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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

V Semester B. E. Regular Examinations Feb/Mar-2025

Artificial Intelligence and Machine Learning

MACHINE LEARNING OPERATIONS

Time: 03 Hours *Maximum Marks: 100*

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

			M	BT	CO
1	1.1	What is concept drift, and how does it affect machine learning models?	02	2	1
	1.2	Why is continuous monitoring important for deployed *ML* models?	02	2	1
	1.3	Describe two challenges addressed by MLOps in production environments.	02	1	2
	1.4	What are the key benefits of offering *ML* models as a service?	02	2	2
	1.5	Differentiate between data validation and process standardization in *ML* governance.	02	3	2
	1.6	Suggest a method to reduce the cost and latency of running ML models on edge devices.	02	2	2
	1.7	What are two key factors to ensure transparency in model auditability?	02	2	2
	1.8	Explain the difference between batch and real-time model deployment with examples.	02	2	2
	1.9	What are the major risks if *ML* models are not maintained regularly during production?	02	2	2
	1.10	How does model evaluation contribute to improving overall model performance? Name two metrics commonly used for evaluation.	02	2	2

PART-B

2	a	Explain the challenges in defining MLOps and how it mitigates risks in scaling machine learning models. Highlight the importance of collaboration among MLOps stakeholders to address these challenges.	06	2	1
	b	Elucidate the key roles involved in MLOps, how each contributes to successful ML operations. Provide examples to illustrate their responsibilities.	10	4	2
3	a	Discuss the role of data exploration, feature engineering, and selection in the model development process. How do these steps impact the overall performance of machine learning models?	10	3	2
	b	How does experimentation in model development help improve machine learning outcomes? Illustrate with an example.	06	2	2

OR

4	a	Explicate the complete lifecycle of Machine Learning Operations (MLOps), including model development, deployment, monitoring, iteration, and governance. Provide examples for each stage.	10	3	2
	b	What is the importance of feature engineering in machine learning? Provide examples of commonly used techniques.	06	2	2
5	a	A banking institution has implemented a fraud detection system using machine learning models to identify suspicious transactions and prevent financial fraud. The system analyzes transactional data, customer behaviour, and historical patterns to flag potentially fraudulent activities in real-time. The bank employs MLOps tools to manage the model life cycle, including training, versioning, deployment and monitoring across multiple environments. Elaborate the various risks the system faces while moving from development to deployment, and continuous monitoring is necessary to assess the model's performance, security, and adherence to ethical standards.	08	3	2
	b	Explain the significance of the runtime environment in ML model production with a real-world example.	08	4	2
		OR			
6	a	Discuss the importance of quality assurance in machine learning systems. How do runtime environments, key testing considerations, and model risk evaluation contribute to building reliable models?	10	3	2
	b	"How can machine learning security measures and model risk mitigation strategies help protect production systems from vulnerabilities"?	06	4	2
7	a	Discuss the importance of feedback loops in machine learning systems. How do concepts like model degradation, drift detection, and retraining frequency ensure model performance over time? Provide practical examples.	10	3	3
	b	What are the key challenges and requirements for scaling machine learning model deployments?	06	3	3
		OR			
8	a	Explain the role of *CI/CD* pipelines and containerization in deploying machine learning models to production. How do these technologies address scalability, reliability, and maintainability in deployment strategies?	10	3	3
	b	How does drift detection help identify and address model performance issues in production environments?	06	3	2
9	a	What are the key elements of responsible AI in the context of MLOps governance? Discuss how governance can be matched with risk levels and provide examples of regulations driving MLOps governance practices.	10	2	3
	b	How does logging enhance observability in machine learning operations, and what are the key components of effective logging in Python?	06	2	2
		OR			

10	a	Explain the role of monitoring and observability in cloud-based MLOps. How do logging practices, particularly in Python, contribute to identifying and addressing model performance issues?	10	2	3
	b	What is the importance of matching governance structures with the risk levels of machine learning systems? Provide examples of how this can be implemented.	06	2	2