Project 1: Music Genre Generation System

Objective:

Modern people rely on music streaming services to discover new music. To improve the efficiency of music creation and recommendation systems, automated classification technology is not only a fundamental aspect of data categorization but also a core technique in music AI applications.

The goal of this project is to develop a machine learning system that can automatically generate music in specific genres, analyzing audio features to determine whether the generated music belongs to genres such as classical, rock, pop, and other similar styles.

Datasets:

Music Genre Dataset: GTZAN Genre Collection

- 1,000 music clips (each 30 seconds long)
- 10 music genres: blues, classical, country, disco, hiphop, jazz, metal, pop, reggae, rock
- Download link: https://www.kaggle.com/datasets/carlthome/gtzan-genre-collection

Evaluation Criteria:

1. **Classification Accuracy**
   Measures the proportion of generated music clips that are correctly identified as belonging to their intended genres by an automatic genre classifier. High accuracy indicates that the generated music closely matches the desired style.
2. **Confusion Matrix Analysis**
   Provides a detailed breakdown of classification results, showing how often generated samples of one genre are misclassified as another. This helps to identify specific genres that the system finds challenging to generate or distinguish.
3. **Loss Curve**
   Visualizes the change in training and validation loss over time during the model's learning process. Analyzing the loss curve helps to assess the convergence, stability, and potential overfitting or underfitting of the model.

4. **Completeness of the GUI Interface**

   Evaluates the functionality and user-friendliness of the graphical user interface (GUI). A complete GUI should allow users to select target genres, generate music samples, listen to outputs, and possibly visualize results (e.g., genre predictions, audio features).

Project 2：Style-Guided Portrait Generation: From Realistic Faces to Comic, 3D Rendered, and Beauty Styles

Description:

This project aims to develop a deep learning–based image generation system capable of producing multiple stylistic variations of a given realistic human face photograph. The model should automatically generate portraits in the following three distinct styles:

1. **Beauty Filter Style**
2. **Comic (Western Cartoon) Style**
3. **3D Rendered Cartoon Style**

This task falls under the category of **style-guided image generation**, which emphasizes not only the accurate rendering of stylistic features but also the preservation of essential facial identity and recognizable features of the subject. Students are expected to implement one or more image-to-image translation models and demonstrate the system's effectiveness in generating stylistically diverse yet consistent outputs.

All results will be evaluated by the teaching assistant (TA) using a predefined set of ground truth images to assess style fidelity and identity preservation.

Objectives:

- To design an automated system that takes a realistic facial image as input and outputs portraits in multiple specified styles.
- To ensure the generated images are of high visual quality and accurately reflect the intended stylistic attributes.
- To develop and train deep learning models with effective style transformation capabilities.

Dataset：

- All required datasets are provided via a shared Google Drive folder.
- The dataset contains paired examples of realistic face photos and their corresponding stylized versions in three styles: beauty filter, comic, and 3D cartoon.
- Students must download the dataset from the designated link provided by the

TA and use it for both model training and evaluation.

https://drive.google.com/drive/folders/1k6g0WfWgzEhzJdJMv_lTE2j9f7CDMURJ?usp=drive_link

Evaluation Criteria:

All submitted models will be evaluated centrally by the TA. During the evaluation phase, a set of withheld realistic portraits will be fed into each team's generation model, and the resulting stylized outputs will be compared with the corresponding ground truth images. The evaluation will focus on the following aspects:

- **Visual quality:** clarity, resolution, and preservation of fine details in generated images.
- **Style fidelity:** how well the generated image reflects the intended style characteristics (e.g., cartoon-like features, 3D shading, beautification effects).
- **Identity consistency:** whether the output image retains key facial features of the original subject and can still be recognized as the same person.

Project 3: Forex Prediction and Trading Decision

Description:

The Foreign Exchange (FX) Market is the most liquid financial market globally, characterized by high volatility and leverage, attracting numerous investors and fintech applications.

When trading in the FX market, investors engage in the following core concepts and operations:
First, an investor must analyze the future trend of a currency pair (e.g., USD/JPY, EUR/USD). If an upward trend is expected, they may choose to go **Long** (buy the currency pair); if a downward trend is expected, they may choose to go **Short** (sell the currency pair).

When opening a position, the trader must pay a **margin** as collateral for risk management. The remaining portion of the position is amplified by **leverage**, typically 10x, 20x, or 50x. After opening a position, the account will reflect **floating profit and loss (Floating PnL)** as the market exchange rate fluctuates, directly impacting the account **equity**.

During the holding period, traders may choose to **increase** or **reduce** their positions. According to risk management strategies, they may also set **Take Profit** or **Stop Loss** conditions. Additionally, if the account equity falls below a certain risk threshold, the platform will trigger an automatic **Liquidation** to protect the remaining capital.

In summary, real-world forex trading combines **predictive analysis**, **risk control**, and **real-time decision-making** in a dynamic system. Traders must continuously adjust their strategies based on market changes to achieve stable returns in a highly volatile environment.

This project aims to design a **multi-currency forex trading simulation system** that integrates **AI-based forecasting models** with **trading decision models**.

Objectives:

1. **Multi-Currency Trading Simulation Environment**

    - Develop a simulation that supports three currency pairs: **USD/JPY**, **USD/EUR**, and **USD/GBP**.
    - During training, any currency pair may be used; however, testing must use the above three pairs.

2. **Support Leverage, Dynamic Capital Management, and Floating PnL Calculation**

   - Default leverage: **5x**, adjustable.
   - Default margin: **$10 USD per position**, adjustable.
   - Liquidation threshold: **30%**, adjustable.

3. **Use Deep Learning Models for Forex Forecasting and Trading Decisions**

   - If an upward trend is predicted → consider **Long** (buy).
   - If a downward trend is predicted → consider **Short** (sell).
   - Predict whether the trend is further strengthening.
   - Evaluate whether the current position is below the risk control limit.

Rules：

1. The simulation runs on a **daily basis** for a period of up to **90 days**.
2. The simulation environment needs to accept **two types** of input data: **historical exchange rates** and the **current actual exchange rate**. For example, if we provide the exchange rates for the past **900 days** and up to **day 990**, the program should start from **day 900** and perform **exchange rate predictions** and **trading decisions** for the subsequent **90 days**.
3. During the simulation, the **actual exchange rate of the current day** is updated in **real time**, but the prediction and trading action models are **not allowed** to access the **actual exchange rate** of the following day directly.
4. For each day, output the following trading information:

   - **Predicted exchange rate**
   - **Actual exchange rate**
   - **Floating PnL**
   - **Position status**

5. The exchange rate prediction model **must** use an **AI model**.
6. The trading action model can be freely designed:
   - Rule-based (e.g., go long if predicting an upward trend, short if predicting a downward trend), or
   - AI-based decision logic (e.g., based on model confidence or predicted signals).
7. A simulation environment code template will be provided. Students must

complete the **exchange rate prediction model** and **trading action model**, and integrate them into a complete simulation system with a **GUI interface**.

Dataset:

Exchange rate data from various countries can be obtained from:
https://finance.yahoo.com
Data extraction methods will be provided in the example code**.**

Evaluation Criteria:

- Prediction accuracy (Accuracy)
- Return on investment (ROI)
- Model architecture and training methodology