

**Poison Ivy**

**Situation report:**

Here at RIT, we are ivy league, but some of our ivy is poisonous. ☺

There is poison ivy on and around campus. People have a hard time recognizing it. Imagine that the Provost has given us of designing an algorithm to automatically identify poison ivy. This algorithm will later be put on an application.

When children are three years old, they are not very smart. Parents talk to children in an absolute sense. They say, “Do not talk to strangers.” What they really want to say is “Do not talk to strangers unless I am with you.” Or, “Do not talk with strangers until you are old enough to have a pretty good judgement of how strange a stranger is.”

Kids are told not to touch any plants that have three leaves. Unfortunately, this includes: Strawberries, Raspberries, Mint, English Ivy, young Virginia Creeper, and many other wonderful plants. Many three-year-old children cannot count to three. What they hear parents say is, “Do not touch plants.” If you tell a three-year-old child not to touch plants with three leaves, the result is many people who grow up scared of plants.

What’s worse, after two generations, the next generation of parents has no clue what poison ivy looks like. When I was growing up, we had to sketch poison ivy by hand. If you learn how to draw something from scratch, you will always be able to remember it. If your brain can synthesize the answer, you will always be able to recognize the answer. That is why we have college exams.

Anyways, the problem at hand is that these days is we now have college students on campus who cannot recognize poison ivy. Our job is to try to devise a program that will isolate and recognize poison ivy, given a picture taken by a human.

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## THE PROJECT

Your project is to develop an algorithm to do semi-supervised object recognition.

That means that a human is giving you the input picture. We can assume that the person taking the picture puts the image of the plant that they want to identify in the middle of the image. So, near the center of the image there should be a plant. The plant should be either poison ivy, or not.

So, this is an exercise in object segmentation. Not only can you assume that the plant will be in the center, you can also assume that the outsides of the image are not the plant. This assumption might not always work, but it is a good start.

You are provided with some labeled images that are either poison ivy, or not. You can use those for developing your classifier.

One of the issues is that the images may be taken with different resolutions of camera. You will probably want to resize the images to a standard size, and work with that size. There is a trade-off here. The bigger the image is, the more pixels that there are on target. However, the more pixels you have to process the slower the processing and development goes.

There is another issue here. Some of the images will be under-exposed, or over-exposed. The contrast might be wrong. You might find images that need contrast enhancement during the processing phase.

Please notice that recognizing the plant as poison ivy, or not, is only about 9% of the grade for the final submission. If you get automatic center/surround segmentation working, and correctly find the edges of the central leaf, you will be well off – even if your classification is not great.

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**CAUTION:**

Checkpoints will probably be graded pass/fail. Do not expect detailed feedback on the checkpoints.

The checkpoints are mostly for you, to make sure you are making progress. Ask for feedback if you need it specifically.

**Submissions:**

1. Checkpoint 1 (10 pts) Oct 7, 2022
  - a. Describe who you will be working with in your team, and in your group.  
Form groups appropriately.
  - b. (This has to be due *before* the break to avoid upsetting students who will be out.)
  
2. Checkpoint 2 (10 pts) Oct 16, 2022
  - a. Do you have a plan for pre-processing the image?
  - b. Do you have your own strategy?
  - c. Show evidence of progress.
  - d. Or, do you have your own checkpoint strategy?
  
3. Checkpoint 3 (10 pts) Oct 28, 2022
  - a. Can you isolate / segment the leaves?
  - b. Can you set handle rotated leaves?
  - c. Or, do you have your own checkpoint strategy?
  
4. Checkpoint 4 (10 pts) Nov 05, 2022
  - a. Can build a shape context for the leaf?
  - b. Or, do you have another method you are trying?
  - c. Or, do you have your own progress to report?
  - d. Show evidence of progress.

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5. **Final Submission:** (60 pts)

Nov 20, 2022

The program must run to get any points. This is “table stakes”.  
The program will be given a set of images from future data.  
That will be the validation data.

	<b>The Program:</b>		
a.	The program detects a leaf in the center of the image, or rejects the image as not containing a leaf.	3	
b.	The program correctly detects edges around a leaf in the center of the image, regardless of the leaf color.	3	
c.	The program segments out the leaf from the center of the image.	3	
d.	The program segments out the leaf from the center of the image, and is not distracted by other leaves behind the main leaf.	3	
e.	The program detects the texture on the leaf, and renders the texture as dark lines. (Shows the veins in the leaf.)	3	
f.	The program converts the input image into edges around the leaf, and generates a shape-context diagram for leaf identification.	3	
g.	The program works on input images of different sizes.	3	
h.	The program correctly identifies input leaves that are poison ivy, and labels the leaf as poison ivy.	6	
i.	The program correctly rejects input leaves that are not poison ivy. Notice that this is not symmetrical. There is RISK analysis done here.	3	
j.	<b>The Write-Up:</b>		
	Abstract of <= 250 words	5	
	Introduction with overview, 1 page	5	
	Methodology – 6 to 10 pages with example figures	5	
	Results Discussion -- what worked and what failed – 2 pages	5	
	Conclusion 1 to 2 pages	10	

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## Project Write-up:

Your finished final project report should be in PDF format. It should be roughly 8 to 12 pages long, printed in one column, single spaced, and should include the following sections:

1. **No title page.** (-5)

Please do not use a page that has just your names on it. This wastes time, and does not count toward the page count. I will take off points if you put in a title page. This is not a thesis.

Just list the names of the people in the group.

2. An **Abstract**, (5)

An abstract which gives an overview of the entire project, and your approach, in one run-on paragraph. This should be  $\leq 250$  words.

3. An **introduction**, (5)

Which describes the problem and gives an overview of the project.

4. **Methodology**, (5)

Up to a ten page section describing what you did and how it worked.

This should give five to eight small examples of the intermediate images you computed.

However, please do not fill the final report with images and think that this counts for ten pages.

5. **Results and Discussion**, (5)

A one to two page section that describes your results, including what worked, and/or anything that went wrong. A one to two page section describing what you learned. This should also include what you tried that failed. Could you break your own algorithm? What was done to set you up for success?

6. A **Conclusion**: (10)

A one to two page, clear concise over-all conclusion explaining what you did, what you are proud of, what your overall results were, what you learned, and what you enjoyed about the project.