





**NASTP National Institute of Information and Technology**  
**Department of Computing BS Artificial Intelligence**

**Submitted By:** Muhammad Umar Riaz (F2024AI007), Ahmad Aziz (F2024AI021), Muhammad Hasnain Imran (F2024AI041) & Fatir Irfan (F2024AI049)

**Roll No:** F2024AI007

**Subject:** DSA Lab

**Submitted To:** Sir Ibad Babar

# Project Report: Hauf – Next-Generation Social Media for Photographers

## 1. Title and Objective

**Project Title:** Hauf (Instagram x VSCO Hybrid)

**Objective:** To develop a high-performance social media platform specifically for photographers that leverages **advanced data structures** (Doubly Linked Lists) for seamless navigation and **Convolutional Neural Networks (CNNs)** for automated content moderation, categorization, and aesthetic ranking.

## 2. Problem Definition and Solution Approach

**Problem:** Traditional social media feeds often lack specialized tools for photographers, such as automated category tagging, AI-generation detection (to maintain "authentic" photography standards), and intuitive, non-linear navigation.

**Solution:** Hauf solves this by:

- Implementing a **Circular Doubly Linked List** for an "Infinite Loop Feed," allowing users to navigate seamlessly through high-quality content.
- Integrating a **TensorFlow-based AI Pipeline** that automatically classifies images into 12 distinct photography niches (e.g., Street, Macro, Astrophotography).
- Utilizing **Vector Embeddings** (\$pgvector\$) for semantic search, moving beyond simple keyword matching to understanding the "vibe" of an image or profile.

+1

## 3. Data Structures & Algorithms

Hauf is built on the principle that efficient data organization leads to a superior user experience.

### A. Circular Doubly Linked List (The Feed)

Instead of a standard paginated list, the "Infinite Loop Feed" uses a Doubly Linked List structure stored within the PostgreSQL database.

- **Structure:** Each **Post** model contains two foreign keys: **next\_post** and **prev\_post**.

- **Logic:** When a new post is saved, it is inserted at the "head." The last post's `next_post` points back to the first, and the first's `prev_post` points to the last, creating a circular loop.
- **Benefit:** Provides  $O(1)$  time complexity for retrieving the next or previous item in the feed, ensuring zero-lag navigation.

**B. Vector Search (Semantic Data Organization)**

The project uses **Sentence Transformers** to convert captions and bios into 384-dimensional vectors.

- **Algorithm:** Cosine Similarity ( $1 - \text{cosine\_distance}$ ).
- **Implementation:** Stored using the `pgvector` extension in Supabase, allowing for  $O(\log n)$  search speeds even with thousands of users.

**4. The AI Pipeline: CNN & Heuristics**

The core "intelligence" of Hauf resides in its multi-stage AI pipeline

+3

**A. Classification with ResNet50**

The system uses a **ResNet50 model** pre-trained on ImageNet. It processes images at a 224  $\times$  224 resolution to identify features corresponding to 12 photography categories.

- **Output:** A JSON object of `ai_tags` with confidence scores

**B. AI-Generated Image Detection**

To protect professional photographers, the system detects "AI Art" using four specialized heuristics

1. **FFT (Fast Fourier Transform):** Analyzes the frequency domain to find patterns typical of GANs/Diffusion models.  
**Edge Detection (Sobel):** Detects "over-smoothing" or unnatural gradients.
2. **Color Distribution:** Identifies statistical anomalies in RGB variance.  
**Pixel Variance:** Flags uniform noise patterns common in synthetic images

Feature	Data Structure / Algorithm	Time Complexity

Feed Navigation	Circular Doubly Linked List	$O(1)$
Semantic Search	pgvector (IVFFlat/HNSW index)	$O(\log n)$
Image Analysis	CNN Forward Pass (ResNet50)	$O(1)$ per image
Ranking Score	Weighted Engagement Formula	$O(1)$

### 6. Sample Output & Logic Flow

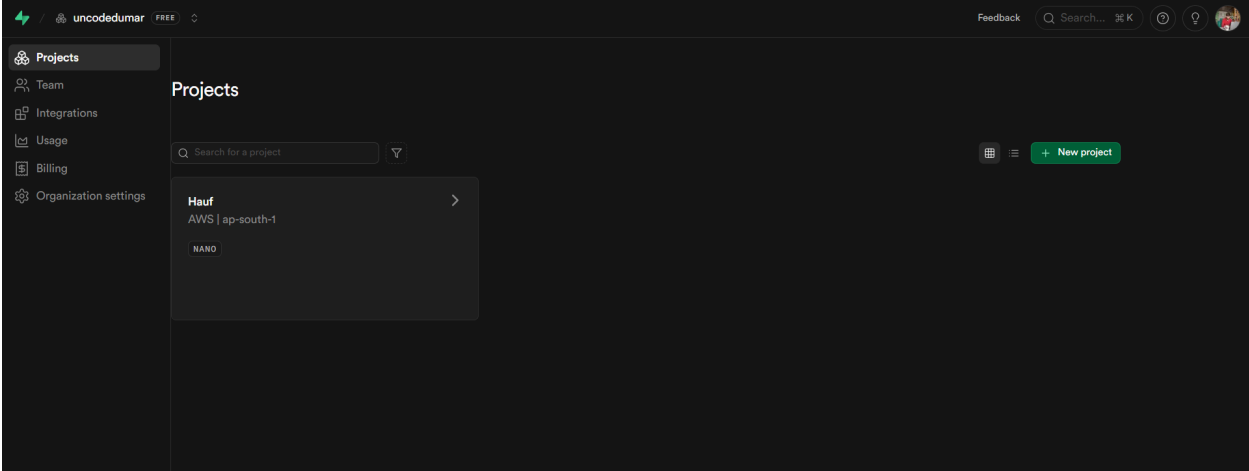
User Profile & LensScore:

The "LensScore" acts as a gamified ranking system. It is calculated as follows:

$$\text{LensScore} = (\text{Likes} \times 1.0) + (\text{Saves} \times 2.0) + (\text{Featured Posts} \times 10.0)$$

**Logic Flow of a Post Upload:**

- Input:** User uploads a High-Res Image.
- Trigger:** Django `post_save` signal initiates the `AllImageProcessor`.
- Analysis:** ResNet50 categorizes (e.g., "Wildlife, 0.98") and FFT detects AI (e.g., "is\_ai\_generated: False").
- Ranking:** An aesthetic score is generated based on confidence and diversity.
- Output:** Post is inserted into the Linked List and becomes visible in the global feed



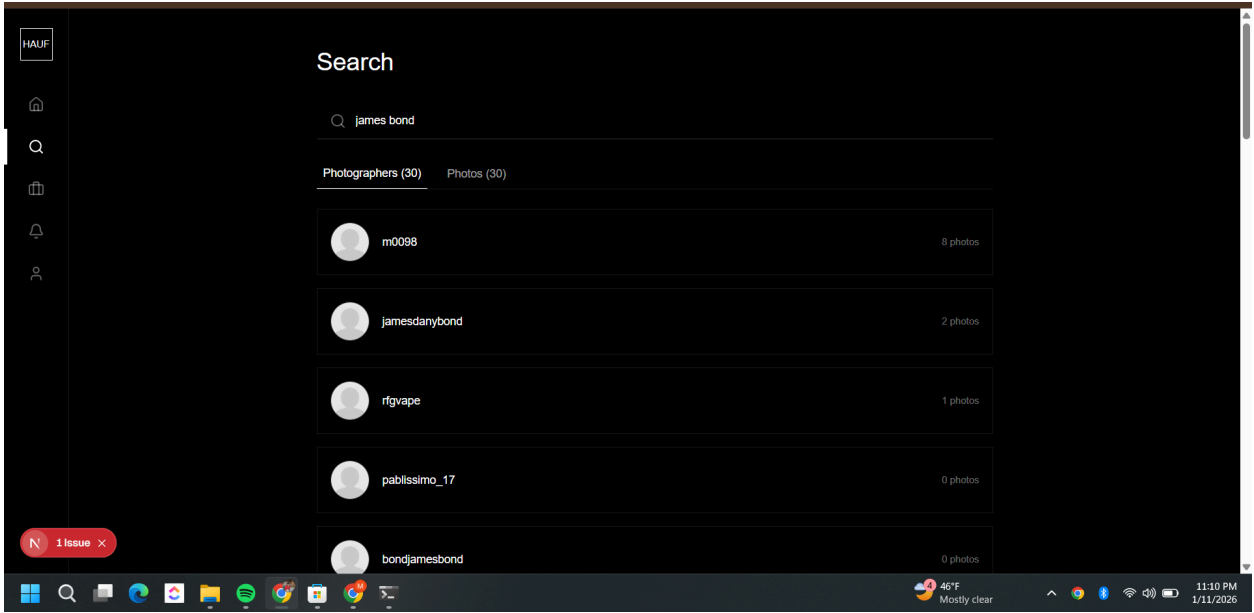
6.

The screenshot shows the 'uncodummar' database management tool. The left sidebar contains navigation options: DATABASE MANAGEMENT (Schema Visualizer, Tables, Functions, Triggers, Enumerated Types, Extensions, Indexes, Publications), CONFIGURATION (Roles, Policies, Settings), and PLATFORM (Replication, Backups, Migrations). The main panel, titled 'Database Tables', displays a table list for the 'public' schema. A search bar is present at the top of the table list. The table list includes columns for NAME, DESCRIPTION, ROWS (ESTIMATED), SIZE (ESTIMATED), and REALTIME ENABLED. A '+ New table' button is in the top right corner of the table list.

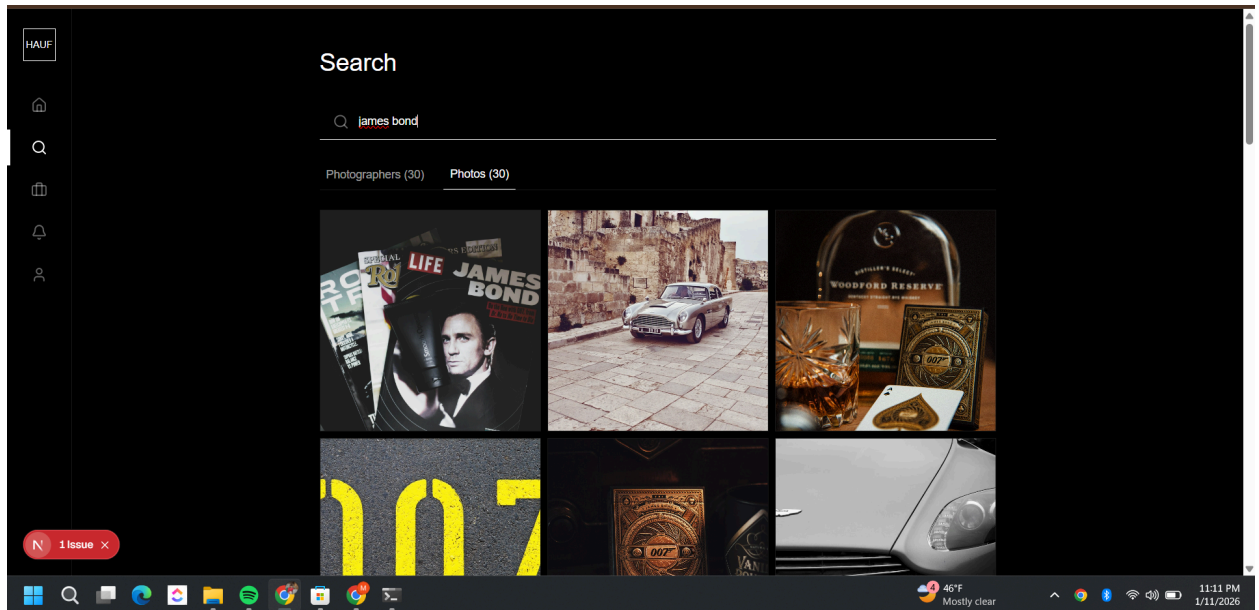
NAME	DESCRIPTION	ROWS (ESTIMATED)	SIZE (ESTIMATED)	REALTIME ENABLED
api_collaboration	No description	0	32 kB	×
api_collection	No description	15	48 kB	×
api_comment	No description	0	49 kB	×
api_featuredpost	No description	10	88 kB	×
api_hirerequest	No description	0	24 kB	×
api_item	No description	0	16 kB	×
api_like	No description	359	128 kB	×

7.

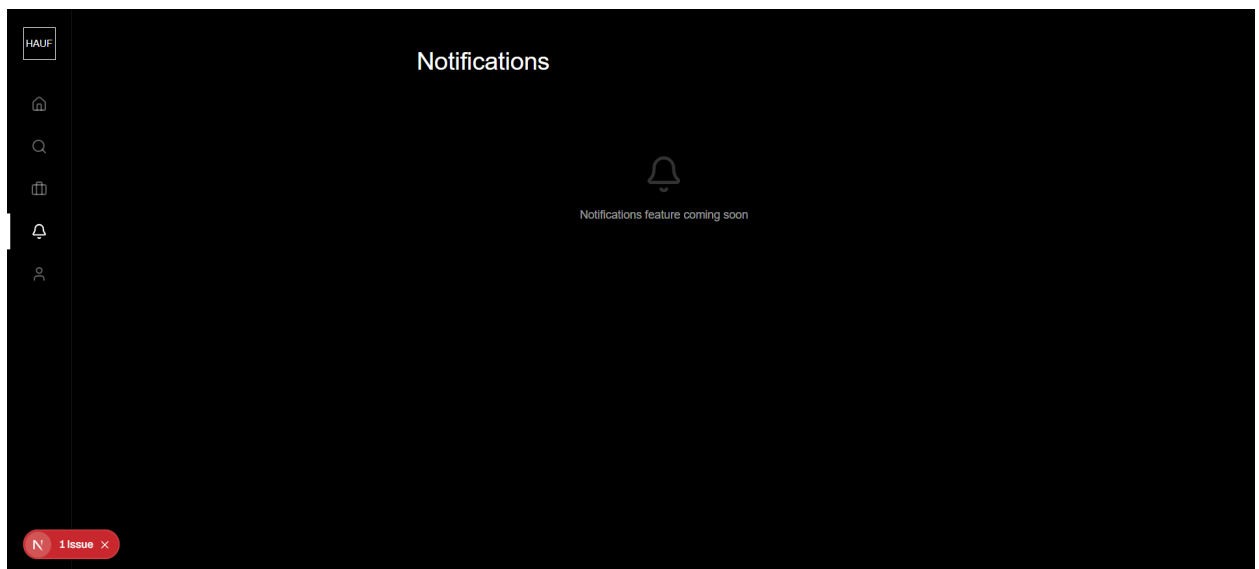
The screenshot shows a social media interface. On the left is a dark sidebar with icons for home, search, post, notifications, and profile. The main content area displays a post by user 'alirezadolati'. The post features a photograph of a woman with long blonde hair, wearing a grey button-down shirt, covering her face with her hands. Below the photo, there are icons for likes (16) and comments. The bottom of the screen shows a Windows taskbar with various application icons and system information: 46°F, Mostly clear, 11:08 PM, 1/11/2026.



8.



9.



## 7. Challenges Faced and Future Improvements

- **Challenges:** Synchronizing the Supabase Auth JWT with the Django backend required a custom authentication class ([SupabaseJWTAuthentication](#)) to ensure secure data flow.
- **Future Improvements:** Implementation of **Graph Data Structures** for "Follower-Following" relationships to calculate a more complex "Social Graph" score

## Conclusion

Hauf represents a sophisticated fusion of traditional **data structures** and modern **Artificial Intelligence**, creating a platform tailored specifically for the high standards of the photography community. By moving beyond a standard linear database approach and implementing a



**Circular Doubly Linked List**, the project achieves a seamless, high-performance "Infinite Loop" feed that ensures  $O(1)$  navigation efficiency between posts.

The integration of the **CNN AI Pipeline**—powered by ResNet50 and custom heuristics—shifts the burden of content moderation and categorization from the user to the system. This automated intelligence not only protects the integrity of the community by flagging AI-generated content through frequency and pixel analysis but also enhances discoverability via vector-based semantic search.

Ultimately, Hauf demonstrates that the strategic application of **advanced backend architecture** (Django & Supabase) and **frontend responsiveness** (Next.js) can transform a standard social media concept into a specialized professional ecosystem. It serves as a robust foundation for a marketplace where photographers are ranked not just by popularity, but by a multidimensional **LensScore** derived from engagement, featured history, and AI-validated aesthetic quality.