

Computer Engineering Senior Project Proposal
B. Eng. Computer Engineering
Academic Year 2559

Project title: Sugar Cane Grading from photo using machine learning

Group number: 2559:39

Group member:

1. Miss Pham Thi Mai Phuong 56070503447 phuongmaipham@icloud.com

Advisor:

Dr. Sally E. Goldin

Introduction

1. **Keywords:** sugar cane grading, machine learning, image processing, convolutional neural network

2. Problem Statement, Motivation, and Potential Benefits

Sugarcane is an important crop in Thailand. In order to produce high quality sugar, sugar companies need detailed information on the cane conditions in different fields. Features such as color and size of the leaves are some indicators of cane conditions (cane health).

A field's condition, such as soil properties, seed quality or irrigation system, has some important consequences for those features. However, not every field is identical. Thus, the features and the resulting cane quality vary from one field to another. This will cause a problem in collecting data: there are too many fields and it is too complicated for sugar companies to do exhaustive surveys to get the information that they need.

To address this problem, this project will work in co-operation with staff from Mitrphol Sugar Company to create a software test bed for improving cane quality control over a large area. The test bed will be able to analyze the sugar cane health from mobile phone photos. The project will use machine learning to train the software to discriminate photos based on cane quality. The results obtained from this project will be useful for developing a real world system to allow individual farmers to send photos of their fields, which can be analyzed and classified to get more detailed information about cane health over a wide area. This project is thus important because it will help sugar companies gain better information with a lower surveying cost.

3. Project Types

This is a research - real world stakeholder project.

4. Proposed Method

The goal of this project is to develop a software test bed (not a final system) for experimenting with sugar cane images using supervised machine learning technique. The test bed will first extract the sugar cane crucial features from mobile phone photos. This test bed will then classify the cane photos into different health categories based on extracted features using supervised machine learning.

The project is expected to contain the following steps:

1. Research basic image processing concepts, machine learning concepts and algorithms with a focus on convolutional neural network
2. Collect, create and understand training/testing data
3. Write pre-processing software to standardize images
4. Extract desired features from input images (could be combined with ML frameworks, depending on which framework will be chosen)
5. Research and test/create prototypes for various ML frameworks (Potential libraries to look at: Caffe, Tensorflow, CUDA) in order to make a decision about which learning framework to use
6. Create experimental design - details of what parameters will vary; how to select training and test images (there are various strategies); how to analyze the results
7. Write scripts to control the experiments
8. Train the learning system
9. Test and analyze the result
10. Repeat training/testing (possibly) with 1) different framework; 2) different parameters.

5. Original Engineering Content

The main issue of this project is to classify mobile phone images into different classes using machine learning. There are already some existing works on this topic (i.e. recognizing images using machine learning). However, the problem of this project is more complicated because sugar cane photos are almost identical. Thus our test bed must be able to tell the difference between two slightly varied details such as two close color tones. Additionally, the choice of machine learning techniques varies depending on the problem. Therefore, we will need to choose and implement a proper machine learning technique that is able to classify the input images into the correct category. Furthermore, if we have time, we will produce a design for a system to receive photos sent from mobile phones, classify them and save the results.

6. Task Breakdown and Draft Schedule

a. Task breakdown

1. Analyze and determine the requirements of the project
2. Plan the project schedule
3. Work on introduction chapter of the report (chapter 1)
4. Research emphasizing on the following topics:
 - i. Work by other researchers on discriminating between similar images using machine learning
 - ii. Machine learning methods for image classification and the available libraries
 - iii. Basic image processing concepts
5. Create the project proposal and get feedbacks
6. Test prototypes for various learning frameworks and make a decision on which learning framework to use
7. Collect and create dataset
8. Study and understand the dataset
9. Create experimental design
10. Complete progress report for the first semester
11. Work on theory and background chapter of the report (chapter 2)
12. Work on methodology chapter of the report (chapter 3)
13. Prepare for presentation for the first semester
14. Write pre-processing software to standardize images
15. Write scripts to control the experiments
16. Test the system and fix bugs
17. Train and test the system with different parameters
18. Analyze the results
19. Complete final report for the second semester (Result + conclusions, chapter 4 and 5)
20. Create poster and prepare for presentation for the second semester

b. Draft Schedule

Step	Operation	Project Duration																																			
		2016																				2017															
		August				September				October				November				December				January				February				March				April			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
1	Analyze and determine the requirements of the project																																				
2	Plan the project schedule																																				
3	Work on Introduction chapter of the report																																				
4	Research emphasizing on the following topics:																																				
	1) Work by other researchers on discriminating between similar images using machine learning																																				
	2) ML method for image classification especially CNN and the available libraries																																				
	3) Basic image processing concept																																				
5	Create the project proposal and get feedbacks																																				
6	Test prototypes for various learning frameworks and make a																																				

7. Deliverables for Term 1

- ✓ Experimental data set
- ✓ Experimental design
- ✓ Some prototype using the selected framework
- ✓ Decision on what learning framework(s) to use, with justification

8. Deliverables for Term 2

- ✓ Complete experimental design of the test bed
- ✓ Software test bed with desirable results
- ✓ Results and data analysis

