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Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Final Examination, Summer 2026

Course Code: CSE414, Course Title: Research Innovation & Technical Writings

Level:4 Term:1 Batch: 65

Time: 02:00 Hrs **Marks: 40**

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.

Configuration	Accuracy	Precision	Recall
Full Model	96%	94%	93%
Without Preprocessing	91%	90%	88%
Without Data Augmentation	89%	88%	87%
Without Attention Module	93%	91%	90%

	(a)	Explain the purpose of conducting an ablation study in deep learning research. Based on the given results, identify which configuration contributes the most to the model's performance and justify your answer.	[2+2]
	(b)	Suppose the proposed model is developed without performing an ablation study. Discuss the possible consequences and explain why an ablation study is important for validating the effectiveness of a deep learning model.	[4]

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2. A hospital has deployed a deep learning–based system to classify chest X-ray images into four categories: Normal, Pneumonia, COVID-19, and Tuberculosis (TB). The system is used as an initial screening tool to assist doctors in making faster clinical decisions. After deployment, doctors observe that some COVID-19 patients are classified as Pneumonia or TB, while some non-COVID patients are incorrectly classified as COVID-19. Such errors may result in delayed treatment, unnecessary isolation, additional diagnostic tests, and increased healthcare costs. Moreover, missing an actual COVID-19 case may increase the risk of disease transmission to other patients and healthcare workers. Therefore, the hospital management wants to evaluate the model using the given confusion matrix before using it for large-scale clinical screening.

	(a)	Considering COVID-19 as the positive class, explain the concepts of True Positive, False Positive, False Negative, and True Negative using appropriate examples from the given scenario. Discuss how each type of prediction may influence clinical decision-making and patient management.	[2+4]
	(b)	In a medical diagnosis system, a false-negative COVID-19 prediction may delay treatment and increase disease transmission, whereas a false-positive prediction may lead to unnecessary isolation and further medical testing. Analyze which type of error is more critical in this scenario. Based on your analysis, explain why accuracy alone is insufficient and identify the performance metrics that should receive greater importance while evaluating the model.	[4]

3. A healthcare startup is developing a deep learning–based system to detect diabetic retinopathy from retinal fundus images. The dataset is collected from multiple eye hospitals using different camera devices, resulting in variations in image quality, illumination, and resolution. Some images contain artifacts such as blurred regions and reflections, while the dataset is highly imbalanced because severe cases are much less frequent than mild or normal cases. Engineers preprocess the images, apply data

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	augmentation, and train several deep learning models, including EfficientNet, ResNet50, Vision Transformer (ViT), and MobileNetV3. The models are evaluated using accuracy, precision, recall, F1-score, and AUC. Since the system is intended for deployment in rural health centers with limited computing resources, the selected model must provide high diagnostic performance while maintaining low computational complexity and fast inference.			
		Based on the above scenario, analyze the engineering problem and identify the relevant CEP (Complex Engineering Problem), KP (Knowledge Profile), and EA (Engineering Activities) attributes. Justify your answers with reference to the problem complexity, required engineering knowledge, and the engineering activities involved.	[5+5+5]	
4.	A research team consisting of a supervisor, two graduate students, and a research assistant collaborates on a journal manuscript. One graduate student performs most of the work, including developing the research idea, conducting the experiments, analyzing the data, and writing the majority of the manuscript. However, before submission, the supervisor decides to list another faculty member as the first author, even though that person made only minor contributions, such as providing general comments during meetings. The student who completed most of the research is listed as the second author. Feeling concerned about fairness, the student remains silent, fearing that objecting may negatively affect future academic opportunities and recommendations.			**CO3**
		Analyze the ethical issues in this scenario with reference to authorship criteria, fairness, and academic integrity. Apply ethical principles to explain how authorship order should be determined and recommend appropriate practices to ensure fair and transparent authorship in scientific publications.	[7]	