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# Daffodil International University

**Faculty of Science & Information Technology**
**Department of Computer Science & Engineering**
**Mid-term Examination, Spring 2026**
**Course Code: CSE414, Course Title: Research Innovation & Technical Writings**
**Level:4 Term:1 Batch:64**

**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.]***

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| **1.** | ***a)*** | Describe the key components of the Introduction section in a research paper and explain the role of each component with an appropriate example. | **[2+5]** | **CO1** |
| **2** | | **Abstract:** White blood cells (WBCs) are a vital component of the immune system. The efficient and precise classification of WBCs is crucial for medical professionals to diagnose diseases accurately. This study presents an enhanced convolutional neural network (CNN) for detecting blood cells with the help of various image pre-processing techniques. Various image pre-processing techniques, such as padding, thresholding, erosion, dilation, and masking, are utilized to minimize noise and improve feature enhancement. Additionally, performance is further enhanced by experimenting with various architectural structures and hyperparameters to optimize the proposed model. A comparative evaluation is conducted to compare the performance of the proposed model with three transfer learning models, including Inception V3, MobileNetV2, and DenseNet201. The results indicate that the proposed model outperforms existing models, achieving a testing accuracy of 99.12%, precision of 99%, and F1-score of 99%. In addition, we utilized SHAP (Shapley Additive explanations) and LIME (Local Interpretable Model-agnostic Explanations) techniques in our study to improve the interpretability of the proposed model, providing valuable insights into how the model makes decisions. Furthermore, the proposed model has been further explained using the Grad-CAM and Grad-CAM++ techniques, which is a class-discriminative localization approach, to improve trust and transparency. Grad-CAM++ performed slightly better than Grad-CAM in identifying the predicted area's location. Finally, the most efficient model has been integrated into an end-to-end (E2E) system, accessible through both web and Android platforms for medical professionals to classify blood cell.<br>**Author List:** Ran Ran, Merve Uslu, Douglas K. Brubaker, and Martin Trapecar | | |
| | ***a)*** | Based on the provided abstract, construct a high-level workflow diagram of the proposed white blood cell classification approach, showing the pipeline data input to final output. | **[5]** | **CO2** |
| | ***b)*** | Write a Related Work describing a deep learning-based method for white blood cell classification based on the information stated in the abstract.<br>Note: Should be written in academic style and must not introduce any details that are not explicitly stated in the abstract. | **[5]** | |
| **3.** | | A group of final-year students is developing a machine learning project to predict diseases using patient medical records collected from a local clinic. They receive the data from the clinic staff but do not clearly explain to the patients how their data will be used in the project. The dataset also contains personal information such as names and contact details. | | **CO3** |
| | ***a)*** | Identify the ethical issues in this situation. Explain how the students should ensure privacy, obtain proper informed consent, and maintain data integrity while conducting their research. | **[2+6]** | |



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