UECS3413 Digital Image Processing

Group Assignment (Jan 2022)

Release of group assignment:
Thursday 10 February 2022

Project Deadline:
Week 12: Wednesday 4 April 2022

1 Instruction

1. This is a **group project**. The minimum group size is 2 and the maximum group size is 3. Members of the group can be from any program (SE, ET) and year of study (2, 3 or 4).

2. When completed, archive all Python source files in ZIP file format. Each filename has 4 parts, group number, Programme (SE/ET), Course Code, Group Assignment (GA) and then .zip/rar. For example, if group number is **G9**, your **ZIP** archive shall be named **G9_SE_XXXXX_GA.zip**.

3. Upload the abovementioned ZIP archive using the link provided (in EWBLE).

4. Please ensure that you are logged into your UTAR student portal on your browser before attempting to access this link to specify your assignment group:
   - https://tinyurl.com/bddh7snm

2 Requirements

Python + OpenCV

3 Project details

PT Wood Industry would like to develop a wood defect detection and grading system to reduce the cost and increase the efficiency and throughputs. In this wood factory, human workers are employed to perform Quality Check (QC) via visual inspection for the wood products. However, according to research, an average human grader can only achieve an accuracy of around 60% with lots of error during wood defect detection. Studies shows that the performance of a human locating and identifying a surface defect is only around 68%. Besides accuracy, a human worker has other disadvantages such as inconsistencies and the inability to work repetitively on the same task over a long period of time. These difficulties gave rise to the need for an automated visual inspection (AVI) system for the wood industry. Thus, PT Wood Industry would like to construct a real-time defect detection and grading system with higher accuracy that can work for different wood species and defects. This system will also send signals to further downstream systems to perform sorting tasks. The system should be able to defect detect and localization the defected parts. In defect detection part, the defective wood can be distinguished from normal wood and the defect type can be identified and reported. With localization part, the defect location can further be localized on the wood image by coloring the pixels within the bounding box corresponding to the defect type.

4 Methodology

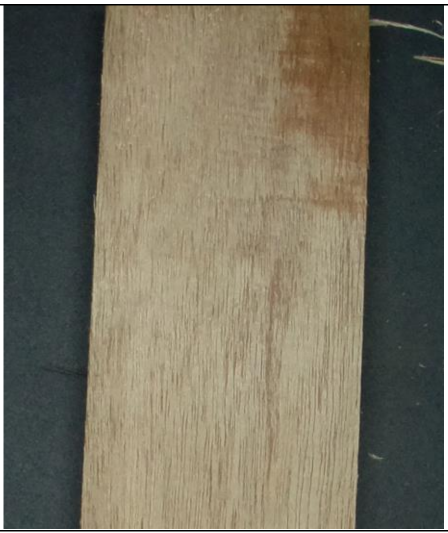
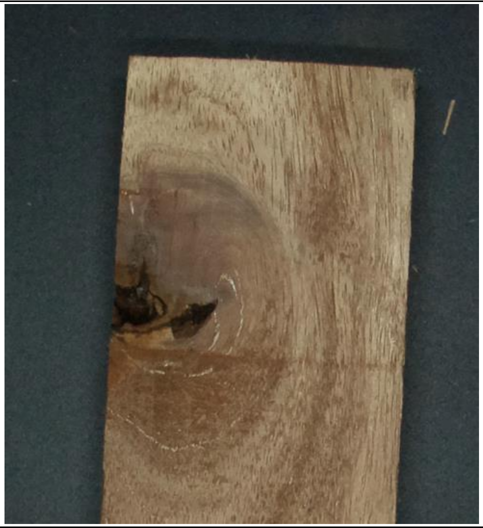
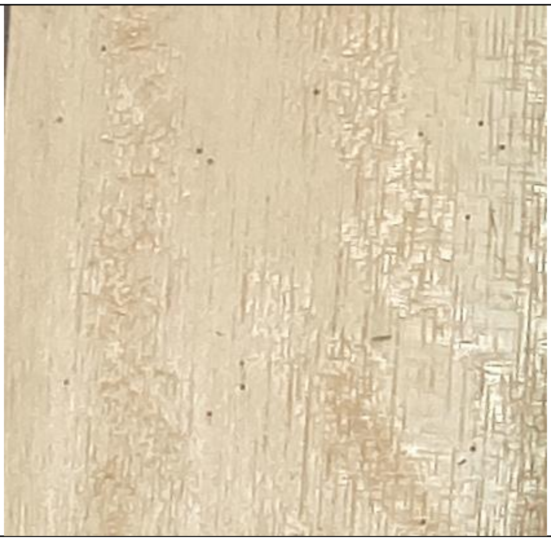
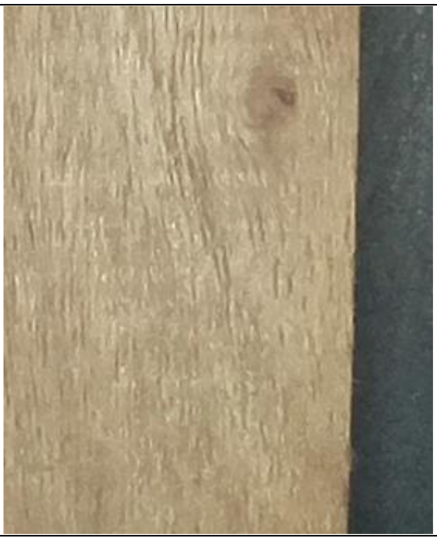
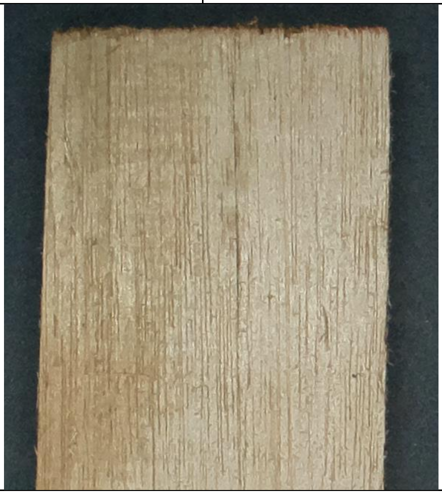
1. Download the “Prepared videos” from specified link and open it up.

2. Implement a wood defect detection and grading system using OpenCV and Python programming language.

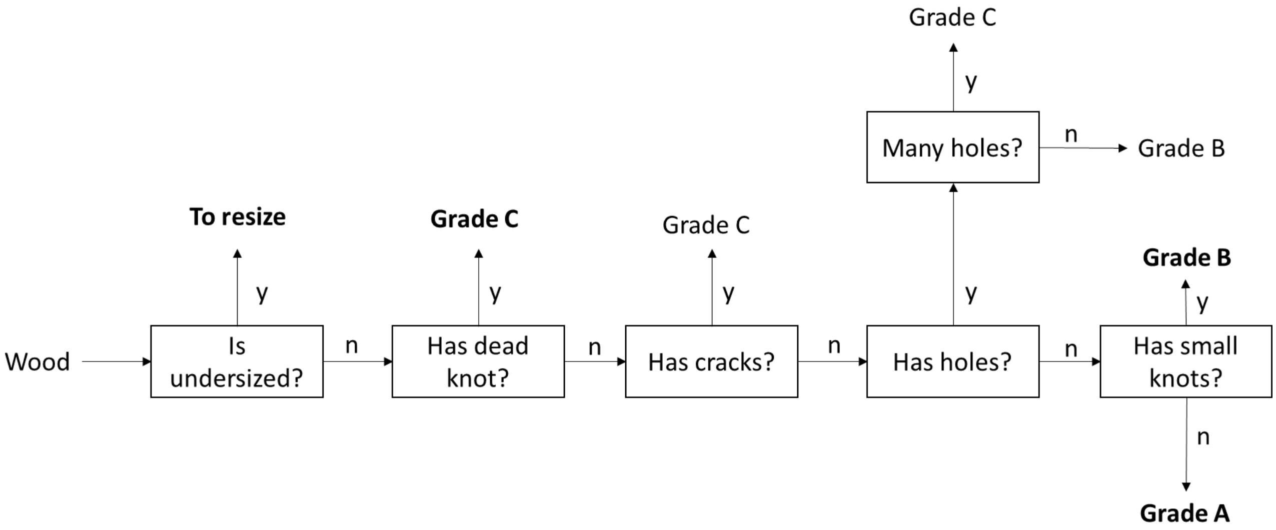
3. The system performs wood defect detection to classify wood into grades.

4. It categorize the woods into four grades, namely **Undersized**, **Grade A**, **Grade B**, and **Grade C**.

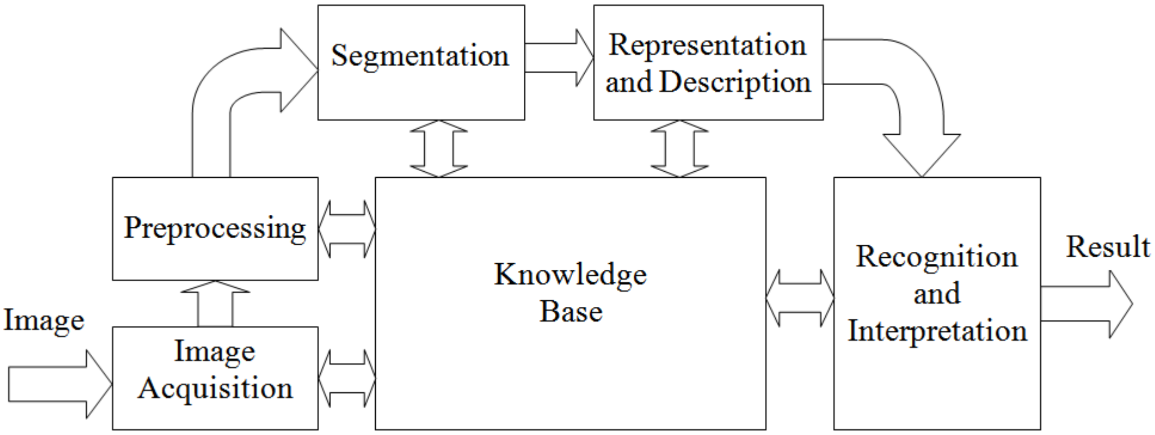
5. The defects that they encounter include **undersized**, **small knots**, **holes**, **dead knots**, and **cracks**.

Images of the Defects:	
	
Undersized	Dead Knots
	
Holes	Small Knots
	
Cracks	

6. Defect Detection Logic is as fallow:



7. Use General Digital Image Processing (DIP) Workflow for Object Recognition as follows (Defect Detection Methods):
    a. Image Acquisition (For this step, a link is provided).
    b. Preprocessing
    c. Segmentation
    d. Representation
    e. Recognition



8. Use Image processing methods to detect the wood defects. Separate algorithms can be employed to detect different defects.

5 Report

- Your report should include abstract, introduction, literature review, proposed method and result and analysis parts.
- Your report should present your results and your analysis of those results.
- There is no page limit.
- Be sure to report the proposed method for each model in the report.

6 Submission details

- Your submission comprises of ONE (1) Word/PDF document and .py files.
- Each student should submit these file individually.
- Submission deadline is week 12. Submission is through a EWBLE.

NOTE: A portion of the marks for this project (see the marking rubric for details) will be awarded based on the achieved results and report vs all submitted results.

7 Graded Components Weightage

- Presentation and Formatting (20%)
- Report and Analysis (30%)
- Code Quality (30%)
- Results (10%)
- Competitive Mark Component (10%)

Presentation and Formatting Rubrics

0	Unreadable report.
1	Difficult to read, with obvious errors in formatting, grammar etc.
2	Acceptable, with some errors in formatting, grammar etc.
3	Good readability, appropriate use of graphics/tables. Minimal grammatical and formatting errors.
4	Outstanding presentation and formatting, no errors at all.

Results Rubrics

0 Not reported.
1 Inaccurate or incomplete results.
2 Basic results reported.
3 Results reported well, with thought given to organizing and summarizing data appropriately.
4 Reporting of results is impeccable, summary is easily viewable at a glance.

Report and Analysis Rubrics

0 Not provided.
1 Perfunctory analysis and/or justification, off-topic or nonsensical.
2 Brief (but correct) analysis or justification provided.
3 Good analysis and justification which clearly provides rationale/reasoning.
4 Very good analysis and justification which convinces the reader.

Code Quality Rubrics

0 Not submitted.
1 Very poor code (no cells, hard to read etc.) or provided code does not work.
2 Working code.
3 Code is well organised and commented.
4 Code is easy to read because it is very well organised, showing proper planning.

Tabulation of Marks

Each graded component receives a mark based on the above rubrics. This assigned mark N is then divided by the maximum mark for the rubric M and multiplied by the weightage W. So the sum of your report marks S will be.