Proposal: Personalized Movie Recommendation System

Team Members:

- Sara Mohamed Hassan
- Omnia Nabil
- Omina Salman
- Mariam Mohsen

Overview:
Our project, *Personalized Movie Recommendation System*, leverages **Generative Adversarial Networks (GANs)** and **autoencoders** to generate personalized movie recommendations based on user preferences. The system integrates a **FastAPI** backend for real-time user interactions, and preprocessing is handled using **scikit-learn** pipelines for categorical and numerical data.

Project Objectives:

1. **Data Collection and Preprocessing**: Collected and cleaned a dataset, implemented preprocessing using **scikit-learn** pipelines, handling both numerical and categorical features.
2. **Recommendation Models**: Developed deep learning-based recommendation models, including **GANs** and **autoencoders** to learn latent user preferences and predict movie ratings.
3. **Model Evaluation and Optimization**: Optimized model performance using **MSE**, **RMSE**, and **MAE**, and saved the trained models for future use.
4. **API Deployment and Real-Time Prediction**: Deployed the system using **FastAPI** to deliver real-time movie recommendations based on user input, leveraging latent vectors for personalized suggestions.

Project Phases:

- **Week 1**: Data Collection and Preprocessing
    - Collected and cleaned movie-related data, including user ratings, movie titles, and IDs.
    - Created preprocessing pipelines for numerical and categorical features using **scikit-learn**.

  Deliverables: Cleaned dataset and preprocessing pipeline (`all_pipeline.pkl`).

- **Week 2**: Building Recommendation Models
    - Implemented a **GAN**-based model for generating user-item matrices and predicting movie ratings.
    - Developed an **autoencoder** to learn and compress user preferences into latent vectors, used for personalized recommendations.

  Deliverables: Trained GAN and autoencoder models (`generator_model.pkl`, `latent_vectors.npy`).

- **Week 3**: Model Evaluation and Optimization
    - Evaluated model performance using **MSE**, **RMSE**, and **MAE**, and tuned hyperparameters for optimal accuracy.
    - Trained and validated models using **train_test_split** for 80-20 data partitioning.

  Deliverables: Evaluation results and optimized models.

- **Week 4**: API Deployment and Documentation
    - Deployed the system using **FastAPI** to provide real-time recommendations based on user input.
    - Documented the project and prepared final deliverables.

  Deliverables: FastAPI deployment and final project documentation.

Tools and Technologies:

- **Programming Language**: Python
- **Libraries**: TensorFlow (Keras), Scikit-learn, Pandas, NumPy, Joblib, Pickle
- **Deep Learning Models**: GANs, Autoencoders
- **Deployment**: FastAPI

Current Status:

- **Data Collection and Preprocessing**: Completed, with pipelines created for data transformation and feature handling.
- **Modeling**: GAN and autoencoder models implemented, enabling user-specific recommendations based on latent vectors.
- **API Deployment**: The system is deployed using **FastAPI**, allowing real-time user interactions and predictions.

Expected Outcomes:

- A functional recommendation system that delivers personalized movie suggestions using latent vectors and GANs.
- Optimized model accuracy through advanced evaluation metrics and hyperparameter tuning.
- Real-time recommendation service integrated into a FastAPI backend.

Conclusion:
This project integrates advanced deep learning models, specifically **GANs** and **autoencoders**, to deliver personalized movie recommendations. The system is deployed via a **FastAPI** backend, allowing users to request real-time recommendations based on their preferences.
