BRACT's

Vishwakarma Institute of Information Technology, Pune

Department of Computer Science and Engineering (Artificial Intelligence)

Art Painting Recogniation System

Group Detail

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Problem Statement

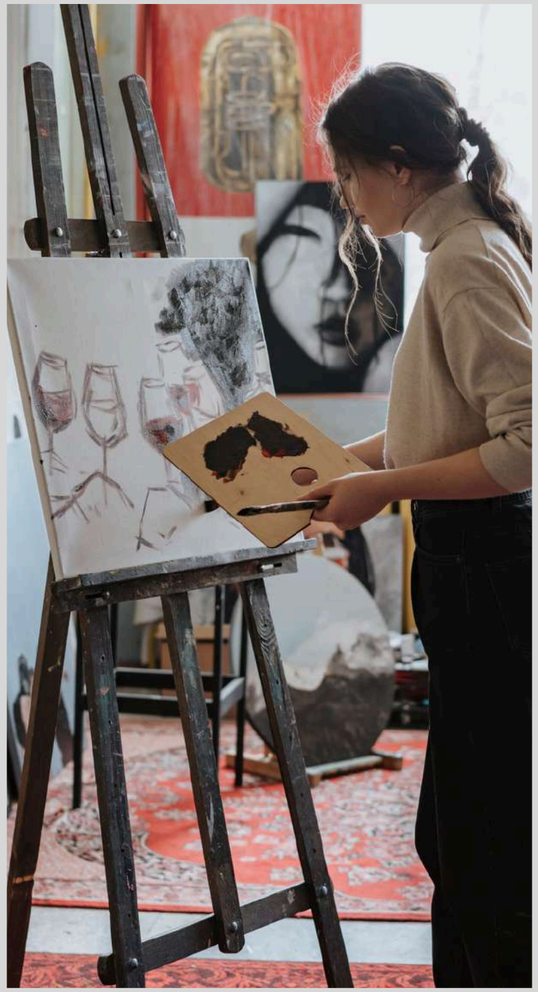
The traditional method for identifying and classifying paintings relies heavily on expert analysis, which can be subjective, time-consuming, and not easily accessible to the public. Existing models often lack accuracy and adaptability, especially when analyzing artworks outside predefined datasets.

The system will:

- Identify paintings from a dataset and offer detailed information about the artist and genre.
- Accurately predict the genre of new paintings outside the existing dataset with high confidence.
- Improve prediction accuracy to over 80% through sophisticated training and validation methods.

By addressing these issues, this system aims to provide a reliable and efficient solution for painting identification, making art classification more accessible to enthusiasts, researchers, and collectors globally.

Introduction



Objective: Develop a painting recognition system that can analyze, classify, and provide detailed information about paintings.

- **Purpose:** Bridge the gap between art and technology.
- **Target Users:**
  - Art enthusiasts
  - Students
  - Historians
  - Art collectors

Functionality:

- Identify and classify paintings based on:
  - Genre, Artist
  - Historical insights/context
- Use machine learning for accurate recognition.

Key Benefit: Makes it easy to identify and remember various types of art.

Literature Survey

Sr.no	Author	Title of paper	Key findings
1	Zhenyu Wang; Jie Lian; Chunfeng Song; Zhaoxiang Zhang; Wei Zheng; Shaolong Yue	SAS: Painting Detection and Recognition via Smart Art System With Mobile Devices	The Smart Art System (SAS) is a mobile-friendly artwork recognition system that employs a deep learning approach. It consists of two modules: (1) SSD-PLL detection, which filters out a complex background, and an ultra-light classifier that integrates MobileNet Local Features Fusion (LFF) to recognize the artwork on mobile devices. SAS has been evaluated using two large datasets with promising results (7,500 Traditional Chinese Paintings, 8,800 Oil Paintings), SAS has shown to significantly improve accuracy and real-time performance when compared to other approaches, and it can make the task of art recognition more efficient and accessible.
2	Giovanna Castellano and Gennaro Vessio	"Deep Learning Approaches to Pattern Extraction and Recognition in Paintings and Drawings: An Overview"	This paper provides a comprehensive overview of deep learning methods applied to pattern extraction and recognition in visual arts, particularly focusing on paintings and drawings. It discusses the challenges and opportunities presented by the integration of deep learning techniques in analyzing and understanding visual artworks

Literature Survey

Sr.no	Author	Title of paper	Key findings
3	Adrian Lecoutre, Benjamin Negrevergne, Florian Yger	"Recognizing Art Style Automatically in Painting with Deep Learning"	This research investigates the use of deep residual neural networks to detect the artistic style of paintings. By retraining pre-trained networks on the Wikipaintings dataset, the study achieves significant accuracy improvements, demonstrating the potential of deep learning in automatic art style recognition.
4	Prathmesh Madhu, Ronak Kosti, Lara Mührenberg, Peter Bell, Andreas Maier, Vincent Christlein	"Recognizing Characters in Art History Using Deep Learning"	Focusing on the iconography of the "Annunciation of the Lord," this study explores the use of convolutional neural networks to recognize characters like Mary and Gabriel across different artworks and styles. It highlights the challenges and potential of deep learning in character recognition within art history
5	Zhenyu Wang, Heng Song	"A Fusion Model for Artwork Identification Based on Convolutional Neural Networks and Transformers"	This paper proposes a fusion model that combines CNNs and Transformers to address the limitations of each approach in artwork identification. The model extracts local features using CNNs and captures global context with Transformers, resulting in enhanced classification accuracy on Chinese and oil painting datasets

Methodology

Data Collection & Preprocessing

- Collect the dataset (images + metadata).
- Resize, normalize, and clean data (handle missing labels, balance classes).

Feature Extraction

- Use deep learning (CNN, transfer learning) to extract painting-specific features.
- Identify texture, color, and brushstroke patterns.

4. Model Selection & Training

- Train a deep learning model for classification

Testing & Validation

- Evaluate model accuracy, precision, recall.
- Adjust parameters to improve performance..

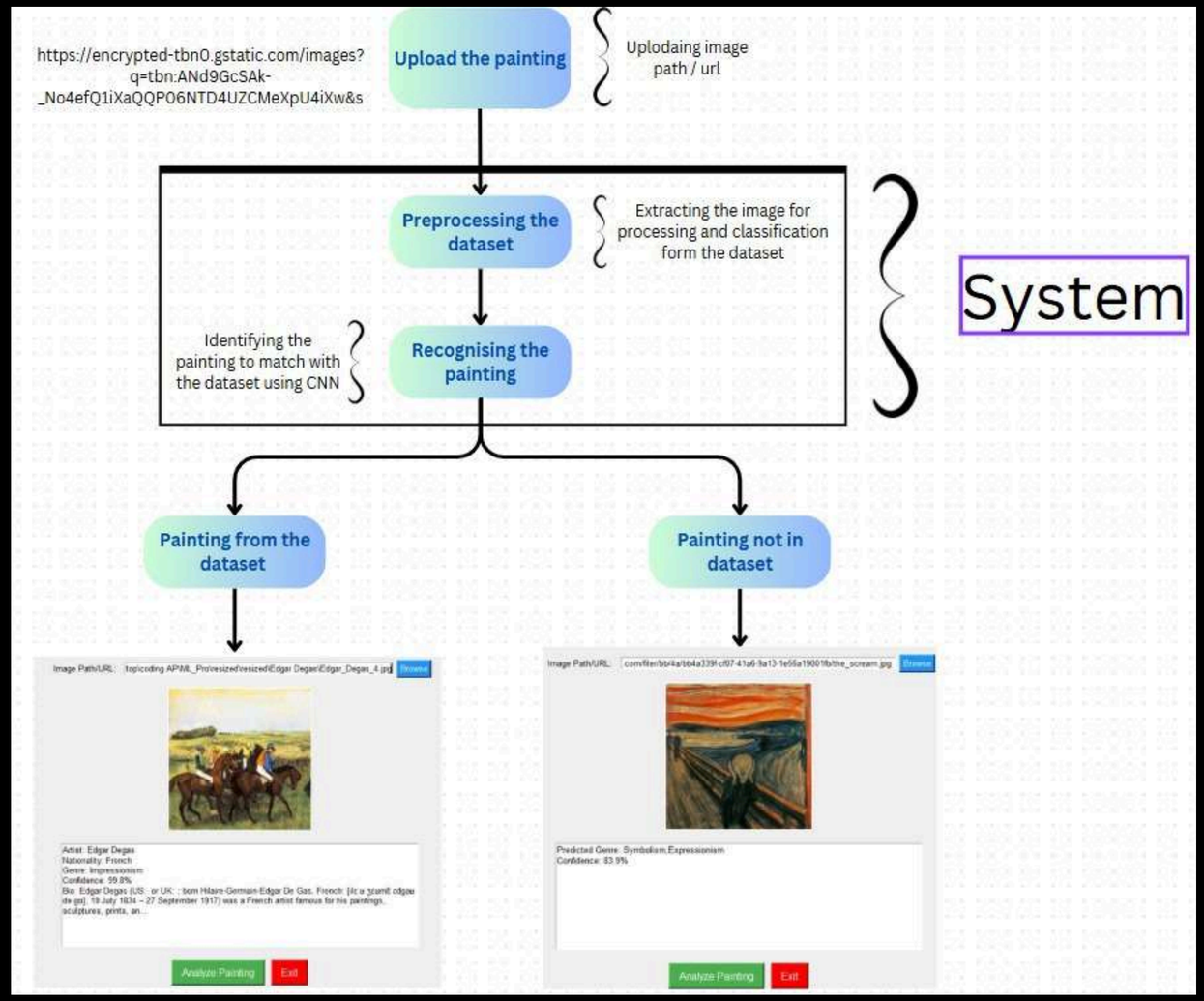
Genre Prediction for New Paintings

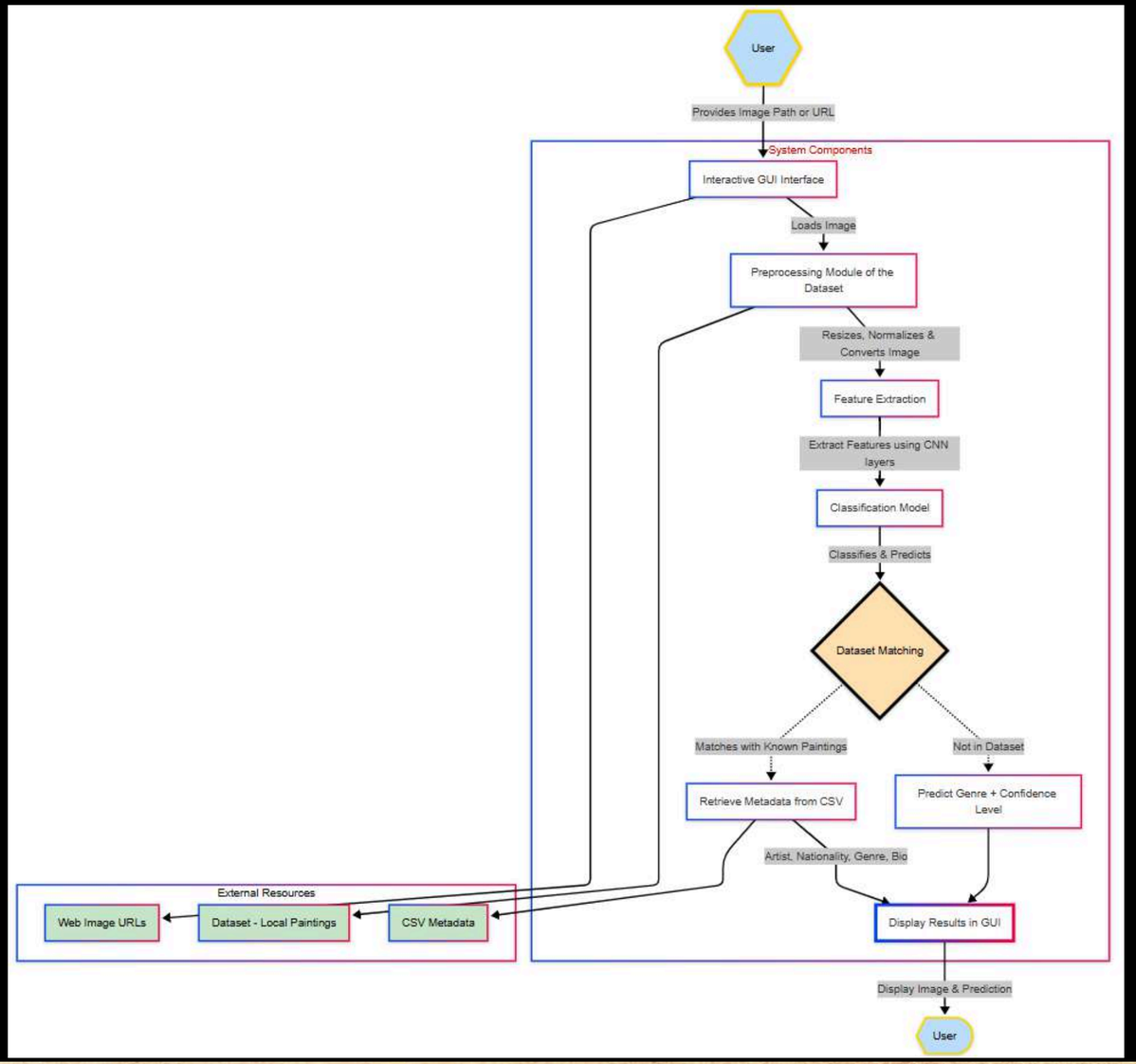
- Classify unseen paintings based on learned features.
- Predict genre with a confidence level.

Deployment

- **Develop a GUI-based application using Tkinter.**
- **Ensure smooth image input and prediction display for users**

Architecture and Flow Diagram





Implementation Details

Tech Stack:

- Programming Language: Python
- Frameworks: TensorFlow, Keras
- Libraries: NumPy, Pandas, Matplotlib, PIL (Pillow), Tkinter
- Visualization: Matplotlib
- Environment: Local Machine (Tkinter GUI), Jupyter Notebook

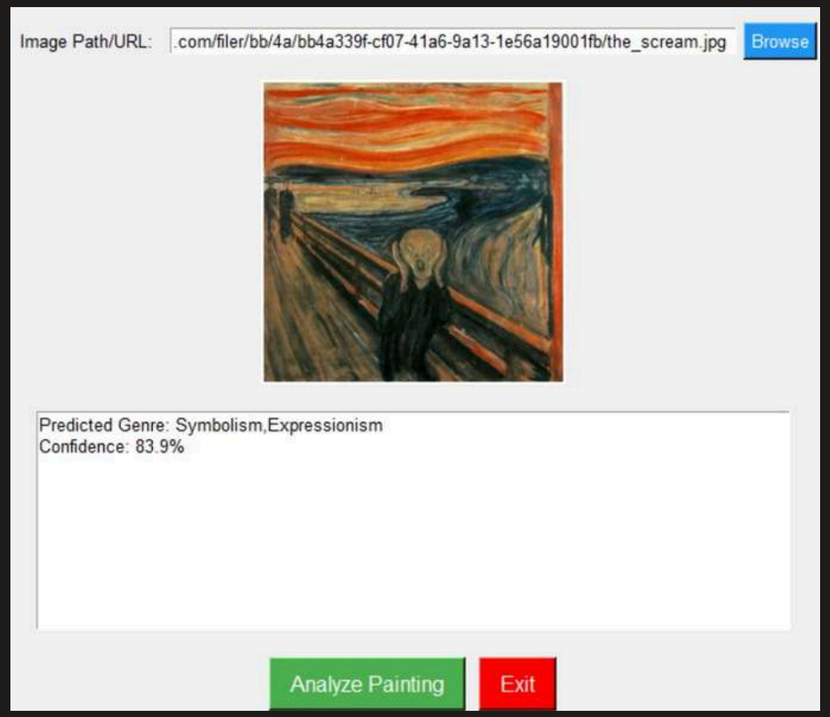
Dataset Details:

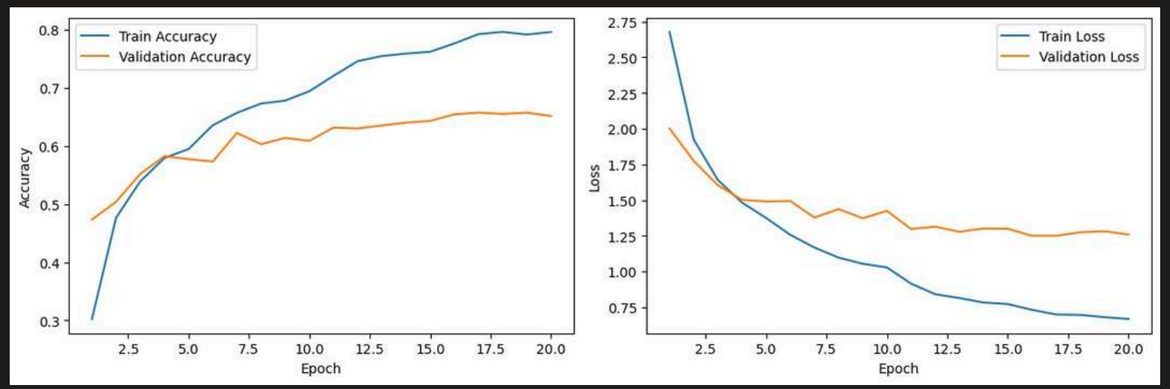
- Source: Local dataset (artists.csv & resized images)
- Size: Multiple images categorized into 39 classes.
- Preprocessing:
  - Images: Resized (224×224), normalized
  - Augmentation: ImageDataGenerator (flips, rotations, shifts).
  - Metadata: CSV file used for mapping images to categories.

Model Training:

- Architecture: MobileNetV2-based CNN
- Loss: Categorical Crossentropy
- Callbacks:
  - EarlyStopping (monitoring validation loss)
  - ModelCheckpoint (saving best weights)
  - ReduceLROnPlateau (learning rate adjustment)
- Hyperparameters:
  - Initial Training: 10 epochs
  - Fine-tuning: 10 epochs
  - Batch Size: 32

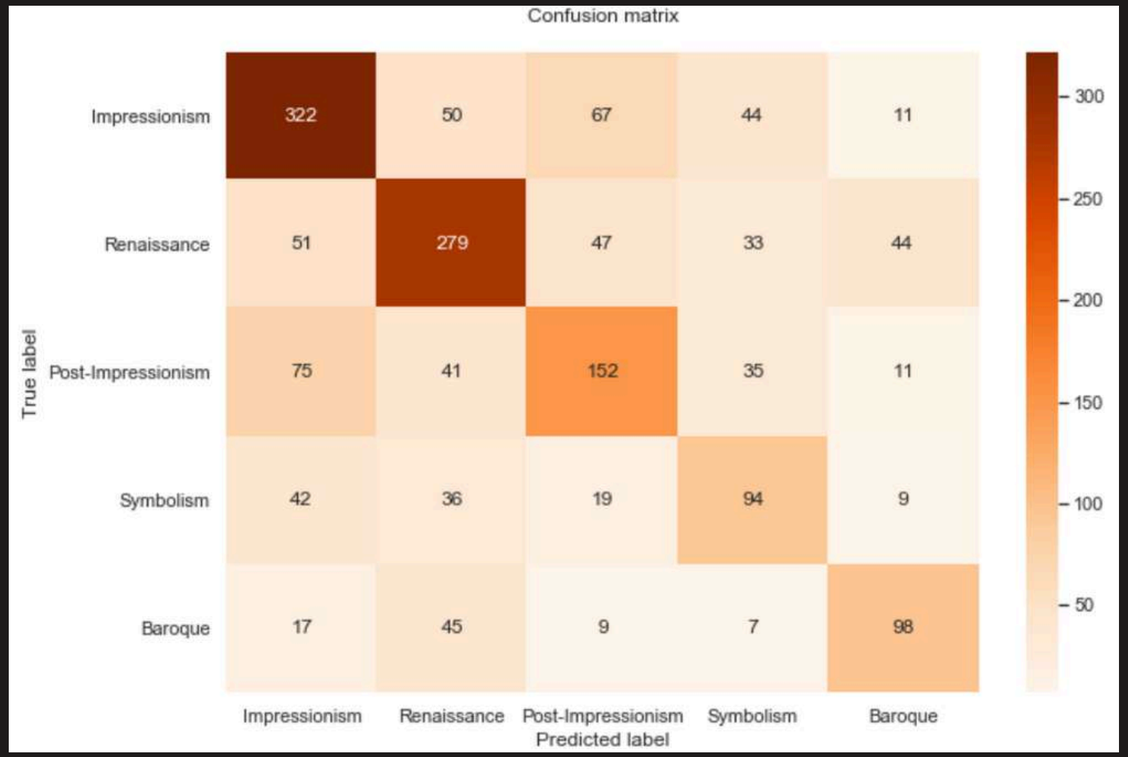
Result - EDA



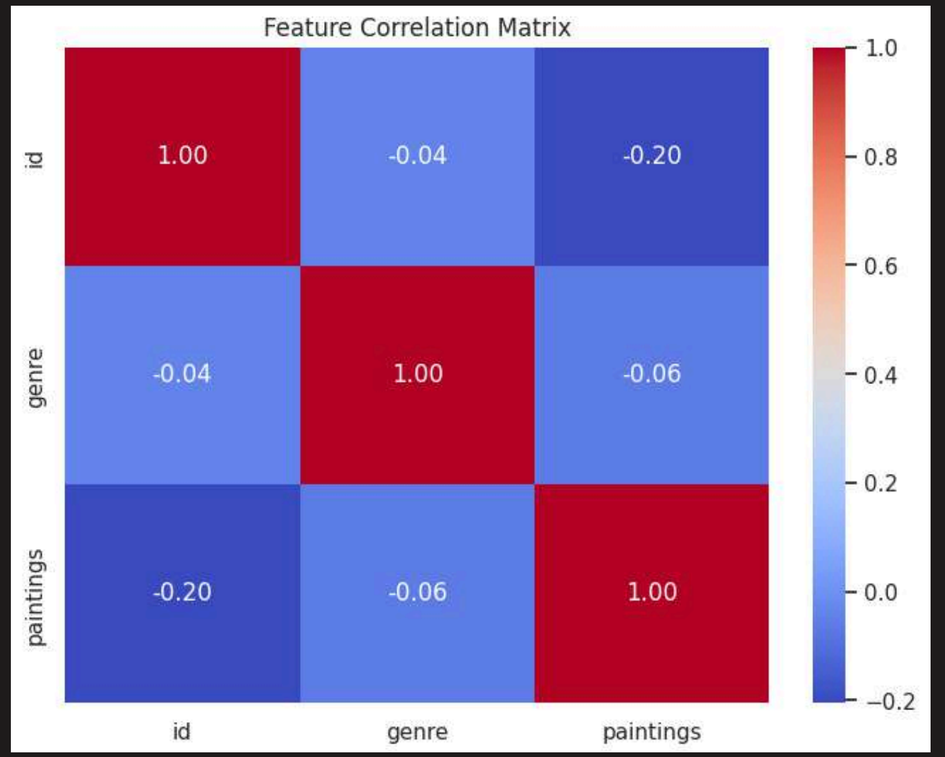


- Final Model Performance:-
  - Validation Accuracy: 68.91%
  - Validation Loss: 1.1867

Result - EDA

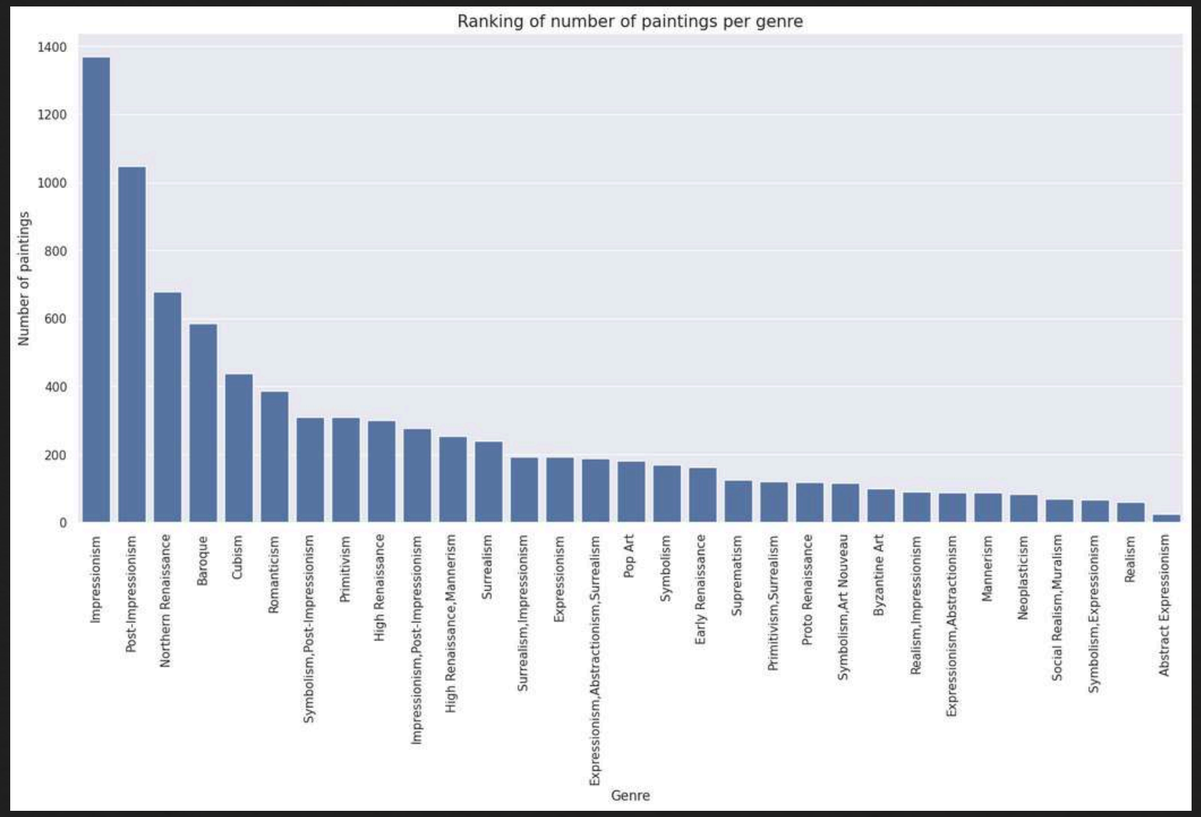


The above image shows a confusion matrix, which is used to evaluate the performance for the classification model of the project.



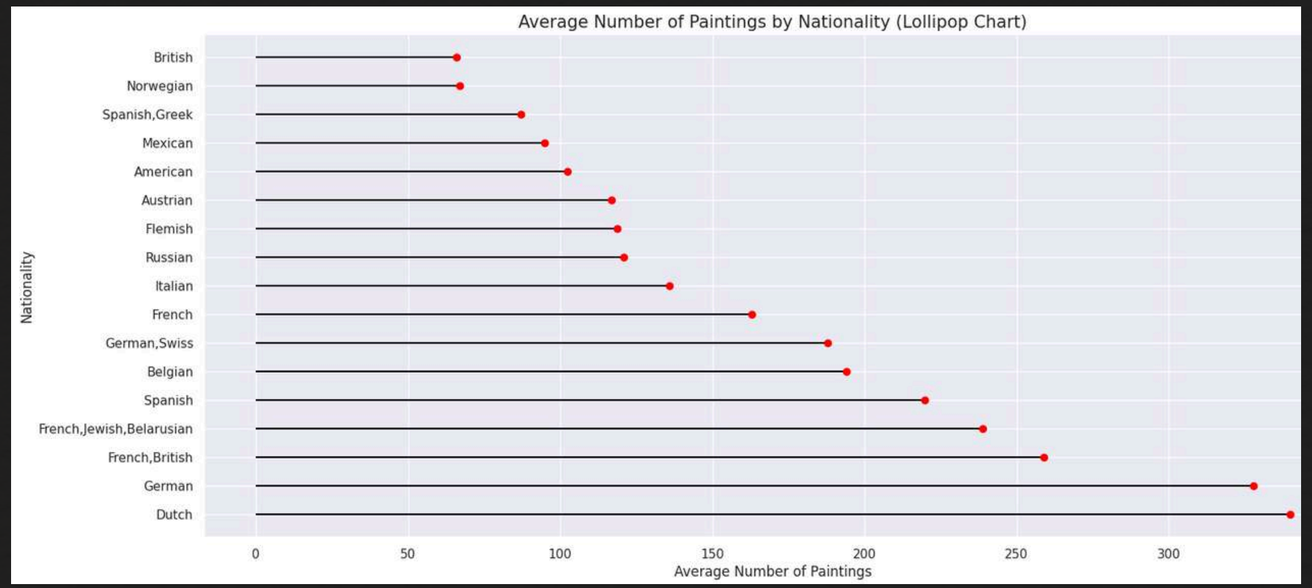
The above image visually represents the correlation between different features in a dataset. The matrix includes three features: id, genre, and paintings.

Results of model in Graphs, Table Form

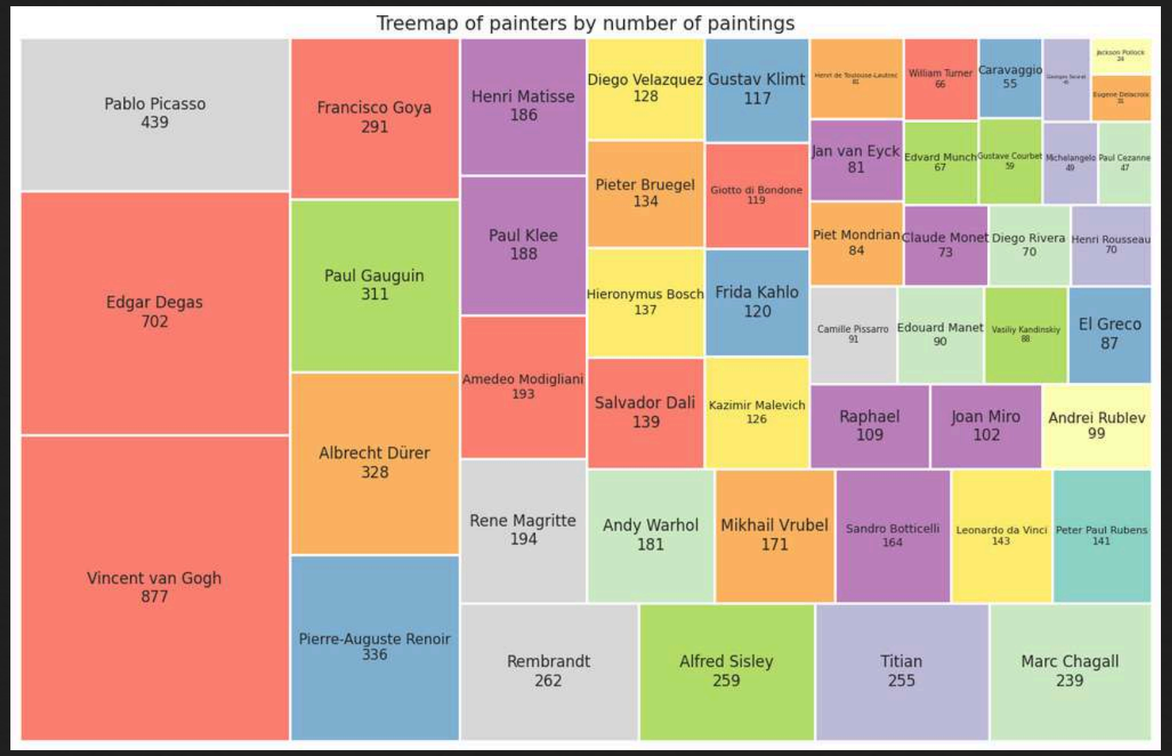


The visualization helps in understanding the prevalence of artworks across different genres, highlighting the dominance of some genres over others.

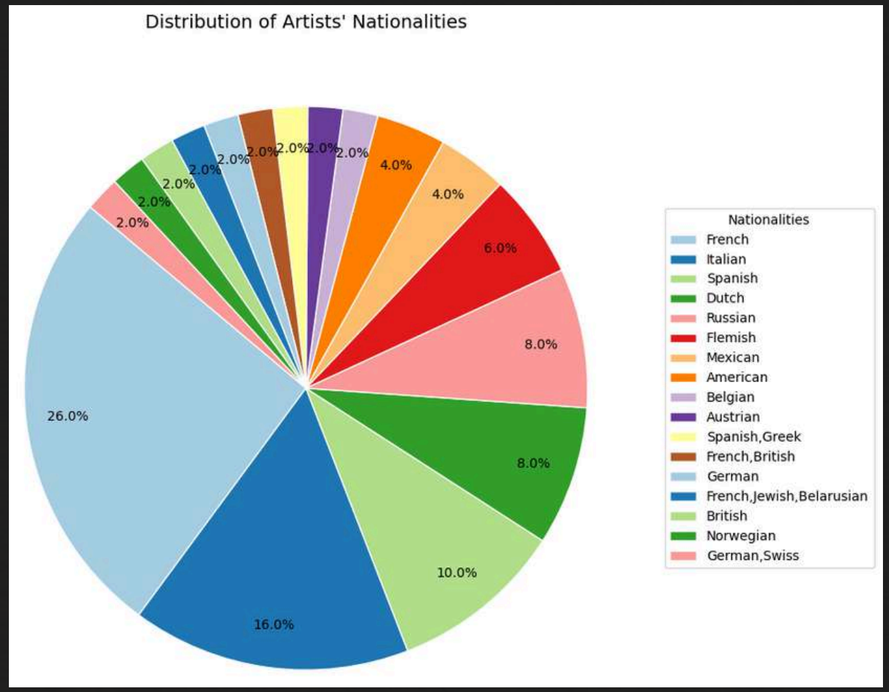
The below chart provides a clear comparison of painting productivity across various nationalities, highlighting the dominance of certain regions.



Results of model in Graphs, Table Form



The above image shows a treemap of painters by number of paintings, providing a visual representation of the volume of artwork by different artists.



The chart provides a clear visual representation of how artists from different countries are distributed, highlighting the prevalence of French and Italian artists.

Unique Contribution

Intelligent Metadata Retrieval & Real-Time Analysis

- *The system does more than just classification—it retrieves and displays historical insights about paintings, including artist background, artistic style, and cultural significance.*
- *A real-time, interactive GUI enhances user experience by allowing seamless image input.*

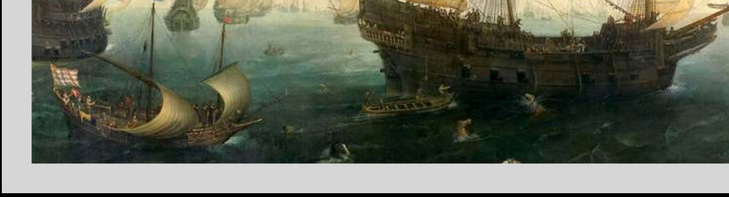
Deep Learning & Self-Learning System

- *Uses CNN-based architectures (MobileNetV2 or ResNet) to extract fine-grained details from paintings, ensuring high precision in recognition.*
- *Features a self-learning mechanism that improves over time by analyzing new artworks, allowing continuous adaptation to emerging painting styles.*

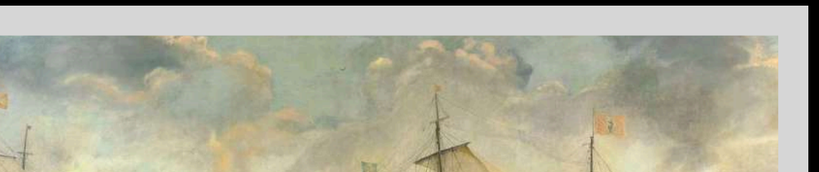
Hybrid Recognition (Dataset + Web Images)

- *Unlike traditional models that work only with predefined datasets, our system can recognize paintings from a local dataset and also analyze new artworks from the web.*

Conclusion



- **Impact:** Transforms how individuals interact with and understand art.
- **Technology Used:**
  - Machine learning
  - Computer vision
- **Core Functionality:**
  - Classifies and analyzes artworks based on:
    - Artist name
    - Genre
    - Confidence level
    - Historical context (Bio)
- **Target Users:**
  - Students & Art Enthusiasts – Serves as a learning tool.
  - Historians, Collectors & Researchers – Expands knowledge of visual arts.

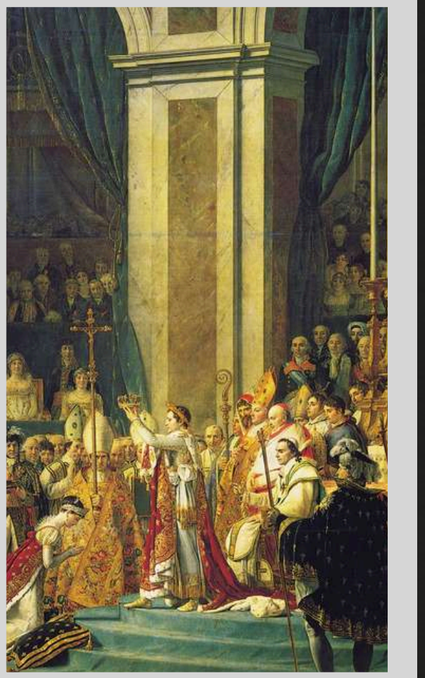


- **Benefits:**
  - Enhances accessibility to art knowledge.
  - Encourages engagement with diverse artistic expressions and movements.
  - Facilitates discussion and reflection on art history.
  - Explores artistic techniques and the influence of prominent artists.
- **Long-term Impact:**
  - Promotes understanding of the cultural and historical significance of art across generations.
- **Future Scope:**
  - Integration with art museums and galleries in different cities and countries.
  - Developing an app for auction houses and dealers.
  - Connecting our model with public cloud server for better accuracy on larger dataset.

References

1.	Zhenyu Wang, Yingdong Yang, Fucheng Wu, "A Painting Artist Recognition System Based on Image Processing and Hierarchical SVM", 2019.	Link
2.	Giovanna Castellano1, Gennaro Vessio ,"Deep learning approaches to pattern extraction and recognition in paintings and drawings", 2021.	Link
3.	Adrian Lecoutre, Benjamin Negrevergne, Florian Yger, "Recognizing Art Style Automatically in Painting with Deep Learning", 2017.	Link
4.	Prathmesh Madhu, Ronak Kosti, Lara Mührenberg, Peter Bell, Andreas Maier, Vincent Christlein, "Recognizing Characters in Art History Using Deep Learning", 2020.	Link
5.	Zhenyu Wang, Heng Song, "A Fusion Model for Artwork Identification Based on Convolutional Neural Networks and Transformers", 2025.	Link
6.	Camillelib, “Art_Classifying_Project”, 2020	Link
7.	enigarv, “Painter_recognition”, 2023	Link

Kaggle Dataset Link: https://www.kaggle.com/datasets/ikarus777/best-artworks-of-all-time



Thank You!