ECE 496/499: Project Ideas + Moving Forward

PROJECT

I need to do a project I can complete in a month. I have 25-30 hrs a week and 4-5 weeks before thesis writing. So 100-150 hrs total. With that in mind, of the following, what would you say is attainable and also fulfills some of the challenges that a thesis should?

1. Which semantic segmentation algorithm is most precise in a use case (plants/pigs for your research group)?

Experiment: have a sample size of plant pictures, run all of them through ~5 different segmentation methods (trained with training set of plant pictures), compare results in terms of precision and computation time

Segmentation Methods: DETR, Fast R-CNN, ….

Purpose: Provide research group that needs plant training data with more precise training data

2. Develop an active contouring algorithm using low-level segmentation that works best in a specific use case (plants/pigs for your research group)?

Experiment: have a sample size of plant pictures, annotate all of them with a box, run them through ~5 different contouring algorithms, compare results in terms of precision and computation time

Purpose: Provide research group that needs plant training data with a faster way of annotating plant images and acquiring plant training data

3. What pre-segmentation simple image processing methods improve segmentation precision the most? (could be specific to plant/pig use case)

Experiment: use different segmentation methods and different image processing techniques. Run a sample size of images through all the image processing methods. Run all those images and the original, unprocessed images through the different semantic segmentation methods. Compare results in terms of precision and computation time.

- Image Processing Methods: transformation (contrast, gamma correction, sharpening), gradient magnitude, ... (other forms of simple image processing)

(would this even help with segmentation? not sure this makes sense in that simple image processing may not have any effect in detecting edges?)

Purpose: Provide research group that needs plant training data with more precise training data

4. Most effective affinity/dissimilarity equation for creating plant training data from plant images?

Experiment: Alter a base graph segmentation method's affinity/dissimilarity equation in different ways. Run sample images through different methods. Compare the results in terms of precision and computation time.

Purpose: Provide research group that needs plant training data with more precise training data

Equation Altering Methods: TBD

Baseline Graph Segmentation Method: TBD

(does this make sense? is this worthwhile given my level of expertise?)

5. Develop precise method of segmenting stem from plant for pruning plant/fruit

Experiment: Utilize sample set of plant images to test different semantic segmentation algorithms (trained to segment stems). Compare the results in terms of precision and computation time.

Purpose: Provide a man-free alternative to pruning plants

(This is a more applied/practical focused project, would you rather I go in this direction?)

6. Develop precise method for specific type of plant for color & quality differentiation to determine nutrient deficiency or to determine whether it’s ready for pruning

Experiment: Utilize sample set of plant images to test different labeling algorithms (trained to differentiate between ready and not ready for pruning). Compare the results in terms of precision and computation time.

Purpose: Provide a man-free alternative to determining whether plants are ready for pruning

OR

Variation of the above?

A different, small, well-defined research project you see being more helpful to one of your research groups/students?

If time allows, I could try to integrate whatever the resulting efficient annotation/segmentation method was into the currently used annotation tool of your research team. Probably less likely due to time.

The projects have diverged from some of the more algorithmic-specific research I was doing in 496 (with DETR and your low-level segmentation work) due to the lack of time (and expertise in the subject). Let me know if you think this is the right way forward.

LOGISTICS

The course page mentions progress updates to be completed. I believe the grading is up to you, so the progress updates are probably up to you too. Would you want me to write up some weekly/semi-weekly updates for this semester? The semester for 496 my brother and I assumed the video meetings served as progress updates. For this semester I can write up updates, do a video call instead, or both. Whatever you prefer.

TIMELINE

Let me know if this sounds ok to you.

1 Detailed project description and detailed steps of completion: 10/04, beginning of next week

2 Project/Research completion: almost completely by 11/03 (some final things could be going on up until 11/11)

3 Send Very Rought Draft of Thesis to You for Feedback: 11/11

4 Send Rough Draft of Thesis to 499 People for Feedback: 11/18

5 Do the oral presentation to you for feedback: 11/28

6 Oral Presentation: 11/30 OR 12/07

7 Submit Final Draft of Thesis: 12/12