. Reality is not so straightforward, where the lines to follow for progress are not set forth. That is why our tradition has been offering the highest respect to the line carvers or the *gurus*. From childhood, the parents then teachers, professors to research supervisors serve as our line carvers. Have you ever wondered why professor-led projects carry more weight on a resume than self-directed ones? or why universities mandated graduate students to have a supervisor? The bottom line is the line-carvers are indispensable.

Along the similar line, you will be designing the line carver or line detection algorithm that can function in a noisy real-world environment. Robots are utilized for precisely arranging or filling grooves in floor tiles as shown in Fig. 4. Therefore, the tile's border lines must be detected. You are provided with few tile images for adjusting parameters of your algorithm. Inside the algorithm, you may convert them to grayscale images for processing, but the output image that will be stored as jpg should be color. Draw the detected lines over the image (like you did for cyclone's path). While evaluating we will use different tiles. Write a python program file `robolin.py`, which accepts command line file path for an input image and directly stores `robolin-tiles3.jpg` file when the linux command `{python robolin.py ./tiles3.jpg}` is being executed.



Figure 4: Precise placement and grooving of the tiles using a robot

Submission

For each question use the original images that are provided to you separately apart from this document. The only purpose of the figures here is to help with the proper explanations.

If your program does not produce output and throws errors, then you will receive a score of 0 for that question. You alone are accountable for the submitted program's proper operation. Kindly make sure it executes and outputs just the things which are being asked for.

Depending on the output quality, partial to full credit will be awarded if the program executes correctly. For plagiarized responses, even if your program does not execute or unexpectedly produces correct answer, in all cases you will be awarded full marks with an honorarium prefix as a negative sign.

Compress only the files listed below into `rollno_A2.zip` (eg.191234_A2.zip) and upload it.

- (optional) folder named: `gangajal`
- `gutter.py`
- `thief.py`
- `robolin.py`

