Interior Design Advisor

(Your Smart Designing Assistant)

Project Code

CS-IDA-2025

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1. Abstract

In the domain of interior design, many individuals struggle to visualize suitable color combinations, furniture styles, and layouts that align with their room's existing appearance. To address this problem, the *Interior Design Advisor* project proposes a simplified web-based application that provides practical design recommendations using image analysis and machine learning. Users can upload a photograph of their room or select a room type, and the system automatically extracts dominant color palettes and identifies the overall room style through lightweight computer vision techniques. Based on these results, it suggests matching color themes, furniture styles, and sample layout ideas to guide users in improving their interior aesthetics. The system leverages OpenCV for color extraction and a pretrained convolutional neural network model, such as MobileNet, for style classification. This project offers an accessible and intelligent solution for users seeking personalized design inspiration without professional help. Academically, it demonstrates the effective integration of computer vision and user-centered design, while its industrial potential lies in enhancing online design and furniture recommendation platforms.

Keywords: Interior Design, Color Palette Extraction, Room Style Classification, Computer Vision, Machine Learning, Image Processing, Recommendation System, Web Application

2. Background and Justification

Interior design recommendation systems have evolved with advances in computer vision and machine learning. Many tools now use deep learning to identify room layouts, styles, and color schemes automatically [1]. However, most research and commercial applications focus on **complex 3D rendering or AR-based visualization**, requiring high computing power and large proprietary datasets [2].

Simpler approaches, such as **color palette extraction** and **room style classification**, have been explored in prior works [3][4], demonstrating that lightweight models like **MobileNet** or **VGG16** can achieve reliable visual classification with minimal computational cost [5].

The justification for this project lies in offering a **feasible yet meaningful** solution that bridges the gap between advanced AI-based design systems and accessible user tools. The goal is to empower everyday users to get professional design insights from basic image analysis while keeping the implementation within capstone constraints.

3. Project methodology

The proposed methodology involves six core phases:

1. **Data Collection**
   A dataset of ~1,000 labeled room images (bedroom, living room, kitchen) will be curated from public datasets like **Open Images Dataset** and **MIT Scene Understanding Dataset** [6]. A small curated catalogue of furniture and sample layouts will be assembled for style reference.

2. **Image Processing**
   Preprocessing will include resizing and normalization. **K-means clustering** and **OpenCV color space transformations** will be used to extract dominant color palettes [7]. These will be converted to HEX codes to display to the user.

3. **Style Classification**
   A **pretrained MobileNetV2** model [5] will be fine-tuned to classify images into styles such as *Modern*, *Minimalist*, *Rustic*, or *Classic*. Transfer learning ensures low training time and acceptable accuracy on modest hardware.

4. **Recommendation Logic**
   A rule-based engine will combine detected color palettes and predicted style labels to generate concise furniture and layout recommendations. Example: a "Rustic" room with earthy tones may prompt wooden textures and warm lighting [8].

5. **Frontend & Backend Development**

   - **Backend:** Flask/FastAPI (Python) for image upload, processing, and model inference.
   - **Frontend:** React or Streamlit for visualization (color palette, detected style, and sample layouts).
   - **Database:** SQLite for logging user interactions.

6. **Testing & Evaluation**

   - Functionality tests on multiple room images.
   - User feedback from 10–15 participants for design quality evaluation.
   - Measure model accuracy and average processing time.

4. Project Scope

In-Scope:

- Image preprocessing

- Color palette generation
- Style classification (3–5 categories)
- Rule-based furniture and layout suggestions
- Web-based front-end with interactive results display
- Testing and performance evaluation

Out of Scope:

- AR/VR-based design visualization
- Real-time 3D room reconstruction
- Integration with e-commerce platforms
- Personalized recommendation learning

This scope ensures a **balanced workload**, focusing on core vision and recommendation functions without overextending into hardware or high-end graphics areas.

5. High level Project Plan

The following table outlines the **detailed project schedule** for the *Interior Design Advisor* system. It highlights the major project activities, expected deliverables, and the team resources assigned for each phase. This structured plan ensures systematic progress from initial data collection to final submission and presentation.

Week	Activity	Deliverable	Resources
1–2	Requirements & dataset collection	Curated dataset, UI skeleton	Team Lead + ML member
3-8	Image preprocessing & color extraction	Color API + visualization	Backend + Frontend
8-16	Model training & evaluation	Trained model + report	ML member

16-20	Recommendation module + Integration	Working prototype	Full team
20-22	User testing & feedback collection	Test report	All members
22-26	Refinement & optimization	Final prototype	Backend + Frontend
26-30	Documentation & final submission	Presentation, report	Project Manager

6. References

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