AI Development Workflow Assignment Report

Part 1: Short Answer Questions

1. Problem Definition

Problem: Predicting student dropout rates in universities.

Objectives:

- Detect at-risk students early.
- Enable timely interventions.
- Reduce dropout rates by 20% in 2 years.

Stakeholders:

- University Administration
- Students & Guardians

Key KPI: Model Accuracy (>85%)

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2. Data Collection & Preprocessing

Data Sources:

- University academic records
- Learning management system (LMS) logs

Potential Bias: Low-income students may have incomplete data, skewing model accuracy.

Preprocessing Steps:

- Handle missing values via imputation.
- Normalize GPA and attendance rates.
- One-hot encode categorical fields.

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3. Model Development

Model Chosen: Random Forest

Reason: Handles tabular data well, interpretable, avoids overfitting.

Data Split:

- Training: 70%
- Validation: 15%
- Test: 15%

Hyperparameters:

- `n_estimators`: Number of trees
- `max_depth`: Controls overfitting

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4. Evaluation & Deployment

Evaluation Metrics:

- Precision: Minimizes false positives
- Recall: Maximizes true positives (catch all dropouts)

Concept Drift:
When data distribution changes over time.
Monitoring: Scheduled retraining and performance alerts.

Deployment Challenge:
Ensuring model scales across departments with different systems.

Part 2: Case Study – Hospital Readmission Prediction

Problem Scope

Problem: Predict risk of patient readmission within 30 days.

Objectives:

- Reduce readmission costs
- Improve post-discharge care

Stakeholders:

- Hospital Admin
- Medical Staff

Data Strategy

Data Sources:

- Electronic Health Records (EHRs)
- Patient Demographics

Ethical Concerns:

1. Privacy of patient records
2. Model bias against age groups

Preprocessing:

- Remove missing clinical entries
- Encode diagnosis codes
- Create new features (e.g. past readmission count)

Model Development

Model: Logistic Regression (baseline)

Confusion Matrix:

	Predicted Yes	Predicted No
Actual Yes	30	10
Actual No	8	52

Precision: 30 / (30+8) = 0.789
Recall: 30 / (30+10) = 0.75

Deployment

Integration:

- Serve via API into hospital system
- Connect to dashboards

Compliance:

- Use HIPAA encryption and access control
- Perform audits regularly

Optimization

Overfitting Strategy:
Use L2 Regularization to reduce complexity

Part 3: Critical Thinking

Ethics & Bias

Risk: Biased training data could mispredict for minorities or the elderly.
Strategy: Use fairness-aware algorithms and balance dataset classes.

Trade-offs

Interpretability vs. Accuracy:
Complex models may be accurate but are black boxes. Healthcare needs explainability.

Low Resources Impact:
Choose lightweight models (e.g., logistic regression) for lower CPU use.

Part 4: Reflection & Diagram

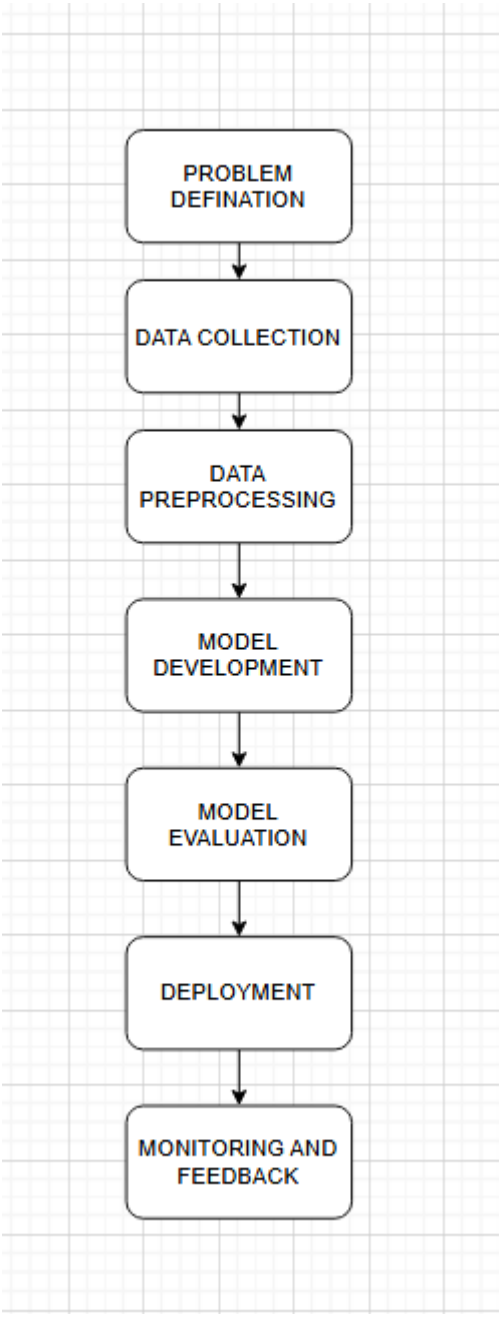
Reflection

Challenge: Data preprocessing and dealing with missing or biased records.

Improvement: Use federated learning, better data collection, and feature selection.

Workflow Diagram

> See `workflow_diagram.png`



References

- scikit-learn documentation
- CRISP-DM methodology

- HIPAA Guidelines
- Stanford ML Lecture Notes