Research Objectives Breakdown

Main Research Question:
Can deep learning + LLM predict student outcomes and provide actionable interventions?

Objective 1: Student Performance Prediction

Objective 2: Student Dropout Prediction

3-Class Classification (Low/Medium/High)

Binary Classification (Dropout/Continue)

Task 1.1: Baseline Model (PPN)

Task 1.2: Feature Importance Analysis

Task 1.3: Class Imbalance Handling

Task 1.4: Confusion Matrix Analysis

Task 1.5: Multi-metric Evaluation

Task 2.1: Attention-based Model (DPN-A)

Task 2.2: Temporal Feature Engineering

Task 2.3: ROC-AUC Optimization

Task 2.4: Precision-Recall Analysis

Task 2.5: Early Warning Threshold

Results (PPN):
Accuracy: 76.4% | Macro F1: 0.764
Interpretable predictions with attention

Results (DPN-A):
Accuracy: 87.05% | AUC-ROC: 0.910
Superior binary classification performance

Integrated Analysis: Multi-Task Learning (HMTL)
Objective: Compare single-task vs multi-task learning
Finding: Task interference observed (67.9% dropout in MTL vs 87.05% in DPN-A)
Conclusion: Dedicated models outperform multi-task approach for this dataset

LLM Enhancement: GPT-4 Recommendation Engine
Converts predictions into actionable interventions
Personalizes support based on student profile + risk factors