UECS3413 Digital Image Processing

Group Assignment (Jan 2023)

Release of group assignment:
Thursday 24 April 2023

Project Deadline:
Week 14: Monday 8 May 2023

1 Instruction

1. This is a **group project**. The minimum group size is 3 and the maximum group size is 4. 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 s pecify your assignment group:
   - https://tinyurl.com/bddh7snm

2 Requirements

Python + OpenCV + Keras

3 Project details

MiTEC company is a leading provider of innovative technologies in the field of manufacturing and engineering. The company has recently acquired a large dataset of texture images from its production line. The dataset contains various types of textures such as rough, smooth, soft, hard, and others. The aim of this assignment is to develop a classification model to classify the different types of textures in the dataset. The model will help MiTEC to improve the quality control in its production line.

4 Dataset Description

Download one of the datasets from following link and read its descriptions.
https://github.com/J-Mourad/Dataset-crowd
Specify the total number of texture images and image size and type. The dataset is already divided into training, validation, and testing sets. If not, divide them into training, validation, and testing sets.

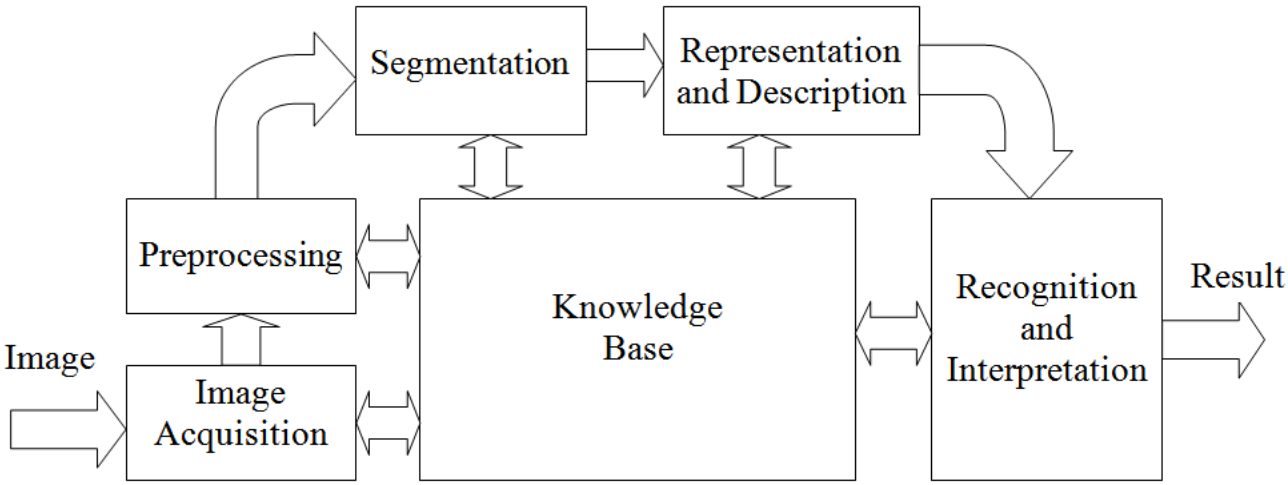
5 Task:

The goal of this assignment is to develop a texture classification model using CNN to classify the texture images into their respective categories accurately. The model should also be able to generalize well on new data.

6 Methodology

1. Exploratory Data Analysis (EDA): Conduct a thorough EDA on the texture dataset to gain insights into the data. The EDA should include statistical analysis, visualization, and interpretation of the dataset.
2. Data Preprocessing: Preprocess the texture images by resizing, normalizing, and augmenting the data to improve the model's performance.

3. Model Architecture: Design a CNN architecture suitable for the texture classification task. The architecture should include convolutional layers, pooling layers, and fully connected layers. Experiment with different hyperparameters to improve the model's performance.
4. Model Training: Train the CNN model on the training set using appropriate optimization techniques such as Stochastic Gradient Descent (SGD) or Adam.
5. Model Evaluation: Evaluate the performance of the classification model using different evaluation metrics such as accuracy, precision, recall, and F1-score. Use the validation set to fine-tune the model.
6. Model Deployment: Once the model is trained and evaluated, deploy the model to the testing set and evaluate the performance on the testing set. Report the final results and discuss the limitations and future work.



7 Deliverables:

- A detailed report documenting the entire process, including data preprocessing, EDA, model architecture, training, evaluation, and deployment.
- The code for the model, including the pre-processing, model architecture, and classification pipeline.
- The trained model weights and hyperparameters for reproducibility.
- A presentation summarizing the findings and recommendations.
- Compare your results with LeNet-5 model and report the results.
- Submission deadline is week 14. Submission is through 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.

8 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.
- Be sure to report the proposed method for each model in the report.
- There is no page limit.

9 Graded Components Weightage

- Results (10%)
- Code Quality (40%)
- Report and Analysis (20%)
- Competitive Mark Component (10%)
- Presentation and Formatting (20%)

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.