

# Image Similarity Search using Feature Detection and Annoy Indexing

Akshat Agarwal

June 15, 2025

## Objective

This project implements an image similarity search engine using deep learning-based feature extraction and Annoy-based approximate nearest neighbor search. We use a pretrained convolutional neural network (CNN) to detect features and index them for fast similarity queries.

## Feature Detection: My Understanding

Feature detection in computer vision means identifying patterns or regions in an image that are informative and discriminative. Deep CNNs like ResNet learn to extract hierarchical features such as edges, textures, and object parts in their intermediate layers.

In this project, we use a pretrained ResNet18 model and remove its final classification layer to obtain a 512-dimensional feature vector that represents the image. These features capture high-level semantics useful for comparing images.

## How It Works

1. **Feature Extraction:** Each image is passed through ResNet18, and the output from the penultimate layer is taken as the feature representation.
2. **Annoy Indexing:** Using Spotify's Annoy library, we create an index of image feature vectors to allow fast approximate nearest neighbor search.
3. **Similarity Search:** Given a new image, we extract its features and query the index for the top K closest vectors using Euclidean distance.

## Benefits

- No training is required since we use pretrained models.

- Fast indexing and querying with Annoy.
- Scalable to thousands of images.

## Example Result

- **Query Image:** A photo of a dog.
- **Top Matches:** Other dog photos with similar backgrounds or breeds.

## Conclusion

This system demonstrates how pre-trained models and efficient indexing can be combined to build a practical image similarity search tool. Feature detection through deep learning provides meaningful image representations that improve retrieval quality.