# AI Agent for Advertising Creative Analysis

## 1. Design and Architecture:

### 1.1 System Overview:

The AI agent consists of the following components as given in description:

1. **Image Analysis Module** - Extracts deep-learning-based features from ad images.
2. **Video Processing Module** - Extracts keyframes and transcribes audio from ad videos.
3. **Performance Analysis Module** - Correlates ad creatives with performance metrics.
4. **Visualization Module** - Generates heatmaps to visualize correlations.
5. **Streamlit Interface** - Provides an interactive UI for users to upload files and view insights from the above uploaded documents.

### 1.2 Tech Stack For AI Agent:

- **Programming Language**: Python
- **Libraries**: OpenCV, MoviePy, Transformers, TorchVision, Matplotlib, Seaborn, Streamlit
- **Machine Learning Models**: ResNet50 (Image Analysis), Whisper (Speech Recognition), Sentiment Analysis (Transformers)

## 2. Setup and Installation Instructions:

### 2.1 Prerequisites:

Ensure you have Python 3.8+ installed. Recommended environment: virtual environment or Anaconda.

### 2.2 Installation Steps:

1. Clone the repository: `git clone https://github.com/your-repo/ad-creative-analysis.git`
   `cd ad-creative-analysis`

2. Install required dependencies: `pip install -r requirements.txt`

3. Run the application: `streamlit run app.py`

# 3. Content Analysis Methods and Correlation Techniques:

## 3.1 Image Feature Extraction:

- Uses **ResNet-50**, a pre-trained deep learning model, to extract feature embeddings from images.
- Converts images to 224x224 resolution for consistency.

## 3.2 Video Processing:

- Extracts **keyframes** at evenly spaced intervals.
- Uses **Whisper ASR** for automatic speech recognition to transcribe audio from videos.

## 3.3 Performance Data Correlation:

- Reads CSV files containing **performance metrics**.
- Converts all columns to numeric values and computes **correlation matrix**.
- Uses Pearson correlation to measure the relationship between features and performance.

## 3.4 Visualization Techniques:

- **Seaborn Heatmap** is used to represent correlations between creative elements and performance metrics.
- **Bar Graphs & Trend Charts** can be added for additional insights.

# 4. Usage and Interpretation of Visualizations:

1. **Heatmap Interpretation**:
    a. Darker colors indicate **strong correlations** (positive or negative).
    b. Values close to **1 or -1** indicate a strong relationship between ad creatives and performance metrics.
2. **Keyframe Insights**:
    a. Identifies visually important moments in videos.

3. **Speech Transcription Analysis**:
    a. Extracts spoken content for sentiment analysis.

# 5. Ethical Considerations and Limitations:

## 5.1 Ethical Considerations:

- **Bias in AI Models**: Pre-trained models may have inherent biases affecting analysis accuracy.
- **User Privacy**: Uploaded files should not be stored permanently because of privacy of users data.
- **Fairness in Ad Evaluation**: The AI should not be the sole decision-maker for ad performance.

## 5.2 Limitations:

- **Accuracy of Feature Extraction**: Deep learning models may not always extract relevant features for every industry.
- **Limited Dataset Scope**: Correlation analysis is only as good as the dataset quality.
- **Real-Time Processing Challenges**: Large video files may slow down processing.

# 6. Future Enhancements:

- **Real-time Video Processing**: Optimize video analysis for real-time insights.
- **Integration with Ad Platforms**: Automate data fetching from Google Ads/Facebook Ads APIs.

# 7. Conclusion:

This AI agent provides a streamlined approach to analyzing advertising creatives by leveraging deep learning and correlation analysis. Future enhancements will focus on improving real-time processing and integrating with existing ad platforms.

## Note:

- In correlation matrix ad_id will not display any value because in performance metrics ad_id column contains strings.