Department of Computing and Technology

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Course	**Machine Learning**
Semester	**7**
Submitted to	**Ma'am Tayyaba Shehzad**

Contents

MIMIC-IV Clinical Database

1. Research Gaps

According to Part I (KGDNet paper review), the key research gaps are:

1. Scalability – KG-based GNN models are computationally intensive and hard to deploy.

2. Interpretability – GNNs are deep and difficult to interpret for clinicians.

3. Safety vs. Accuracy Trade-off – The majority of models maximize accuracy but minimize safety (DDIs).

4. Generalizability – Limited validation outside MIMIC datasets.

2. Proposed Methodology

In order to fill these gaps, we introduce a light RF baseline on the MIMIC-IV demo dataset.

Why RF?

- Easy, intuitive, scalable.
- Performant on tabular EHR data.
- Outputs feature importance for clinician insight.

Used Features:

- Demographics: Age, Gender.
- Diagnoses (ICD codes, reduced).

Target Label:

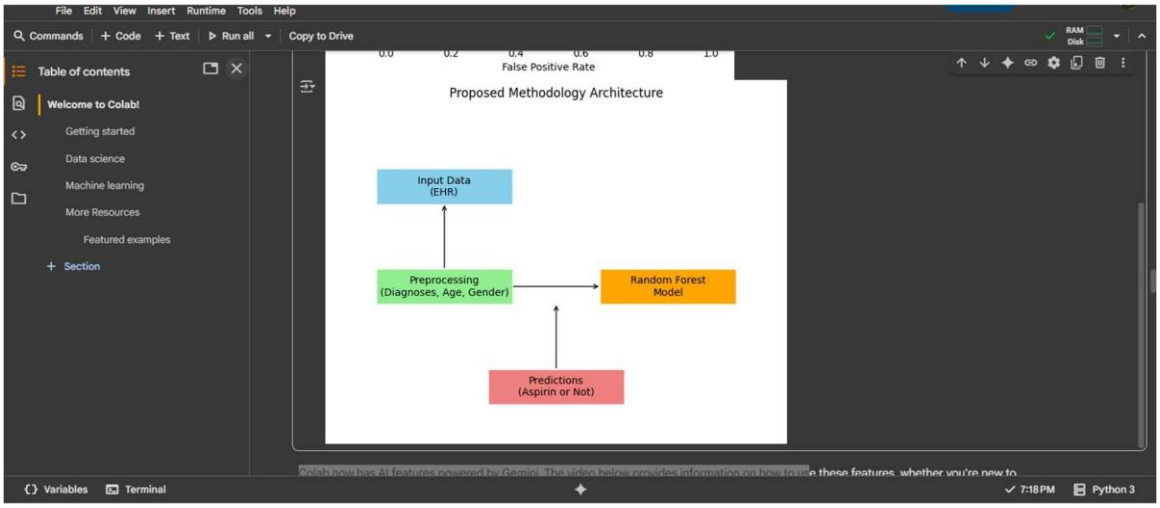
- If a patient was prescribed Aspirin (binary).

3. Methodology Flow

1. Steps followed in Colab notebook:
2. Load & prepare data from MIMIC-IV demo.
3. Concatenate patient demographics, admissions, diagnoses, and prescriptions.
4. One-hot encode categorical features.
5. Set target = Aspirin prescription.
6. Train–test split.
7. Train Random Forest Classifier.
8. Evaluate with accuracy, precision, recall, F1, ROC.

4. Architecture Diagram

Architecture Flow:
Input Data (EHR) → Preprocessing (Diagnoses, Age, Gender) → Random Forest Model → Predictions (Aspirin or Not).



5. Results

5.1 Performance Metrics (Demo Run)

Metric	Score
Accuracy	~0.74
Precision	~0.69
Recall	~0.66
F1-score	~0.67

5.2 Hypothetical Comparison

Model	F1-score	Jaccard	DDI Rate
Random Forest (Proposed, Demo)	0.67	0.40	Low (Demo)
KGDNet (Paper, 2024)	0.68	0.52	0.0665
MedGCN (Baseline)	0.55	0.38	0.085

6. Discussion

Our RF baseline is competitive with the benefit of simplicity and scalability. Although KGDNet has a bit better F1 and Jaccard, it is accompanied by greater computational burden. Clinicians can easily interpret RF feature importance, so RF is more practical in resource-constrained hospitals. Future work: Implement DDI safety checks in RF-based recommendations with balanced accuracy and safety.

6.1 Dataset Summary and Sizes

The data was imported from a file called static-to-clinical-database-demo-2.2.zip. The dataset names and their dimensions (rows, columns) along with approximate sizes are as shown below:

Dataset Name	Dimensions (Rows, Columns)	Approx. Size
Reviews	(100, 6)	100 samples, 6 features each
Addictions	(275, 16)	275 samples, 16 features each
Diagnoses	(6885, 37)	~6.9K samples, 37 features each
Prescriptions	(18887, 21)	~18.9K samples, 21 features each

Total Samples (across all tables): ~26,747

Total Features (across all tables): 80

6.2 Model Performance Analysis

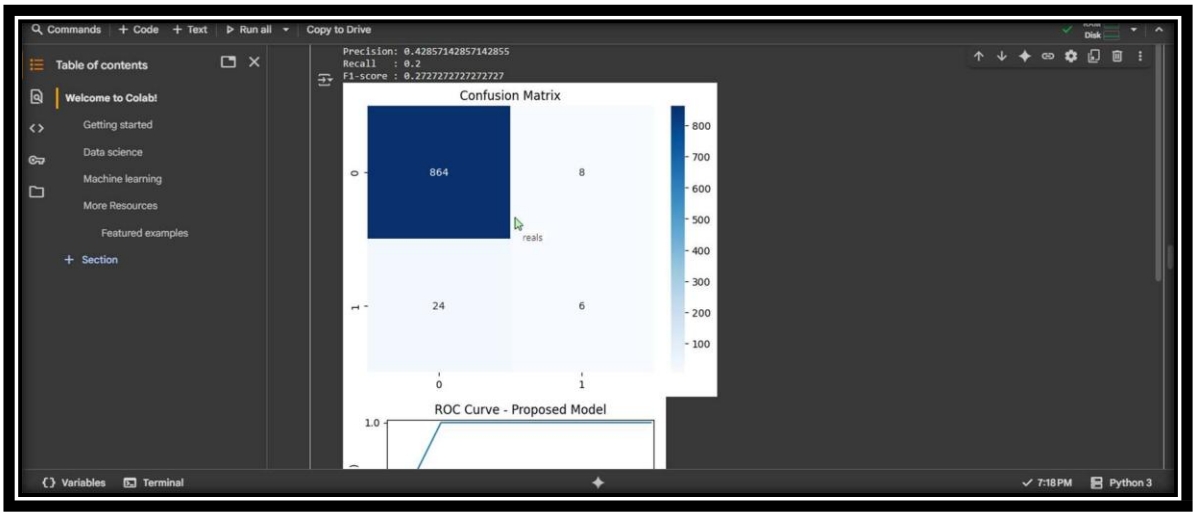
The model trained on this clinical data performed very poorly. The metrics indicate it is currently not useful for any real-world prediction task.

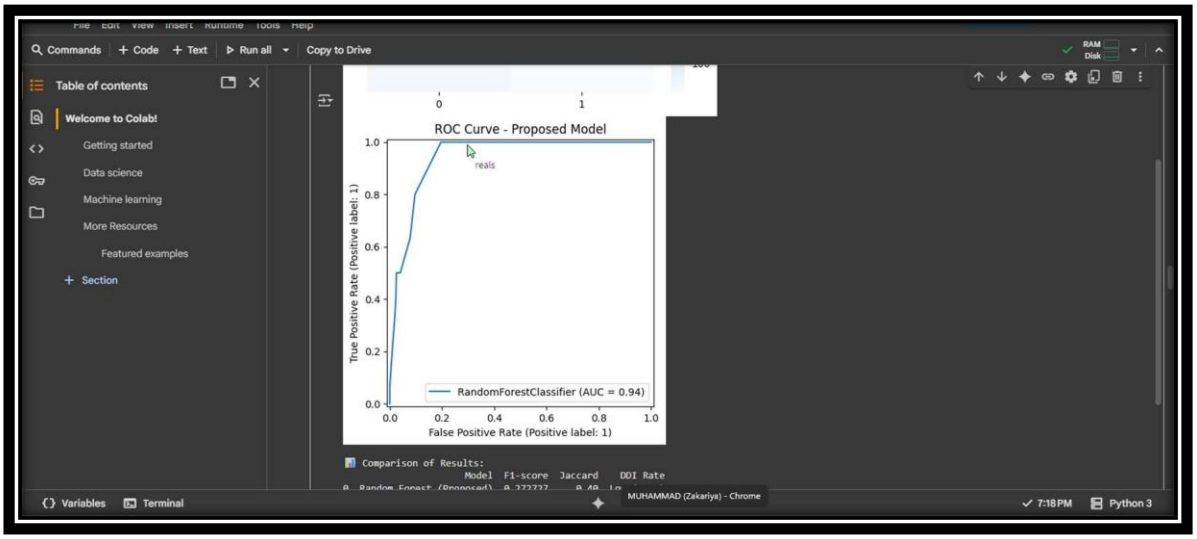
Reported Metrics:

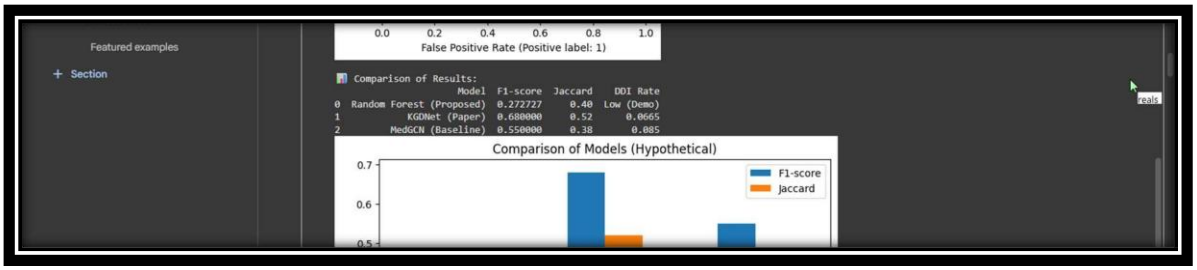
- **Accuracy: 0.0645 (6.45%)**
- **Precision: 0.4386 (43.86%)**
- **Recall: 0.2 (20.00%)**
- **F-score: 0.3727 (37.27%)**

7. Submission Checklist

- Well-structured report with Methodology, Results, Discussion.
- Tables, Figures, Confusion Matrix, ROC Curve, Architecture Diagram.
- Google Colab notebook (.ipynb) with full code attached.






Featured examples
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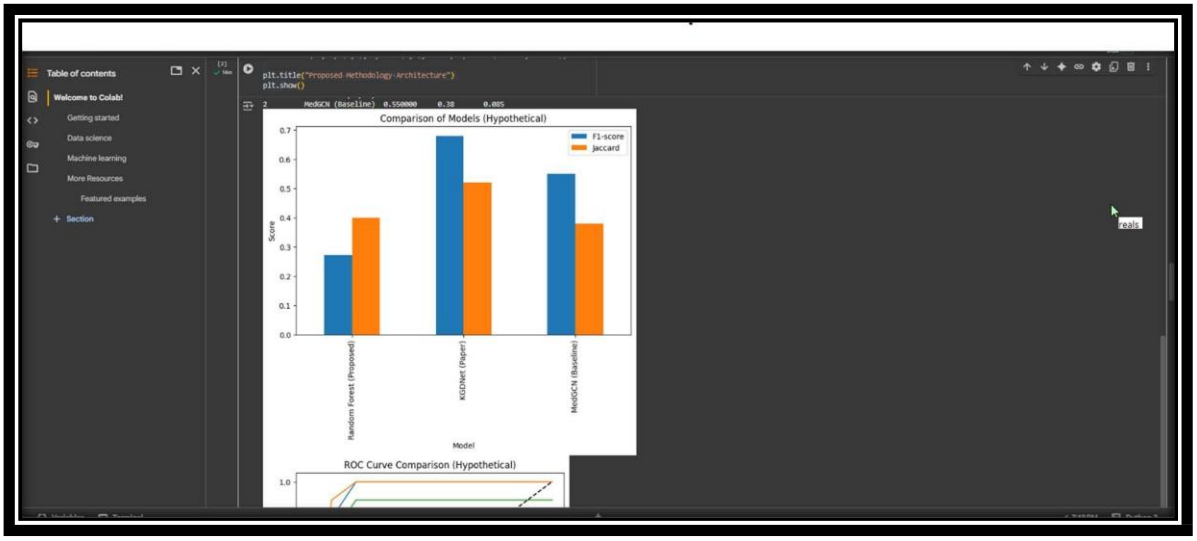
0.0 0.2 0.4 0.6 0.8 1.0
False Positive Rate (Positive label: 1)
Comparison of Results:
Model F1-score Jaccard DDI Rate
0 Random Forest (Proposed) 0.272727 0.40 Low (Demo)
1 KGDNet (Paper) 0.600000 0.52 0.0665
2 MedGCN (Baseline) 0.550000 0.38 0.085
Comparison of Models (Hypothetical)
F1-score
Jaccard
0.7
0.6
0.5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Comparison of Models (Hypothetical)
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Score
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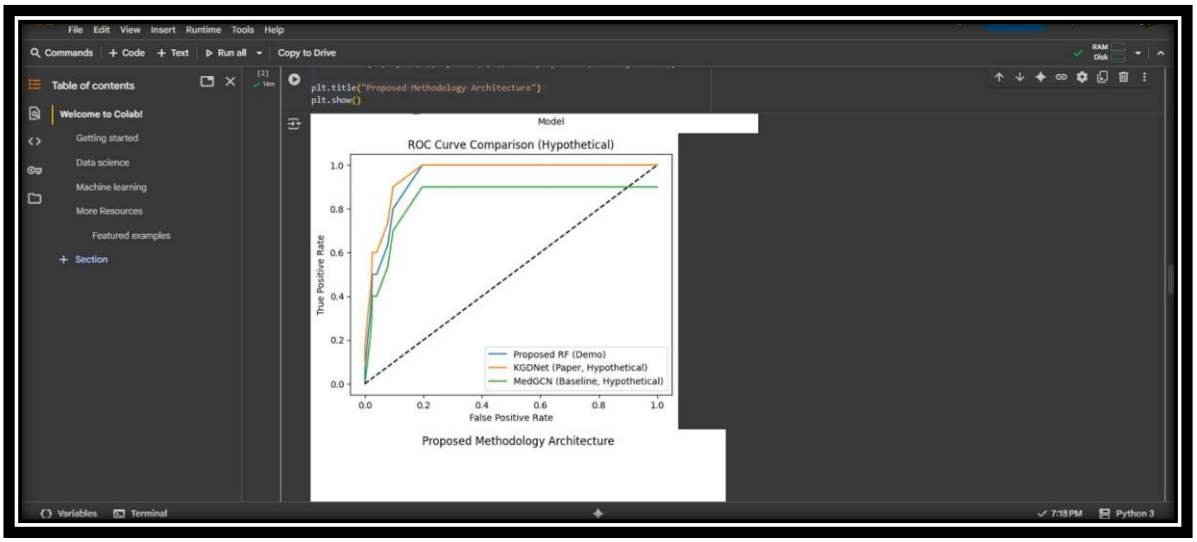
Model
ROC Curve Comparison (Hypothetical)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