Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Mid-term Examination, Summer 2026
Course Code: CSE414, Course Title: Research Innovation & Technical Writings
Level:4 Term:1 Batch:65

Time: 01:30 Hrs **Marks: 25**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.		A group of CSE students is conducting research to evaluate the effectiveness of an AI-powered adaptive learning platform designed to improve students' programming skills and learning experiences. The platform provides personalized recommendations, automated feedback on programming assignments, and intelligent study plans based on students' learning progress. To conduct their research, the students have designed two projects: • **Project 1**: Interview 15 undergraduate students from different academic years to understand their experiences, opinions, challenges, and perceptions regarding the usability and effectiveness of the AI-powered learning platform. • **Project 2**: Survey 200 undergraduate students using a structured questionnaire to measure their satisfaction levels with the platform on a scale of 1 (Very Dissatisfied) to 5 (Very Satisfied). The survey also collects information on students' frequency of platform usage, perceived learning improvement, and overall satisfaction. During data collection, the researchers record participants' names, student IDs, email addresses, academic performance (CGPA and course grades), and responses to the interviews and questionnaires. The collected data will be analyzed to determine whether the AI-powered learning platform positively influences students' learning outcomes and engagement.		**CO1**
	a)	Identify the type of research technique used in Project 1 and Project 2. Then, distinguish between the two techniques.	**[3]**	
	b)	As beginner CSE researchers, discuss two ethical issues that should be considered when handling the collected data.	**[4]**	
2		Medicinal plants including Ocimum tenuiflorum L. (Tulsi), Azadirachta indica A. Juss. (Neem), and Kalanchoe pinnata (Lam.) Pers. (Pathar kuchi) are essential sources of bioactive compounds, yet leaf diseases threaten their yield and phytochemical integrity. This study proposes LSeTNet, a lightweight hybrid CNN (Convolutional Neural Network) Transformer architecture with Squeeze-and-Excitation (SE) blocks, achieving 99.72% accuracy, 1.00 macro F1-score, and AUC = 1.00 across 12 disease classes (1,000 images/class post-augmentation) using only 9.38 M parameters and 2.50 GFLOPs. Five-fold cross-validation yielded 99.74% ± 0.14% accuracy, with rapid convergence and no overfitting. Explainable Artificial Intelligence (XAI) via Gradient-weighted Class Activation Mapping (Grad-CAM) (mean intensity: 0.1664–0.2702), Local Interpretable Model-agnostic Explanations (LIME), and t-distributed Stochastic Neighbor Embedding (t-SNE) (silhouette score: 0.87) confirmed biologically meaningful attention on pathological regions. External validation on the independent BD-MediLeaves dataset (8 classes, 8,000 samples) achieved 99.42% accuracy and 0.99 macro F1. With 6.98 ms/image inference latency and 35.81 MB memory, LSeTNet enables real-time, edge-based deployment. It significantly outperforms DenseNet169 (95.56%), ViT-B16 (95.61%), and LW-CNN+SE (95.39%), establishing a transparent, efficient, and generalizable benchmark for precision phytopathology and sustainable medicinal plant cultivation. **Author List**: Preeti Raj Verma, Deepika Pantola, Navneet Pratap Singh		
	a)	Based on the information provided in the above scenario, identify the essential elements of an effective literature review and use them to compose a concise literature review paragraph.	**[5]**	**CO2**

3		Accurate skin cancer classification is essential for early diagnosis and effective treatment; however, existing deep learning methods still face challenges in handling lesion variability, imaging artifacts, and domain shifts across clinical settings. This study proposes a novel hybrid deep learning framework that integrates Convolutional Neural Networks (CNNs) and Vision Transformers (ViTs) through a Multi-Scale Cross-Attention Fusion (MSCAF) module for robust and interpretable skin lesion classification. The framework is trained on the HAM10000 dataset and externally validated on the PAD-UFES-20 dataset to evaluate its generalizability across different clinical sources.		CO2
		The proposed model employs an automated Region-of-Interest (ROI) extraction module to isolate diagnostically relevant lesion regions while reducing background interference. The extracted ROI images are processed using a dual-branch architecture, where a CNN captures local texture patterns and a Vision Transformer learns global contextual dependencies. The MSCAF module effectively fuses multi-scale spatial and semantic features through cross-attention mechanisms, generating a discriminative representation for final classification. Performance is evaluated using five-fold cross-validation and independent external validation. The proposed framework achieves an accuracy of 98.4%, precision of 98.1%, recall of 97.8%, F1-score of 97.9%, specificity of 99.0%, and an AUC of 0.994 on HAM10000, while maintaining 97.3% accuracy on PAD-UFES-20. Comparative analysis demonstrates superior performance over ResNet50 (94.8%), DenseNet121 (95.2%), EfficientNet-B4 (95.9%), ViT-B/16 (96.4%), Swin Transformer (97.1%), and conventional CNN-ViT hybrid models (97.5%). Furthermore, Grad-CAM and attention-map visualizations provide clinically interpretable explanations by highlighting diagnostically relevant lesion regions. The results demonstrate that the proposed framework offers a reliable, accurate, and explainable solution for computer-aided skin cancer diagnosis.			
	a)	Design an end-to-end workflow illustrating all stages of the proposed framework, from dataset collection to final model evaluation.	[8]	
	b)	Based on the proposed methodology, analyze its potential limitations and propose alternative methods or additional techniques that could address these limitations and improve the overall framework.	[5]	