B.Sc. (Hons) in IT – Field of Specialization Interactive Media
2025 - Year 03 – Semester 02

SE3071 – Digital Image Processing
Final Project – Domain-Specific Image Analysis and Enhancement Tool using Python & OpenCV

Type: **Individual Assignment + VIVA**
Semester**: Year 3 Interactive Media**
Due Date: Will be announced in due course
Weight: **25%**

Objective

To design and implement an image processing application tailored to a real-world domain assigned based on the last digit of your IT number. The tool should apply digital image processing concepts from the module to acquire, process, enhance, analyze, and present images relevant to your allocated field.

Domain Allocation

Your assigned application domain is based on the **last digit of your IT Number**

Last Digit of IT Number	Assigned Domain	Example Image Types
0	**Medical Imaging**	X-ray, MRI, CT scans, ultrasound images
2	**Education / e-Learning**	Whiteboard photos, textbook scans, lecture slides
4	**Agriculture**	Plant leaves, crop fields, aerial farm images
6	**Security / Surveillance**	CCTV frames, license plates, face images
8	**Heritage & Culture**	Old photographs, artifacts, museum documents

Submission Guidelines

1. Submit your **Python project folder** with scripts, images, and dependencies.
2. Submit a **PDF report** (max 8 pages) including all documentation requirements.
3. Attend your **individual VIVA session**.

Assignment Tasks

Part A – Core Functionalities (Mandatory) – 30 Marks

Implement the following in your assigned domain:

1. **Image Acquisition & Display**
    - Load and display an original image.
    - Show metadata (dimensions, channels, color depth, file size).
2. **Color Space Conversions**
    - Implement BGR ↔ Grayscale, BGR ↔ HSV, and BGR ↔ Binary conversions.
3. **Histogram Analysis**
    - Generate histograms for grayscale and color channels.
    - Apply Histogram Equalization to enhance contrast.
4. **Basic Geometric Transformations**
    - Implement Rotation, Scaling, Translation, and Cropping.

Part B – Advanced Image Processing Features – 30 Marks

Select **any 3** of the following techniques **and apply them to your assigned domain images**:

1. **Image Smoothing & Noise Reduction**
    - Apply **Median**, **Gaussian**, and **Averaging** filters.
2. **Edge Detection & Sharpening**
    - Implement **Sobel**, **Laplacian**, and **Canny** edge detection.
    - Apply sharpening filters.
3. **Morphological Operations**
    - Apply **Erosion**, **Dilation**, **Opening**, and **Closing** to relevant binary images.
4. **Segmentation Techniques**
    - Apply **Thresholding** (Global + Otsu's) and one **region-based method** (Region Growing or Watershed).
5. **Frequency Domain Filtering**
    - Apply **Ideal / Gaussian High & Low Pass Filters** using Fourier Transform.

Part C – Documentation & VIVA – 40 Marks

- **Documentation (10 Marks)**
    - Introduction & objectives (linked to your assigned domain).
    - Methodology with screenshots and code snippets.
    - Justification of chosen techniques for your domain.
    - Challenges faced and solutions.
- **VIVA (30 Marks)**
    - Live demonstration of the tool.
    - Explanation of algorithms used.
    - Domain-specific theory and practical questions

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Marking Rubric – SE3071 Final Project (25%)

Criteria	Exceeding Expectation (Full Marks Range)	Meeting Expectation (Mid Marks Range)	Satisfactory (Lower Marks Range)	Below Expectation (Minimal Marks Range)	Marks
Core Functionalities (Part A) (30 Marks)	All required acquisitions, conversions, histograms, and transformations are correctly implemented, well-documented, and highly relevant to the chosen domain.	Most features are implemented with minor errors or omissions, but overall functionality is correct, and domain relevance maintained.	Some features implemented, but several missing or partially working. Domain relevance is weak or inconsistent.	Very limited or incorrect features, no clear domain mapping or tool fails to demonstrate basics.	**30**
Advanced Features (Part B) (30 Marks)	Three advanced techniques applied correctly, optimized for domain relevance, with evidence of strong understanding of algorithmic choices.	At least two advanced techniques applied with correct implementation but limited optimization for the domain.	Only one advanced technique applied correctly, or multiple with errors reducing functionality.	None implemented or implemented incorrectly with no domain justification.	**30**
Documentation Quality (10 Marks)	Report is clear, comprehensive, and professional. Includes intro, objectives, methodology with screenshots & code, justification of methods, and challenges faced.	Report is complete with minor gaps in explanation, justification, or visuals.	Report is minimal, missing several required sections or poorly explained.	No report submitted, or report lacks clarity and detail.	**10**
VIVA – Demonstration (10 Marks)	Smooth, confident demonstration of a fully working tool. All functionalities presented clearly.	Demo works with small issues but overall tool is functional.	Limited demo shown, only partial features working.	Tool fails to run or no demo presented.	**10**
VIVA– Understanding & Explanation (20 Marks)	Strong explanation of algorithms, clear domain-specific knowledge, confident answers to questions.	Good explanation with some gaps in technical or domain-specific reasoning.	Basic recall of concepts with weak domain linkage.	Incorrect, incomplete, or no explanation of algorithms.	**20**